An Evaluation of the Impact of IMT in three small-medium irrigation systems in Northern Vietnam

by

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ABSTRACT

This thesis critically assesses the effectiveness of Vietnam's transfer of responsibility for the operation and management of its irrigation systems through a process of reform, known as Irrigation Management Transfer. It has been the objective of many governments to reduce expenditure on irrigation infrastructure management, to improve the performance of irrigation systems, and to increase agricultural production. Shifting responsibility from government to farmers through Irrigation Management Transfer (IMT) is considered to be a cornerstone of water-management policy designed to achieve such benefits, and IMT has been supported by international organisations such as the World Bank, the Asian Development Bank and the Japanese International Cooperation Agency.

The Vietnamese Government in the early 1990s transferred responsibility for the operation and management of its irrigation systems to groups of farmers through local Water User Associations or Agricultural Co-operatives. Although IMT has been beneficial to both the Government and farmers in Vietnam, there are a number of concerns to be addressed. Evaluations of IMT in Vietnam were conducted during the pilot phase of infrastructure development projects whilst funding donors were still present, or immediately on completion of projects. In addition, methodological approaches applied to evaluate the results of the IMT have been limited to quantitative assessments. There has been very little research engaging farmers who have directly participated in the IMT and who have been directly impacted by it.

This study begins to fill research gaps by exploring the perceptions of farmers about the changes the IMT has made to them, society and to irrigation systems management. Three irrigation systems in Vietnam provide the case studies for this research. The case studies have been selected to contrast varied geographic conditions (from mountainous to flat landscapes) and different local governance models.

An evaluation framework has been developed by this thesis, synthesised from previous evaluation studies of IMT from other countries. Seven elements related to the impacts of IMT form the basis of the evaluation of each case study: revenue and financial performance issues, water supply, operation and management of infrastructure, agricultural benefits, social and economic outcomes for farming households, and governance aspects of IMT.

The study is based on 15 in-depth interviews with government agency staff, four focus groups with Irrigation Management Company (IMT) staff, Water User Association (WUA) members and 200 questionnaires administered to farmers. The findings suggest several benefits for farmers including increased agricultural productivity, increased household income, and the ability of farmers to diversify their household income. The administration of irrigation systems has improved since the IMT with farmers reporting they receive a more reliable delivery of water. Farmers also report social benefits associated with the IMT and the more equitable supply and access to water has resulted in improved community cohesion and less conflict between upstream and downstream farmers.

This thesis demonstrates that there are problems still to be addressed including long-term sustainability of irrigation systems including regular maintenance and upgrades, protection of irrigation system infrastructure from destructive practices, challenging inequitable funding policies and unreliable/insufficient funding support, lack of technical and management training programs for members of WUAs, and farmer resistance/reluctance/refusal to participate in the operating and managing the irrigation systems.

This thesis study contributes to a greater understanding of the impact of IMT in Vietnam by providing a detailed analysis through three case studies and from various stakeholder perspectives (Government, local organisations and farmers). Factors that have assisted beneficial outcomes from the IMT are explored along with the barriers that impede progress. The achievements of the IMT from farmer’s perspectives will contribute towards a greater understanding of more sustainable approaches to irrigation systems management.

DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed:

Date 20/11/2017

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ACRONYMS

AC	Agricultural Cooperative
ADB	Asian Development Bank
ASIAN	Association of South East Asian Nations
BoT	The Tuyen Quang province Irrigation Management Board
CPC	Commune People' Committee
DARD	Department of Agricultural and Rural Development
MARD	Ministry of Agricultural and Rural Development
DANIDA	Danish International Development Agency
GDP	Gross Domestic Product
NGO	Non-Government Organization
PIM	Participatory Irrigation Management
IMT	Irrigation Management Transfer
IMC	Irrigation Management Company
ISM	Irrigation System Management
ISF	Irrigation Service Fee
IS	Irrigation Station
IMB	Ngoila Irrigation Management Board
IWMI	International Water Management Institute
IIMI	International Irrigation Management Institute
INPIM	International Participatory Irrigation Management
MCB	Million Cubic Meter
O&M	Operation and Management
ODA	Overseas Development Agency
PPC	Provincial People's Committee
PRA	Participatory Rural Appraisal
FAO	Food and Agriculture Organization
WUAs	Water User Associations
WB	World Bank
JICA	Japan International Cooperate Agency
VNPIM	Vietnam Participatory Irrigation Management
VND	Vietnamese Dong

Chapter 1 INTRODUCTION

> *An irrigation system is defined as a set of physical and social elements used for the acquisition, control, delivery and dispersion to the crop root zones of water. Its output- water- is one of a number of inputs to the irrigated agriculture system (Rao, 1993, p.2).*

1.1 Introduction

Irrigation systems are vitally important in meeting the food demand for the rapidly expanding population of Vietnam which is projected to reach nearly 108 million by 2049 (General Statistics Office, 2011). Moreover, Vietnam, like many countries, is facing rising competition for water resources, especially as demand grows from industries and urban development, and there is a significant increase of water scarcity, deterioration of water quality, and impacts of climate change (Malano et al., 2004). This creates the need to improve the effectiveness of water management institutions, including irrigation systems. Since the 1990s, the Vietnam Government has been making efforts to increase efficiency of irrigation works by investing approximately $USD250 million each year building new irrigation systems and implementing the devolution of responsibility from government agencies to irrigation user groups (Tiep, 2008a). However, state-built irrigation schemes are under-performing. Reasons for under-performance include that government-owned and managed infrastructure is often poorly maintained and is deteriorating; water fees are low and there is an inadequate collection of fees; irrigation agencies are over-staffed; and farmers are dissatisfied with the poor quality of service. In addition, in recent years, attempts to implement participatory management models utilised in other countries have not been suitable for Vietnam where farmer-managed irrigation still depends very much on the political mandate of government institutions. Such criticisms are not well supported by research and evaluation of post-transfer impacts on farmers and productivity are lacking (Malano et al., 2004; Molle & Chu, 2009).

There is a lack of research and publications in regard to outcomes of the transfer of responsibility for irrigation system management in Vietnam. Nor has there been investigation into the impact of local water user groups in managing water resources. The efficiency of most of Vietnam's irrigation systems is not well understood; there has been limited evaluation and analysis as to the efficiency and sustainability of the transfer program (Thuan, 2004). Almost all evaluations of the transfer of irrigation management responsibility were conducted either during donor funded infrastructure development projects or immediately on project completion. Previous research is based mainly on quantitative approaches that investigate the outcomes of the transfer (Molden et al., 1998; Rodríguez-Díaz et al., 2008; Yakubov, 2012b). Of note, the farmer's perspective about the results of irrigation system transfer have been overlooked and yet this group of people are arguably the most important as they are the group most reliant on the performance of irrigation systems.

Global perspective-irrigation systems and agricultural productivity

Globally, agricultural production is considered to be a fundamental instrument for sustainable development as the major economic activity and key source of income and employment of rural populations, and agriculture plays an essential role in alleviating poverty (Lipton et al., 2003; Rijsberman, 2003; World Bank, 2008). Irrigated agriculture brings food and livelihood for 2,400 million people worldwide (Raymond, 2004a). According to FAO (2004), the demand for agricultural products is forecast to increase at an average rate of 2% every year from 1999 to 2030. In the developing countries, it is estimated that by the year 2025 rice production will increase by 65% from 1995.

Agricultural production is the largest user of freshwater, accounting for approximately 70% of total water usage (Fischer et al., 2007; Wriedt et al., 2009) compared to 10% of industrial use and approximately 20% for other uses (Aly et al., 2006). Irrigated agriculture in developing countries uses between 70% to 90% of accessible water, and contributes to nearly 38% of the world's food production (World Bank, 2012).

Furthermore, there are rising concerns about the increasing water supply requirements of agriculture. It is predicted that there will be a reduction of water resources and increased water scarcity due to climate change. Globally, a water crisis is looming (Weatherhead & Knox, 2000; Falloon & Betts, 2010).

In term of increased water supply requirements, there is an increase in competing users resulting from urbanisation, industrialisation, tourism development and population growth, and more water usage in domestic, industrial and aquaculture sectors (Wriedt et al., 2009; Waibel, 2010). Over several decades there has been an expansion of irrigated agricultural land. There has been a three-fold increase from approximately 100 10^6 hectares (1950s) to more than 300 10^6 hectares (2010) (Figure 1-1) and there is an increase in the demand for food to satisfy the rapidly increasing global population. The world's population is estimated to be more than 9 billion in 2050. It is expected that 60% more food will be needed between now and 2050 (FAO, 2008; Falloon & Betts, 2010).

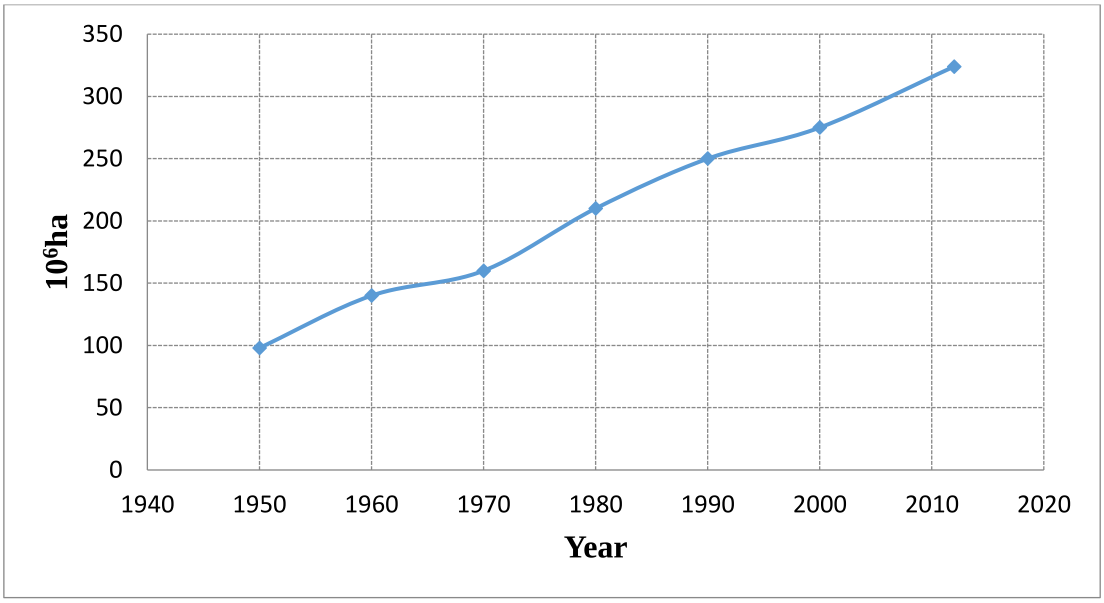

Figure 1-1: Global coverage of irrigated agricultural areas, 1940-2012

Source: Adapted from Satoh et al. (2007, p.284) and FAO (2012, p.12)

As a result, there is an anticipated increase in demand for water which in turn will place pressure on irrigation systems management to adapt to the significant increases in demand (Falloon & Betts, 2010). Governments in many countries have been trying to build new irrigation systems and to improve the efficiency of the existing infrastructure, however, financial shortage is one of the main problems faced by many countries. In practice, limited funding is spent on irrigation infrastructure. As a result, there is a steady decline in the irrigation system performance. Many international organisations and recent studies illustrate that the investment in irrigation especially in Asian countries and the rate of growth in the coverage of irrigated areas has begun to decline (FAO, 2003; Lipton et al., 2003).

Since the 1950s, in order to improve the efficiency and capacity of irrigation systems, reform programs have been implemented by many countries. The purpose of these reforms was to reduce the roles of central government and to encourage farmers' participation in managing irrigation systems. This has resulted in the establishment of groups of local water users to take responsibility to manage medium to small scale irrigation infrastructure. Devolving responsibility is considered to be the panacea to increase the effectiveness of irrigation systems and water management (FAO, 2007; Miyazato et al., 2010).

However, in spite of the long list of theoretical benefits and anticipated outcomes, these reforms have not brought the expected improvements in practice and have not achieved their expected goals. Many of these reforms have failed (Brenan, 2001; Campos & Hellman, 2005; World Bank, 2007; Swain & Das, 2008; Bryan & Taha, 2009; Hamada & Samad, 2011). The transfer of management responsibility has been shown to perform well during pilot or project phases because activities including the establishment of farmer groups were implemented and funded by donor projects (Kurian, 2001; World Bank, 2008). In Asia, irrigation reforms have largely relied on the funding and expertise of international aid providers (Yakubov, 2012b). Initially over a very short period there were a thousand local water user organisations formed, but, which over time have not been very efficient or effective due to top-down management approaches and heavy bureaucracy (Bandaragoda, 2006; FAO, 2007; Meinzen-Dick, 2007; Abdullayev et al., 2008; Gastélum et al., 2009; Abdullaev et al., 2010; Cosgrove & Rijsberman, 2014).

Four major constraints identified for the failure of reform programs are:

- Lack of support from governments, including insufficient funding, or inadequate institutional frameworks, governments have not wanted to face the difficulties of changing laws and institutional arrangements;

- Irrigation transfer examples in Asia have transposed the concept from developed countries through international donor support. In reality, conditions are very different. For example, in developing countries systems support a large number of water users on low incomes compared to developed countries with a small number of water users on average incomes. Furthermore, local organisations are usually established by project staff not from the local community; but from other countries. These people may not understand the physical and cultural conditions;
- Lack of managerial skills among newly formed water user groups;
- Lack of farmer's experience, expertise, and confidence in management has led to a lower level of contribution to the decision-making process of water user groups. Consequently, WUA managers and service staff are frequently left without any control, accountability or feedback from water users (Yakubov, 2008).

1.2 Problems of Irrigation Systems Management and the Irrigation Systems Transfer in Vietnam

In Vietnam, spending on irrigation management and flood control is the largest component of the total agricultural expenditure, accounting for between 50% and 70% (Barker, 2004). The World Bank (2013) claims that in Vietnam more than 50% of irrigation and drainage infrastructure is deteriorating or operating below its design capacity and the financial sustainability of many irrigation schemes is uncertain.

Although there has been a series of reform initiatives and a number of advancements in irrigation systems management, the systems are not yet working effectively for the following reasons.

Highly bureaucratic and top-down approach

A legacy of centralist planning with a highly bureaucratic and top-down approach is used in water management generally and irrigation systems specifically. The national policy framework is considered to have failed to take local conditions into account (Waibel, 2010, p.37). Government planners rather than policy advisers or analysts set targets and identify budgets for investment programs whereas locally diverse problems require local solutions (Bass et al., 2009). Government-operated irrigation works have been criticized as an ineffective way to manage irrigation works. Tang (1992) states the performance of government-controlled systems is consistently lower than local, self- governing systems. Criticisms of Government-owned and managed models include:

- Infrastructure is deteriorating and often poorly maintained;
- The water fee is too low and collection of fees is inadequate;
- There are a large number of staff in government irrigation agencies;
- Water allocation services are poor;
- Water users are dissatisfied (Raymond, 2004b).

The degradation and low efficiency of irrigation systems

Vietnam undertook profound reform measures for irrigation during the 1990s. The Vietnamese Government encouraged farmers to participate in irrigation infrastructure management. The most impressive success of the transfer reform has been the improvement of collection of water fees by local water user organisations. However, the performance of irrigation infrastructure is disappointing (Malano et al., 2004). Lack of transparency and ongoing dependence on government subsidies to maintain irrigation infrastructure are two weaknesses. In some areas responsibility for maintenance of irrigation systems has been transferred to local farmers but the Government owns the infrastructure. Hence, farmers do not protect the irrigation systems as they might if it was their own asset. As a result, reservoirs and pumping stations have rapidly become degraded. The degradation and low efficiency of irrigation works has resulted in water shortages for cultivation (Tiep, 2007).

Institutional arrangements for irrigation systems transfer are limited

Although the transfer program has been implemented since 1990s, there is no specific legal document guiding the formation of locally managed water user groups nor information about how to ensure the sustainability of local groups (Van Riessen & Nguyen, 2004; Tiep, 2004). Many WUAs were established initially but later disbanded due to limitations of legal support and an inadequate institutional framework (Stacey, 1999).

Plusquellec (2006) also suggests that there is insufficient co-operation between water resource technicians and farmers. In some places cooperatives have disappeared or have become defunct. IMC staff do not participate in strengthening the technical and management skills of water users because they are afraid of losing their jobs if irrigation works are transferred to farmers. IMC staff worry about their job security when they believe the leaders of WUAs are acting on behalf of IMC instead of acting on behalf of the local community (Plusquellec, 2006). Farmers have not been actively participating in the transfer program. In some areas only 20-25% of farmers have applied to join for the following reasons:

- Farmers fail to recognize the potential benefits if they were to participate, as the Government is still providing financial support for the Operation and Management (O&M) of irrigation works.
- Farmers often lack self-confidence and are risk averse due to lack of training before irrigation systems are transferred (Tiep, 2004)

The above issues interact with each other and this leads to many problems: conflicts between farmers or WUAs, degradation of works, wasteful use of water, and an ineffective service. As a result, farmers are not willing to pay the appropriate water fee required to maintain and operate their irrigation systems.

This study will investigate the impact of the transfer of responsibility for irrigation management in Vietnam focusing on three irrigation systems (small and medium systems). These systems play an extremely important role in agricultural development as approximately half of all irrigated land in South, and Southeast Asia is served by small-scale irrigation systems (Lam, 1996).

1.3 Significance of the Research

This study will focus on analysing the long-term impacts of Vietnam's IMT to consider whether the transfer has been sustainable over time. A number of irrigation management policies are considered to have had a significant impact on irrigation system performance. These will be evaluated to identify unanticipated outcomes from the IMT and its associated policy reforms.

This study also seeks the perspective of farmers, those most affected by the process of the trasfer of responsibility for irrigation system management. By doing so, this research aims to identify best practice, and aspects of existing systems that should be changed to improve irrigation management. Benefits of enhanced irrigation management may include household incomes through increased agriculture production and crop diversification. Improved irrigation efficiency can help contribute to the development of rural economies and Vietnam's economic growth. This project may also help solve social problems related to irrigation management.

1.4 Aim and Objectives

The aim of this study is to compare and contrast three small-medium irrigation systems in Northern Vietnam to assess the impact of the transfer of irrigation management responsibility.

1.4.1 Objectives

The objectives of this study are:

- To develop an evaluation framework by which to examine the results of the transfer of irrigation management responsibility in the three case studies;
- To explore the perceptions of farmers within the case study areas regarding current performance of irrigation systems in terms of O&M, and agricultural productivity; the effectiveness of governance of irrigation system management; the legacy of government IMT policies including funding arrangements;
- To identify barriers to effective irrigation management in selected case studies;
- To propose possible solutions to overcome barriers to irrigation management in northern Vietnam.

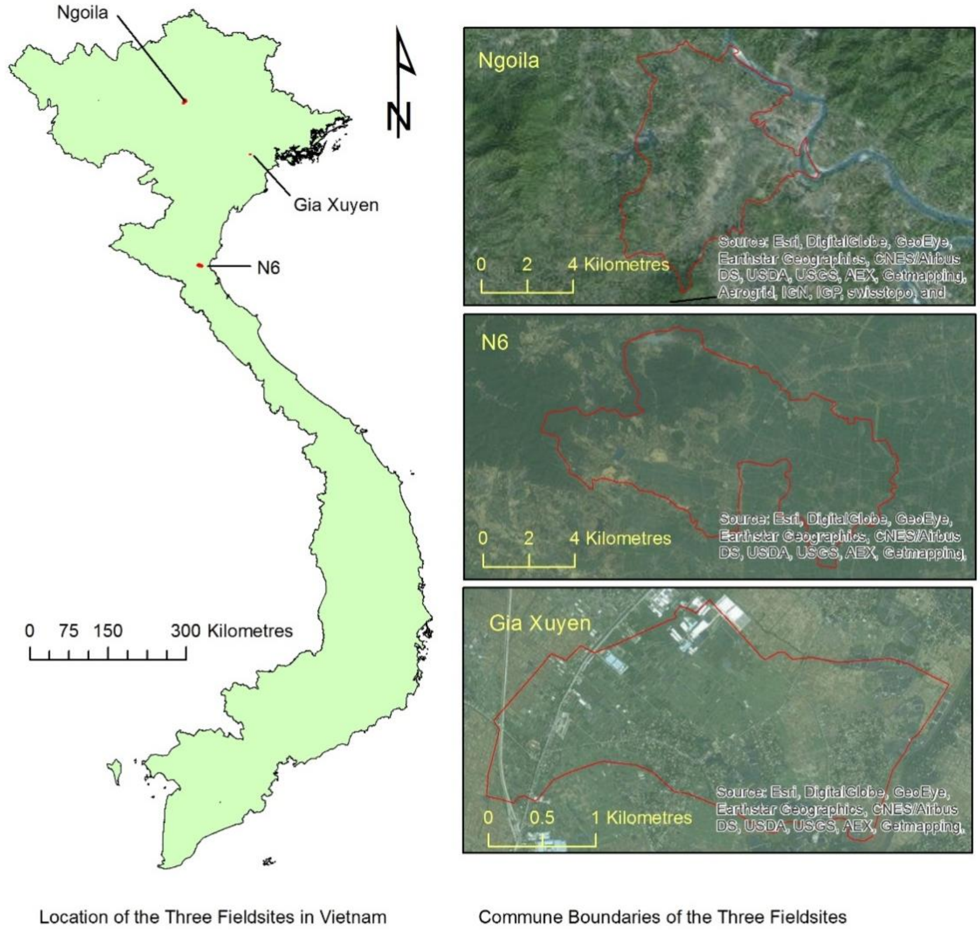

Figure 1-2: Three case study locations (Left map) and province boundaries of each case study location (boundary shown in red—Ngoila- Tuyen Quang Province; N6 - Nghe An Province; Gia Xuyen- Hai Duong Province) (Right maps)

Source: Created for this study

1.5 Study Outline

The thesis consists of nine chapters - a brief outline of each chapter is presented below:

Chapter 1 provides an overview of the roles of water to agriculture, the rising problems of water crisis which affect food security not only in Vietnam but also in the global context. This chapter also illustrates problems of IMT after an extended implementation in Vietnam and provides the main direction of this study including aim and objectives and the importance of this research.

Chapter 2 focuses on the introduction of the driving force leading to IMT being applied in a large number of countries, the concept of participatory irrigation management (PIM) and IMT, and Water User Association (WUA) are also introduced. One of the important aspects in this chapter is to indicate the literature review gap in term of IMT, PIM and WUA performance evaluation.

Chapter 3 presents the methodology for this study, the methods used to collect and analyse data. The mixed method approach is introduced in this study to evaluate IMT based on seven aspects of the evaluation framework.

Chapter 4 introduces the irrigation systems management in Vietnam, including the evolution of agricultural development and irrigation decentralisation, the roles of irrigated agricultural production and irrigation systems in terms of contribution to the economy, poverty reduction and improved employment, and the financing distribution between irrigation management entities. This chapter also presents the governance structure for irrigation management from national to commune level. This chapter also describes the features of irrigation schemes in the three case study regions.

Chapters 5, 6, and 7 respectively analyse the results of the IMT for three case studies. Each chapter introduces the physical characteristics specific to each selected irrigation system, then describes the governance model for each (the Irrigation Management Board in Ngoila, Water User Organisation (WUO) in N6, and Agricultural Cooperative (ACs) in Gia Xuyen). The results of the empirical study follow structures according to the elements of the evaluation framework.

Chapter 8 provides a comparison and synthesis of the results across the three case studies. It provides an overview of the key features of each case study, the aspects bringing success and areas for improvement.

Chapter 9 illustrates the importance of this study in a global context. This chapter also provides a series of recommendations to improve existing governance arrangements in Vietnam, specific to the models described by the case studies. Limitations to the study implications for future research are presented.

Chapter 2 LITERATURE REVIEW

The efficient use of water resources, especially within irrigation systems, plays an important role in ensuring food security, alleviating poverty and promoting sustainable development (Geijer et al., 1996; FAO, 2003; World Bank, 2007; Kadirbeyoğlu & Özertan, 2011). In Asia, the spread of irrigation has become a major contributor to the success of the green revolution (Hamada & Samad, 2011). However, how to improve water resource use efficiency is a major question for which many countries are seeking solutions (FAO, 2011). In most developing countries the majority of irrigation infrastructure is usually constructed and managed by the public sector (Groenfeld & Sun, 1997; Satoh et al., 2007). Sociologists and economists have assumed that the state was capable of effectively handling irrigation infrastructure O&M because of its capacity to provide substantial capital investment and technical input requirements (Hamdy & Lacirignola, 1997). However, recent studies indicate that many irrigation systems managed by government have been working less efficiently than expected due to poor management (Hamdy & Lacirignola, 1997; Hamada & Samad, 2011; Yakubov, 2012a; World Bank, 2013). A deterioration of irrigation infrastructure creates conflicts between upstream and downstream water users. As a result, for the past two decades, many countries have implemented a policy of irrigation system management transfer from central government to local groups of water users. France, USA and Taiwan started such a process in the 1950s while most developing countries, including Vietnam, have been adopting these policies since the 1990s (Tiep, 2008b; Uysal & Atış, 2010). The purpose of decentralizing responsibility for irrigation management is to increase the effectiveness and efficiency of water delivery. The process of decentralising responsibility from government to water users has resulted in a significant rise in annual crop yield, the area of dry land cropping and the gross value of agricultural output globally. However, these benefits are challenged due to increasing pressure on agricultural production to meet the food requirements of growing populations. Pressure is likely to continue to escalate under conditions of water scarcity predicted under future climate change (Wijayaratna & Vermillion, 1994; Tanaka & Sato, 2003; Satoh et al., 2007).

This chapter will review the concepts of Irrigation Management Transfer (IMT) and expose gaps in the literature in terms of results of IMT and methods used to evaluate the impacts of IMT. **Section 2.1** summaries the reasons why Irrigation Management Transfer (IMT) has been implemented in a large number of countries. The concepts of IMT, the main objectives it is intended to achieve, and the forms and levels of IMT are also presented in this section. **Section 2.2** illustrates the key features of IMT including the notion of participation, Participation Irrigation Management (PIM), Water Users Associations (WUA), and water fees which directly affect the implement of IMT. **Section 2.3** introduces the gender participation in irrigation systems, the important role of women in the governance of WUAs to bring more success to IMT. **Section 2.4** summarizes the success of IMT/PIM in several countries from which Vietnam may draw lessons. **Section 2.5** exposes a gap in the literature in terms of the impact of IMT and the approaches used to evaluate IMT. **Section 2.6** discusses the focus of previous studies in evaluating the performance of IMT/PIM which have been adapted to build the evaluation framework for this study.

2.1 Irrigation Management Transfer (IMT)

Over the last three decades many countries have implemented a ‘relocation’ of responsibility and authority of irrigation infrastructure from central government to non-government organisations such as water users’ associations, a process called Irrigation Management Transfer (IMT) (Vermillion & Sagardoy, 1999). Other terms describing this relocation include turnover, take-over, devolution, decentralization, and privatization. This thesis uses the term IMT. The spread of IMT was implemented rapidly as it was introduced in both developed and developing countries. It first began and then expanded in the USA, Japan, Spain, Australia, France, Colombia, and Taiwan during the 1950s through to the 1970s (Vermillion, 1993). The mid-1980s witnessed an upsurge in efforts by governments around the world to implement the IMT process (Vermillion & Sagardoy, 1999). IMT has been implemented gradually and incrementally in some countries such as the Philippines and Indonesia. Some countries adopted a “big bang” approach to implementation such as Mexico and Turkey when millions of irrigated areas were transferred from government to local management, or when IMT has been implemented across a whole country (Svendsen & Nott, 2000; Yazar, 2002; Raymond, 2004a). In other cases, governments negotiated IMT on a case-by-case basis, or governments mandated the transfer of targeted systems e.g. Indonesia and India (Swain & Das, 2008). By 1999, nearly 50 countries had implemented IMT, as presented in Table 2-1. According to Garces-Restrepo (2007), IMT has spread to all five continents. The bulk of the irrigation reform peaked in the 1990s, with countries such as Morocco (1990), Australia (1994), Turkey (1994), Peru (1995), Albania (1996) and Zimbabwe (1997) commencing the process. In the 2000s, more than 57 countries embarked on some type of irrigation sector reform.

Table 2-1: The number of countries and states adopted IMT from 1960s to 2000s

Latin America	**Asia**	**Africa & Near East**	**Europe & Central Asia**
Brazil, Chile, Colombia, Dominican, Republic, Ecuador, El Salvador, Guatemala, Mexico, Peru	Bangladesh, China, India (Andhra Pradesh, Bengal, Gujarat, Haryana, Maharashtra, Tamil Nadu), Indonesia Laos, Nepal, Pakistan, Philippines, Sri Lanka, Viet Nam, Tawain	Ethiopia, Ghana, Jordan, Madagascar, Mali Mauritania, Morocco, Niger, Sudan, Nigeria, Senegal, Somalia, South Africa, Sudan, Turkey, Zimbabwe, Romania, Swaziland	Albania, Armenia, Bulgaria, Cyprus, Georgia, Kazakhstan, Macedonia, Moldova, Romania. Chroastia,

Source: Adapted from Vermillion and Sagardoy (1999, p.3) and Graces- Restrepo (2007).

2.1.1 What is Irrigation Management Transfer

Irrigation Management Transfer (IMT) was first defined by Vermillion and Johnson (1995, p.1) as "reduction of the size and roles of government in irrigation management and corresponding expansion of the roles of farmer organizations through local institutions in irrigation management", or, in other words the relocation of responsibility and authority for irrigation management from government to water users or private farmer groups.

Svendsen et al. (1997) built on Vermillion's definition suggesting that IMT refers to a process of shifting a number of basic irrigation management functions from government agencies to private sector entities, non-government organizations

(NGO), local governments, or to local-level organizations with farmers at the base (Samad & Vermillion, 1999; Vermillion & Sagardoy, 1999). Yercan (2003) makes a central claim that IMT is “a process in which stakeholders influence policy formulation, investment choices and management decisions affecting their communities, and they establish the necessary sense of ownership” (Yercan, 2003, p.1).

2.1.2 Why has IMT been followed as a strategy globally

> *IMT promotes civic empowerment, diminishes corruption, enhances efficiency and improves public service delivery (World Bank, 2007, p.426)*

According to the Food and Agricultural Organisation (FAO), the World Bank (WB) and other development agencies such as the Asian Development Bank (ADB), and the Japanese International Cooperation Agency (JICA), the transfer of management responsibility for irrigation systems began due to difficulties associated with irrigation infrastructure in both developed and developing nations (FAO, 2007; World Bank, 2007). Three main problems prompted the transfer of management including shortages of funding to upgrade and maintain irrigation systems, the degradation of irrigation infrastructure, and in some places, conflicts between farmers.

According to the FAO and International Water Management Institute (IWMI), shortage of government funding for constructing new irrigation systems and maintenance of existing irrigation infrastructure were the most common difficulties faced in many countries in the 1950s (Johnson, 1997; Vermillion, 1997; FAO, 2007; Yakubov, 2012a). At this time, both developed and developing countries invested heavily in building new irrigation systems. Over time, there has been a dramatic expansion of irrigated areas. However, government funding for irrigation systems has remained relatively constant, or has not increased in keeping with construction (Nkhoma & Mulwafu, 2004; Yildirim & Çakmak, 2004). Many countries have experienced financial and budgetary crises leading to severe reductions in new irrigation infrastructure investment (Gorriz et al., 1995; Yazar, 2002; FAO, 2007). New economic policy and structural adjustment programs have led to a reduction of general budget allocations for irrigation O&M (Swain & Das, 2008). While the funding for building new irrigation systems was provided by central governments, farmers or water users have been charged for their water use by government companies to help maintain irrigation systems. However, over the last 20 years, farmers in several countries have been refusing to pay water fees, often because they are too poor to pay for their water use (Wijayaratna & Vermillion, 1994; Yercan, 2003). Governments have found it increasingly difficult to finance the costs of irrigation O&M (FAO, 2007).

Despite the immense investment into irrigation systems, significant deterioration of physical structures, and poor maintenance of existing irrigation infrastructure has been a concern for many governments. The costs shifted to farmers have generally not covered the costs of water supply. Poor management of government-owned irrigation systems (Brenan, 2001; Yercan, 2003; Nkhoma & Mulwafu, 2004; Swain & Das, 2008; Parker & Speed, 2010) and illegal interference of farmers gaining access to water supplies (Satoh et al., 2007) is reported to be a problem. In countries such as the Philippines and Malawi, irrigation systems are in moribund condition with dilapidated infrastructure; there is no active engagement of farmers in the maintenance of irrigation infrastructure (Wijayaratna & Vermillion, 1994; Nkhoma & Mulwafu, 2004). As a result, farmers have registered their dissatisfaction with the O&M of physical infrastructure (Parker & Speed, 2010). There is also discontent about poorly defined water entitlements, uncontrolled water delivery and disintegration of indigenous irrigation institutions (Swain, 1998). Consequently this has led to a continuous decline in agricultural production (Nkhoma & Mulwafu, 2004).

Different social and political conditions have resulted in the purposes of transferring the responsibility for irrigation system management being seen differently. For instance, an increase in the number of conflicts between upstream and downstream farmers was a problem in Japan. When irrigation systems were managed by groups of farmers based on village communities, the overuse of water from upstream farmers brought serious water shortages for downstream farmers, which led to conflicts (Tanaka & Sato, 2003). There was a rising confidence in the farmers' capacity and farmer-sponsored organizations to take over management of irrigation infrastructure (Anonymous, 1982). In contrast, Malawi transferred irrigation management responsibility due to the shift from an autocratic to democratic system of government (Nkhoma & Mulwafu, 2004). This reform was implemented by the desire of the state to conform to global trends of IMT from central government to local farmer organisations (Nkhoma & Mulwafu, 2004). The experiences of Japan and Malawi are not unique. Many other countries have implemented IMT based on the changes in social and political conditions (Gorriz et al., 1995; Hamdy, 2007).

2.1.3 What is IMT Intended to Achieve

Generally, the aim of transferring management responsibility for irrigation systems from governments to farmer organisations is to shift the financial burdens from the government to water users (Groenfeldt & Svendsen, 2000) but at the same time increase agricultural productivity (Vermillion & Sagardoy, 1999). A number of authors indicate the ideals of IMT benefitting both government and communities (Vermillion & Johnson, 1995; Geijer et al., 1996; Vermillion, 1997; Geoenfeldt, 2003; Cook, 2004; FAO, 2007). Geijer et al. (1996) identify four main ideals of IMT:

- First, reducing financial pressures for governments both in operation and labour force payments, with less money being allocated to infrastructure development and payment for reduction of civil service staffing levels;
- Second, increase irrigation scheme performance such as improved maintenance and irrigation service, higher water use efficiencies, improvement in the equity of water distribution for downstream farmers by encouraging farmers to participate in irrigation infrastructure management, and by making irrigation service providers more accountable by improving water supplies for farmers;
- Third, IMT responds to broader national democratisation and privatisation policies and programs leading to an improvement in the relationship between farmers and Irrigation Management Company (IMC) officers;
- Finally, IMT enhances sustainability and reduces detrimental environmental impacts of irrigation systems.

The considerable benefits to farmers through IMT have been identified by many scholars (Uphoff et al., 1990; Svendsen et al., 1997; Groenfeldt & Svendsen, 2000; Raby, 2000). FAO (2007, p.5) including:

- Better cropping intensities, and increased agricultural production;
- Farmer satisfaction with water supplies;
- Significant reduction in the number of conflicts between upstream and downstream farmers;
- Improvement in the water user's sense of ownership and transparency of financial accounting after the transfer. Farmers had some control over organisational governance.

IMT is about replacing government, not just working with the government. Government needs to hand over either all or part of its responsibility for groups of farmers. In the case of full transfer, new governance arrangements have been established to manage entire irrigation systems; partial transfer requires the co-operative management between existing government and new farmer organizations. In both cases, participation of farmers plays an essential role to ensure IMT succeeds (Vermillion & Sagardoy, 1999).

2.1.4 Forms and levels of IMT

Irrigation Management Transfer is complex, and the application of IMT has varied by country. It has been implemented at sub-system levels, such as distributary canal commands, as well as for entire irrigation systems. According to Vermillion and Sagardoy (1999, p.2) "IMT is a multi-faceted reform which may involve changes in:

- public policy and legislation;
- mandates and structure of public and local organizations;
- agency budgets, personnel policies and assignments;
- water rights and farmer organizations;
- operational procedures and technology design;
- installation of new support services.

Different types of IMT have been identified (Geijer et al., 1996; Vermillion & Sagardoy, 1999; Geoenfeldt, 2003; Vermillion, 2003; FAO, 2007; Hamdy, 2007) which include:

(1) Full transfer—Farmer owned and managed through a local organisation

Under a full transfer of responsibility for irrigation management local organisations have full rights to make decisions about their irrigation system. Both the management function and ownership of irrigation facilities are transferred from the government to local communities including: reservoirs, pumping stations, and canals. Under full transfer farmers become co-operative owners of the systems they are using. This is a form of privatization.

(2) Partial transfer-Government owned but farmer managed (Shared ownership and management)

The ownership of irrigation infrastructure remains under the management of government agencies while local organisations are allowed to manage irrigation system functioning. Under partial transfer there is shared ownership and management between government and local organisations.

Figure 2-1 illustrates the two different types of transfer, showing the management roles and responsibilities between government and local group of farmers and/or the private sector. The first block shows the full transfer programs whereas the second and third blocks is the partial reform when both ownership and management are shared between government and group of farmers. The lowest block illustrates the joint management between farmers and government.

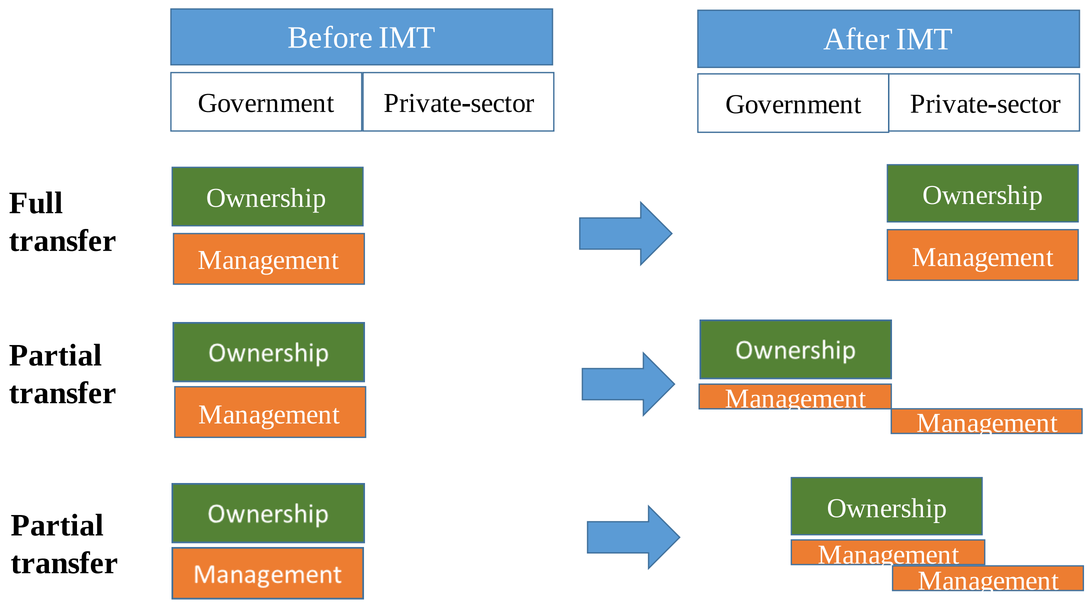

Figure 2-1: Schematic diagram of different levels of IMT

Source: Adapted from FAO (2007, p.6)

International organisations claimed that IMT would not achieve success without the participation of water users, and conditions such as the establishment of local organisations, collection of water fees, and introduction of water rights (FAO, 2007). The involvement of farmers in decision-making by establishing a water user organisation is considered a prerequisite, the cornerstone of IMT, and a process that facilitates the implementation of the transfer of responsibility (FAO, 2006; World Bank, 2008). Empirical research indicates that IMT has been most successful in small and medium irrigation systems, and concludes that the management of large systems should be retained by government (Pradhan, 1989; Tang, 1992; Lam, 1996; Hamada & Samad, 2011). In addition, in the context of IMT, water pricing and water fees play an important role in ensuring the sustainability of local water user organisations, and the performance of IMT.

2.2 Key features of Irrigation Management Transfer

A key characteristic identified for both partial and full IMT is the engagement of farmers in the management and governance of irrigation systems. This aligns closely with wider movements and practice of participatory management.

2.2.1 Participation

Community participation is a widely accepted yet complex and challenging concept which has been discussed and considered as a means to achieve sustainability in development projects (Gladnet, 2002). The concept of participatory management emerged in the 1960s and 1970s. Since that time the concept of participation has been applied broadly in many fields, including health (Viswanathan et al., 2004), social work, education and rural development (Govinda & Diwan, 2002; Preston et al., 2009). In terms of agricultural management and irrigation systems management, there has been an increase in the number of development projects that encourage stakeholders/people to be involved from the initial design period of a project through to the implementation process. Participation is considered critical in bringing desired benefits from programs and projects (Pretty, 1995; Bryan, 1997; FAO, 1997). Participation is expected to reduce the degree of government management while at the same time encourage people/stakeholders to participate more in governance. This process is needed to promote sustainable and equitable development (FAO, 2007).

2.2.1.1 Definition of Participation

There are various definitions of participation. Participation was first defined to focus on measuring the notions of contributing, influencing, sharing, or redistributing power and control of resources, benefits, knowledge, and skill that participants gained by participating in decision-making (Korten, 1980; Paul, 1987; Ghai & Alcántara, 1990). However, there is a debate in the literature about whether participation is a “means”, an “ends” or both. Narayan (1994, p.7) defines participation as “a voluntary process by which people including the disadvantaged (in income, gender, ethnicity, or education), influence or control the decisions that affect them”. This definition confirms that participation is a means to define the end. Participation is an important component and contributes greatly to the success of development projects in terms of economic, social and environmental benefits by giving people a voice or choices (Narayan, 1994). The World Bank defines participation as “a process through which stakeholders influence and share control over development initiatives, and the decisions and resources which affect them”

(World Bank, 1996, p.3). The World Bank also indicates five main reasons for community participation including:

(1) Local participants have considerable experience and insight into what works, what does not work and why;

(2) The commitment of local people to projects increases when they participate in planning projects;

(3) Technical and managerial skills can be developed by local people, hence, increasing local employment opportunities;

(4) Participation of local people can bring an increase in resources available for projects such as locally derived building materials, and their labour, and

(5) the involvement of participants strengthens the relationship between local people, planners, and professionals (World Bank, 1996).

2.2.1.2 The level of participation

Community participation is a dynamic and multidimensional process. Various levels of participation have been recognized by many scholars. The origin of community participation was developed by Arnstein (1969). She constructed a 'ladder' of participation in which there are eight levels of participation from manipulation (non-participation) to citizen control as presented in figure 2-2.

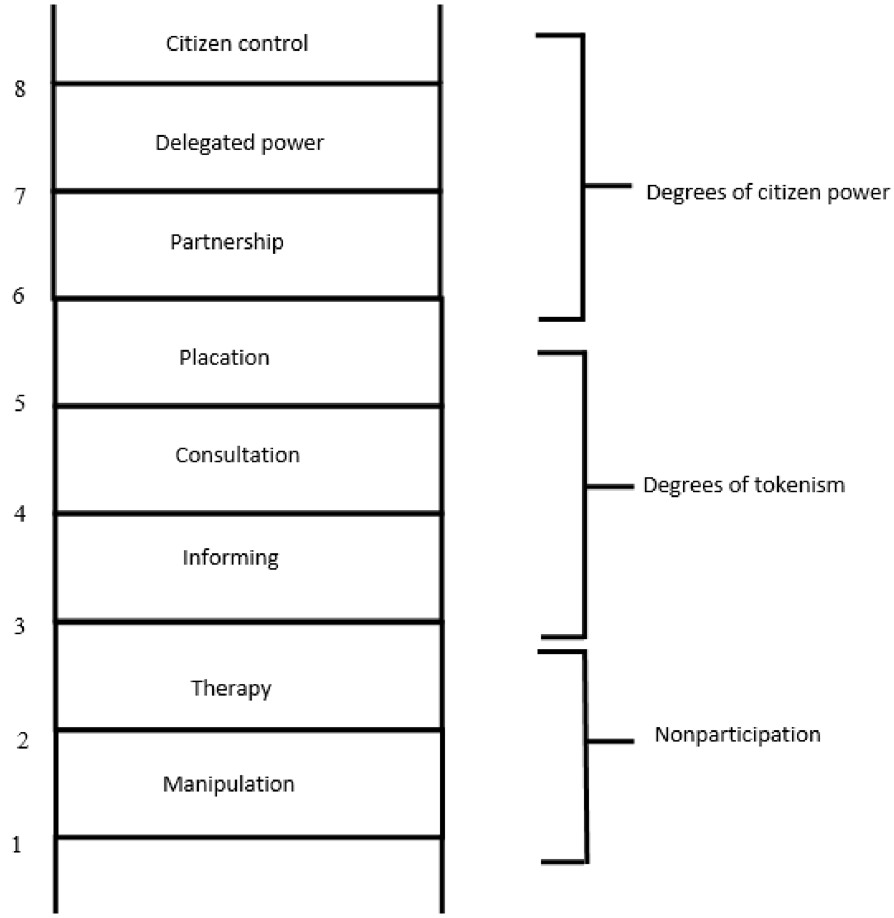

Figure 2-2: Eight Rungs on a Ladder of Citizen Participation

Source: Adapted from Arnstein (1969, p.217)

As can be seen from figure 2-2, level (1) and (2) Manipulation and Therapy are two levels in which community people are not able to participate. Level (3) and (4) Informing and Consultation are "tokenistic". In these two levels, the community is informed but it is not clear that their views will be heeded. As a result, the status quo is not necessarily going to change. Level (5) Placation, starts to allow citizens to have rights in decision-making. Level (6) Partnership enables negotiation and engagement between local people and decision-makers. Level (7) and (8) allow people to participate in governance and have full managerial power.

Pretty (1995) has applied Arnstein's idea to sustainable agriculture using seven levels of participation from Manipulative to Self-mobilization as presented in table 2-2 where local people have no power and passively receive information to selfdetermined roles, where local communities and members have a voice in making decisions and changing systems.

Table 2-2: Pretty's typology of participation for sustainable agriculture

Particip-ation Level	**Participation types**	**Definition**
1	Manipulative participation	Participation is simply a presence. Although local people are representatives in the governance, they are unelected and have no power
2	Passive participation	Local community only are informed or announced when something has already happened or has been decided. There is on-way announcements, people's responses are not listened to by project managers. The information being shared belongs only to external professionals.
3	Participation by consultation	People are encouraged to participate by answering questions. No sharing decision making between local community and planners, and professionals are under no obligation to take on board people's views.
4	Participation for material incentives	People participate by contributing resources such as funding or labour force, but are involved in neither experimentation nor the process of learning. Local community have no stake in prolonging technologies or practices when the incentives end.
5	Functional participation	Participation seen by external agencies as a means to achieve project goals, especially reduced costs. People may participate by forming groups to meet predetermined objectives related to the project. Such involvement may be interactive and involve shared decision making, but tends to arise only after major decisions have already been made by external agents. At worst, local people may still only be coopted to serve external goals.
6	Interactive participation	People participate in joint analysis, development of action plans and formation or strengthening of local institutions. Participation is seen as a right, not just the means to achieve project goals. The process involves interdisciplinary methodologies that seek multiple perspectives and make use of systemic and structured learning processes. As groups take control over local decisions and determine how available resources are used, so they have a stake in maintaining structures or practices.
7	Self-mobilization	Local people become independently organisation. They have rights to make contacts with other external institutions. Self-mobilization can spread if governments and NGOs provide an enabling framework of support. Such self-initiated mobilization may or may not challenge existing distributions of wealth and power

Source: Adapted from Pretty (1995, p.1252)

These concepts of participation have been considered in agricultural and irrigation management. The participation of water users/farmers in irrigation management is called Participatory Irrigation Management (PIM). There is long history of farmer's participation in agricultural management. The involvement of farmers in irrigation systems management has been one of the driving factors behind agricultural reforms in irrigated agriculture. The concept of PIM and the principles for success of PIM are presented in the following section confirming that achieving efficiency in irrigation management is challenging without farmer participation.

2.2.2 Participatory Irrigation Management

Irrigation Management Transfer (IMT) is often discussed in the literature interchangeably with a second, interrelated concept, PIM. Typically, PIM refers to the increased involvement of water users in irrigation management along with the government (Vermillion & Sagardoy, 1999); it consists more of a behavioural or attitudinal change than a reform process. Thus, while IMT relocates the role of the government to NGOs or water user associations, PIM is about the relationship between water users and government by adding farmer participation to government management (FAO, 2007, p.4).

PIM has been evaluated and shown to bring many of the same benefits to irrigation management as IMT, including sustainability of irrigation infrastructures, lessening the financial burden of government, and improving water supply services (Meinzen-Dick & Reidinger, 1995). PIM is considered to be an important way "to increase overall development and livelihood impacts from irrigation investments" (Geoenfeldt, 2003, p.2). PIM is nearly always the approach taken in community development projects. Evaluation frameworks of PIM are also relevant for considering the success of IMT.

2.2.2.1 The definition of Participatory Irrigation Management

PIM refers to the participation of farmers or water users in all aspects and at all levels of irrigation management. "All aspects" includes initial planning, designing new and rehabilitating irrigation infrastructure, construction, supervision, financing, decision making, O&M, monitoring, and evaluation of the system. "All levels" refers to the involvement of managing entire irrigation systems from headworks to the end of tertiary canals or partial systems, and involvement in governance policy at various scales (commune and city) (Groenfeld & Sun, 1997; Groenfeldt & Svendsen, 2000; Vermillion, 2003). PIM is also described as an approach in which farmers are involved in all stages of irrigation development by participating in O&M of irrigation systems (Hamada & Samad, 2011). Geoenfeldt (2003) states that PIM is not only an approach to irrigation management, it is also considered as an approach to rural development. PIM is considered to be the sole option for improving the irrigation performance. Two forms of capital are built by the PIM process:

(1) productive capital: PIM provides for better physical maintenance of irrigation infrastructure, and

(2) social capital: water users participate in their governance with new institutions such as water user organisations, farmers have the chance to improve management and ‘soft’ leadership skills.

2.2.2.2 Principal for success of PIM

The success and endurance of PIM is dependent upon how well it meets its principles Ostrom (1992). Yoder (1994) identifies three main factors for ensuring successful locally managed systems: (1) clear roles of WUA, (2) member’s awareness of PIM and (3) suitable practice of irrigation and association management. There are 11 main characteristics under these three principles as presented in Table 2-3.

Table 2-3: Yoder’s characteristics for success of PIM

No	Principals	Definition
1	Interrelationship between Construction and Management	Irrigators play important roles not only in responsibility for construction but also to define the structure of their organizations. Construction leaders need to demonstrate they are capable and trustworthy.
2	Ownership and Membership	Ownership is defined in that those who build the irrigation systems have rights being supplied water from the systems and are recognized as being responsible for operation and maintain the systems, whereas membership is defined by the irrigation allocation rules which determine who has the authority to establish the membership rules that create and shape the system.
3	Security of the Irrigation supply	Considered as the limits to which irrigation can be delivered. Those who join the system later receive water after those with the first rights take all they need.

No	Principals	Definition
4	Strong organization	The system is called a strong irrigation organization when it has adequate labour to maintain and the ability to distribute adequate water during severe drought.
5	Representation	All irrigators have same voice in making decisions, and in small systems, high rate of member attendance in the general meetings ensure that decisions have strong member support.
6	Monitoring	Know exactly how much water supply is available and the timing of the expected delivery by irrigators and the ability to monitor compliance of irrigation delivery to individual farmers are an essential factor in the success of irrigation systems to ensure equitable O&M costs as well as reduce conflicts.
7	Resource Mobilization	The ability to contribute labour and financial resources to operate and maintain irrigation systems.
8	Communication	Interactions between members ensure the success of the system and it helps members to share information and enables timely response to emergency situations.
9	Accountability	Irrigators and local organisation members will not be re-elected again if they did not work effectively in previous official terms.
10	Accounts and Records	That the accounts are typically checked by audit committees and reports are given to members at meetings are an important characteristic that builds trust for irrigation organizations.
11	Conflict and Sanctions	Systems are called successful if most disputes among water users were solved internally, and graduated sanctions should be applied that take into account the extent and damage caused by the infraction.

Source: Adapted from Yoder (1994)

Hamada and Samad (2011) suggest that although the PIM approach has been applied in many irrigation systems, the results have not always been successful. This study found that the key problems which contributed to the failure of PIM are the lack of farmer's awareness about the necessity for PIM; the need for the formation of local groups; the lack of development of a relationship between government and local organisations; and failing to deal with water shortages. Consequently, for PIM to be successful in addition to the principles identified above there is a need to focus on improving water users' knowledge, and to empower local governing associations. Hamada and Samad (2011), recognising previous shortcomings derived five basic principles to achieve sustainable PIM:

(1) Clear and adequate roles split between WUA and government;

(2) Guaranteed amounts of water delivery to users when they understand the necessity of irrigation after participating in WUA;

(3) Farmers received benefits from using water and paid service fees;

(4) Equality of water allocation, O&M cost-sharing, and decision-making should be equal between water users;

(5) Financial transparency was disclosed to individual water users.

PIM is closely related to IMT. PIM is a process of evolving roles of water users in the functions of irrigation systems management, whereas the process of transferring entire or partial of ownership or management of irrigation systems is the role of IMT. In addition, the mechanism for PIM via IMT is through local community groups called water user associations (WUAs). The success of IMT is determined by the efficacy of WUAs. Following sections further explain the role of WUAs.

2.2.3 Efficiency of water governance

One of the functions of IMT is to improve efficiency in the governance of water management. The OECD (2015: p.3) suggests that water efficiency 'relates to the contribution of governance to maximise the benefits of sustainable water management and welfare at the least cost to society'. According to the OECD (2015: p.10 and 11) governance approaches that improve efficiencies in water management include a number of principles including: frameworks for accountability and trust in decision-making, the promotion of stakeholder involvement in water policy design and implementation; the mobilisation of water finance; that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest and the promotion of the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders.

2.2.4 Size of Irrigation Systems

IMT has been shown to be more successful in small and medium size irrigation systems rather than large systems. In Asia, small-scale irrigation systems play an extremely important role in agricultural development. Small-scale irrigation systems irrigate half of the land in South and Southeast Asia. The livelihoods of the majority of poor farmers are decided by small scale irrigation infrastructure (Chambers, 1988).

Ounvichit et al. (2008, p.147) define “a small-scale irrigation system as one where irrigation water users know each other and their leaders personally know every water user”. Meinzen-Dick (2007) describes small-scale irrigation infrastructure as supplying a group of farmers, while larger systems supply communities with some crossing international boundaries. In Nepal, the classification of irrigation systems is based upon both size and geography (Lam, 1996), as shown in Table 2-4. Small-scale irrigation technologies (usually referred to as micro-irrigation technologies) are accessible to small-scale farmers while large irrigation systems are complex and require sophisticated technologies. Many Asian countries, such as the Philippines, Indonesia, Nepal and Japan have focused on transferring O&M to small communal schemes, mostly covering a few hundred hectares or less. Small-scale irrigation works effectively when users know each other and leaders personally know every water user and all users are thoroughly familiar with the field conditions (Hamada & Samad, 2011)

Table 2-4: Classification for irrigation systems in Nepal

System Classification	Non-Terai Area	Terai Area
Small Systems	Less than 50 Hectares	Less than 500 Hectares
Medium Systems	50 to 500 Hectares	500 to 5000 Hectares

Source: Adapted from Lam (1996, p.1304); (The Terai is the flat plains in India

Irrigation systems irrigating less than 500 ha are considered small irrigation schemes in Indonesia (Geijer et al., 1996) while in Vietnam, an irrigation system is considered small-scale if it serves less than 150 ha (Trung et al., 2005).

2.2.5 Water User Associations (WUAs)

IMT is the transfer of responsibility and authority for management of irrigation systems from government agencies to private-sector or local community organizations that represent the interests of water users. Most commonly, these organisations are referred to as WUAs.

A WUA is a group of water users along a lateral canal who establish their own cooperative non-profit organization with a set of rules to manage water deliveries within their area. WUAs are legal entities and are essentially single-purpose organizations concerned mainly with O&M of irrigation facilities (Brenan, 2001). WUAs can provide a useful and critical building block in water governance.

WUAs provide a forum whereby water users act collectively to govern an irrigation system or subsystem. This may include deciding which irrigation services should be provided, how and by whom they will be provided, and under what terms and conditions. The actual management of the irrigation system (i.e. delivery of services) may be done by the WUA or third parties. After IMT has been adopted, such services may be financed entirely by farmers or with some combination of resources provided by farmers and government (FAO, 2007, p.11). As such, WUAs are expected to prevent deterioration of irrigation systems which previously had suffered due to financial shortages resulting from recurring costs to maintain infrastructure and difficulties in collecting water use fees from famers (Vermillion & Sagardoy, 1999; Qiao et al., 2009).

The formation of WUAs is a central and essential element of IMT (Vermillion, 1997; Facon, 2000a; Groenfeldt & Svendsen, 2000) (Raymond, 2004a; Pant, 2007; Teamsuwan & Satoh, 2009). Ultimately, the success of IMT is decided by the fate of the WUA (Satoh et al., 2007).

2.2.6 Water Pricing

The fundamental role of water prices is to help distribute limited goods and service to consumers and to determine the allocation of limited resources among competing water users (Bosworth et al., 2002). Water pricing covers capital investment and O&M costs, it influences the efficiency of irrigation and affects the equity of distribution in terms of income, and social justice for water users (Sampath, 1992; Unver & Gupta, 2003).

2.2.6.1 Cost of water

The costs of supplying irrigated water consist of variable and fixed costs. Variable costs are the costs of processing and delivering water to end users, including electricity prices, and O&M, while fixed costs are the initial investment capital costs incurred when irrigation systems were built (World Bank, 1997).

Botsworth et al (2002) expand on this concept identifying four kinds of costs: Full Supply Costs, Full Economic Costs, Full Costs and Environmental Costs (Figure 2-3). Full supply costs (Irrigtion Serviece Costs) include capital charges and O&M while full economic costs consist of full supply costs plus opportunity costs and economic externalities. Full costs includes full economic costs plus economic and environmental externalities while environment costs account for public health or ecosystem impacts (Bosworth et al., 2002).

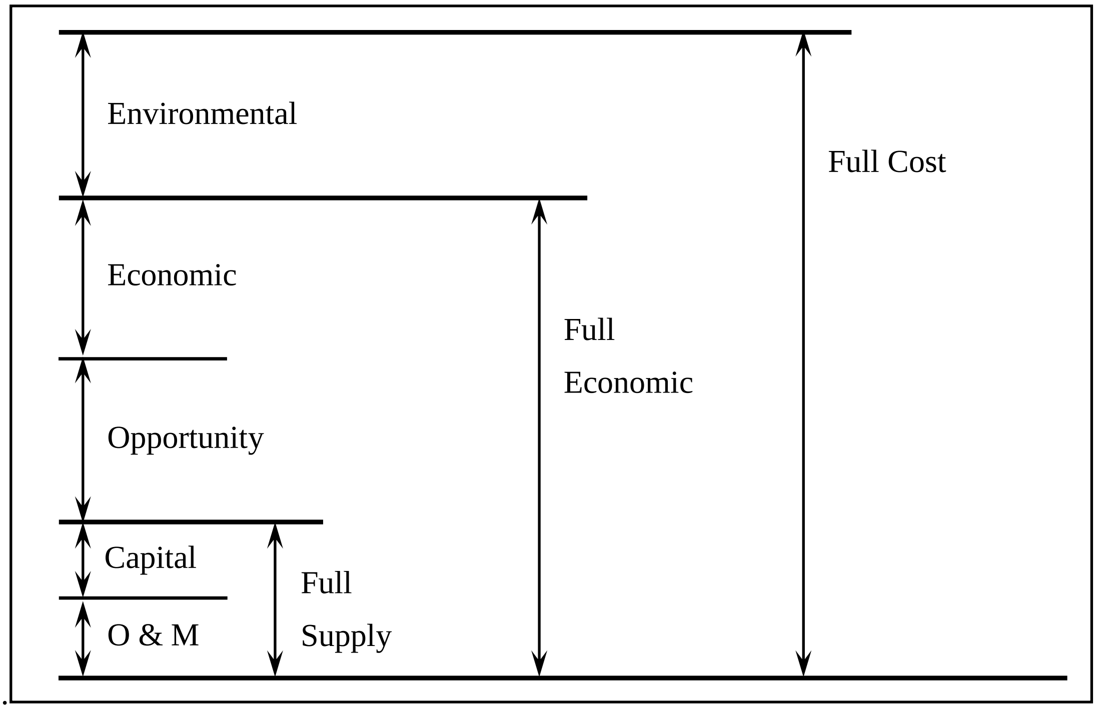

Figure 2-3: General principles for the cost of water

Source: Adapted from GWP (2000, p.19)

2.2.6.2 Irrigation water pricing

There are a number of rising economic pressures on water resources. This is especially true for irrigation agriculture as a major consumer of water. A useful means for achieving efficient allocation of irrigation water delivery is to put the right price on it (World Bank, 1997; Abu-Zeid, 2001). Water fees are considered an essential means of increasing water efficient allocation (World Bank, 1997). It is understood that water fees paid by farmers or other water users are expected to meet cost recovery for the O&M of irrigation systems. There is a variety of methods for pricing water depending on natural and financial considerations. The purpose of implementing water pricing is to recover at least the cost of O&M of irrigation schemes. Water pricing methods include volumetric, non-volumetric (output and input pricing) and market-based pricing methods (Tsur et al., 2004).

Volumetric pricing mechanisms charge for irrigation water based on the quantities of water consumed. Marginal cost pricing is a special case of volumetric pricing which equates the price of a unit of water with the marginal costs of supplying the last unit of water (Easter & Welsch, 1986).

There are several non-volumetric methods commonly used in irrigation management: output pricing, input pricing and area pricing. Water users pay water fees for each unit of output they produce, which is called output or crop-based pricing. Under input pricing a farmer pays for irrigation water indirectly through higher prices for inputs purchased from the government or water agencies (e.g. cost recovery of infrastructure construction). Area pricing is a water fee charged per unit of irrigated area, which depends on the kind and extent of irrigated crops (World Bank, 1997; Abu-Zeid, 2001; Easter & Liu, 2005).

The implementation of water markets, which rely on market pressures to determine the price for irrigation water (Mariño & Kemper, 1999) are also important. Participants may trade water rights including the right to purchase some quantities of water at a particular price during specific periods of time, or, water users may trade water on the spot, or for future delivery. Using water markets, irrigators are given a water endowment and are free to sell or buy shares of entitlements from other farmers (World Bank, 1997; Alexander & Potter, 2004).

In the process of IMT, water fees play a central role ensuring the autonomy and sustainability of WUAs (Unver & Gupta, 2003; Pant, 2007). The purposes of ensuring sustainability of services, improving water conservation, and increasing irrigation systems efficiency are three main objectives that many governments are considered when they implement IMT (Abu-Zeid, 2001; Molle et al., 2008). Water pricing must be acceptable to the water users; they should be willing to pay fair assessments. This acceptable price was defined when water users are supplied with reliable service including adequate, timeliness and fairness of water distribution (Abu-Zeid, 2001).

2.3 Gender roles in Irrigation System Management and WUAs

In the context of irrigation management Meinzen-Dick and Zwarteveen (1998) indicate there is a lack of systematic research of gender participation in irrigation systems and other natural resources management, especially women's involvement. Gender refers to the socially determined attributes of men and women which are revealed in a range of practices and ideas including labour allocation, roles, and resources (Zwarteveen, 1994). When IMT was implemented in many countries, it was expected that women would take part in both directly managing irrigation system management and participating in the governance of WUAs (Pant, 2007). The Dublin Statement of the United Nations Conference on Environment and Development (1992)—concerned with the emerging crisis in global fresh water resources—stated as one of its principles:

> "Women play a central part in the provision, management and safeguarding of water. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women's programmes, including decision-making and implementation, in ways defined by them" (ICWE, 1992, p.4)

In many countries, men are considered the best presenters of water related interests. Men dominate as the head of farms and other leadership roles in the community and women are helpers to their husbands (Meinzen-Dick & Zwarteveen, 1998; Van Koppen & Koppen, 2002) .

While there is rhetoric about the important role of women in the management of irrigation systems, female participation has been shown to be minimal in the governance of WUAs (Goetz, 1995; Meinzen-Dick & Zwarteveen, 1998). There are cultural reasons to explain this. For example, in Kenya women are not allowed to participate in any work connected with the irrigation furrows of the Marakwet irrigation system. Women are forbidden to bathe or touch the water due to a sustained belief that in doing so they are likely to give birth to twins or have a breach birth (Adams et al., 1997).

In the context of South Asia in terms of agricultural practices, the situation is different. Women work in close collaboration with men and take part in managing irrigation infrastructure by providing their labour or other resources. As a result, women directly or indirectly receive benefits from the use of irrigation water for productive and domestic purposes (Meinzen-Dick & Zwarteveen, 1998).

In Nepal, there are only a few activities in which women do not actively take part in irrigated agriculture. Men are engaged in technological aspects and high production-augmenting tasks, such as ploughing or fertilizer application, while women participate in labour-intensive tasks including weeding, harvesting, or collecting water fees (if they are in WUAs). Table 2-5 shows that the total working hours in agriculture practices by women is higher than that of men, women spend total 54% compared to 46% of men involved. However, men's contribution on physical maintenance of canal systems is significant higher than women. They are 3.68 hours/day compared to 2.24 hours/day respectively.

Table 2-5: Average physical involvement in irrigated agriculture by gender in Nepal

Activities	Physical involvement (hours/day/0.325 ha)	
	Women	Men
Seedbed preparation	3.34	2.24
Sowing seed	4.21	2.65
Land preparation	2.28	4.23
Pulling and bundling of seed	4.26	2.18
Transplanting	5.92	1.33
Fertilizer application	0.61	4.32
Chemical spraying	0.32	3.29
Harvesting and post-harvesting	5.84	2.29
Weeding	5.87	1.67
Irrigation	2.24	3.68
Threshing	2.12	4.14
Total of all activities	**37.01**	**32.02**
Proportional mean (%)	**54.00**	**46.00**

Source: Adapted from Upadhyay (2003, p.505)

There has been a steady increase in the number of women using water for irrigation, and acting as heads of farms; women play a crucial role in crop production, contributing up to nearly 80% of production (Meinzen-Dick & Zwarteveen, 1998). However, there is minimal female participation in the governance and management of irrigation systems (Meinzen-Dick & Zwarteveen, 1998; Upadhyay, 2003). Upadhyay (2003) also indicates that even where some women were elected to be members of a WUA they did not know they were elected, or they did not actively participate in the governance of WUAs (Upadhyay, 2003). Furthermore, in some cases women were not allowed to speak before men in WUA meetings. This sidelining of women is unfortunate because as Pradhan (1989) notes, in some cases women can solve conflicts better than men because women are more patient, persuasive, encourage, and guide farmers better than men.

2.4 Research gaps related to IMT

Despite the fact that IMT has been implemented across many countries, little evidence is available about the effects or impacts of IMT on irrigation management performance, agricultural performance, farming communities and government finances (Vermillion, 1997; Samad, 2002; Koc et al., 2006; FAO, 2007; Yakubov, 2012b).

While WUAs have been acknowledged as critical to the success of IMT, little is known about their actual performance. There has been significant growth in the number of WUAs across countries, yet the effects of WUAs have not been studied consistently (Hamdy & Lacirignola, 1997) nor have their effects been examined in isolation from other changes in irrigation systems (Subramanian et al., 1997, p 21). To date there has been little published research evaluating the sustainability of WUAs (Hamada & Samad, 2011). Studies have mainly focused on the impact of WUAs on irrigation management but there is a lack of research about the factors that make WUAs sustainable over the long term.

Although there have been numerous evaluations of IMT the impact of it is usually evaluated three to five years after the transfer. A longer time lapse is needed post-transfer to more firmly establish or decide the success of IMT (Vermillion, 1997).

Although there are a number of studies about IMT and the global push from major international agencies for high-quality impact studies based on qualitative research, (Yakubov, 2012b) quantitative approaches have largely been used to evaluate the impact of IMT, farmers being capable of evaluating irrigation performance on their own seems to be completely lacking in the literature (Yakubov, 2012a). A standard methodology for evaluating the performance of irrigated agricultural systems was developed by International Water Management Institute (IWMI) in the 1990s. They developed 'a set of external and other comparative performance indicators that will allow for comparative analysis of irrigation performance across irrigation systems' Maldon et al (1998). Their performance indicators quantitavely measure water supply and agricultural and financial performance.

Studies adopting the standard methodology have failed to capture the dynamics of the shift of power and have not sufficiently reflected real outcomes of IMT (Samad & Vermillion, 1999; Bandyopadhyay et al., 2007; Rodríguez-Díaz et al., 2008; Araral, 2011; Mishra et al., 2011; Yakubov, 2012a). Vermillion (1997) suggests that such evaluations rely heavily on secondary data collected from agency offices which may not reflect the actual situation. It has been identified that the perspective of farmers is missing.

Molden et al. (1998) and Rodríguez-Díaz et al. (2008) suggest that there are two key limitations to using these types of indicators to compare performance of irrigated agricultural systems:

- the uncertainty involved in many of the estimates because most evaluation data is from secondary sources, not directly collected and measured by researchers, the quality of the secondary sources is unknown, estimating leads to errors in research outcomes (Molden et al., 1998);
- Direct comparisons using performance indicators do not provide an overview of the actual performance of different places. Some performance indicators related to the internal processes of particular organisations may not be suitable for use of comparison with others, or, best practice examples may not

be easily adapted to other places with poor performance (Rodríguez-Díaz et al., 2008).

2.5 Previous Evaluation frameworks for IMT/PIM/WUA

In many development projects, the concept of PIM and IMT are described or referred to interchangeably as though they are the same thing (Vermillion, 1997; Yazar, 2002; Pant, 2007; Satoh et al., 2007; Uysal & Atış, 2010; Hamada & Samad, 2011). While the approach of PIM and IMT are quite different, evaluations of these have measured similar things. For example, the performance of PIM has been assessed with regard to WUAs performance in Turkey (Uysal & Atış, 2010) and India (Badatya & Mohapatra, 2010). The basic principles of PIM can be applied to IMT, and the final goal of both PIM and IMT is sustainable irrigation management through the use of WUAs; they share similar fundamental objectives to provide sustainable and adequate financing for the O&M of irrigation infrastructure (Geoenfeldt, 2003; Pant, 2008; Hamada & Samad, 2011)

Since the development of the IMWI's standard methodology a number of evaluation frameworks have been developed to evaluate IMT/PIM/WUA more broadly than only the performance of an agricultural system. An enhanced set of parameters that include both governance and social considerations have since been incorporated. Following is an overview (an amalgamation) of the different elements of previous evaluations of IMT and PIM. These elements form the basis of the framework for this study in examining the three case studies in Vietnam.

2.5.1 Financial Arrangements for effective IMT

One of the most commonly applied criteria in previous IMT/PIM evaluations is how well the new governance arrangements are performing from a fiscal point of view. The capacity for new governance structures to be self-sufficient, to generate sufficient income through collection of irrigation services fees to help service irrigation system costs and to distribute funds for effective utilisation is considered paramount (Molden et al., 1998; Samad & Vermillion, 1999; Samad, 2002; Teamsuwan & Satoh, 2009). If income generation is successful then theoretically there should also be a measureable reduction in government expenditure (Groenfeldt

& Svendsen, 2000; Samad, 2002). An additional financial consideration is how transparent accounting procedures are within WUAs. Transparency of accounts is critical for the development of trust among water users (Merrey, 1996; Shioda & Onimaru, 2007).

2.5.2 Water Supply Management

From a practical view point, the intent of IMT is to reap improved agricultural outcomes from improved water delivery. Most evaluation criteria in regard to water supply therefore, are about ensuring the security of irrigation supply. This criteria includes reliability, adequacy and timeliness of water supply—that is, water arrives when it is needed, in the volume it is needed, to everyone who needs it along a canal network, from the beginning to end of the network (Pant, 2007; Uysal & Atış, 2010; Hamada & Samad, 2011).

2.5.3 Operation and Management of Irrigation Facilities

Irrigation performance is directly related to the physical functioning of the infrastructure of an irrigation system. Evaluation criteria related to O&M are the adequacy of attention paid to upgrading, servicing, repairing, infrastructure and keeping canals free from silt, weeds and rubbish (Pant, 2007; Shioda & Onimaru, 2007; Poddar et al., 2011).

2.5.4 Agricultural benefit

The underlying intent of IMT reform is to improve agricultural productivity. Criteria used to assess the outcome of IMT agricultural benefits include increases to cropping intensity and diversity (more cropping cycles are possible in a season/year), yields are greater (Wijayaratna & Vermillion, 1994; Tanaka & Sato, 2003; Bandaragoda, 2006) and it may be possible to expand irrigated areas (Bos et al., 2005; Poddar et al., 2011).

2.5.5 Economic impact on Farmers

IMT in practice typically means that farmers pay more for the water they use through the application of the ISF. This fee however, in theory, is borne by the benefits accruing to more reliable irrigation systems such as a simultaneous increase in household income due to improved yields and the potential for income diversity. Improved irrigation services relieve some of the burden and time constraints of farmers, allowing income supplements through other income sources (Bos et al., 2005; FAO, 2007).

2.5.6 Social effects of IMT

One of the least well documented aspects of the outcomes of IMT social. Such measures are not easily quantifiable. However, there are important social factors likely to result from IMT including a change in the participation of farmers on local committees (improving their ability to influence decisions and have autonomy). In theory, if water supply becomes more equitable along an irrigation system then there is likely to be more harmony amongst water users. There may also be a change of the role of women for a range of reasons (Satoh et al., 2007; Koso, 2008; Uysal & Atış, 2010)). Part of the process of IMT is the education of farmers who through their improved awareness change their practice (e.g. make efforts to save water).

2.5.7 Governance of IMT

The relocation of responsibility from government to NGO or water user association is about governance. Criteria to measure the effectiveness of new governance structures include leadership capability, an understanding and shared agreement as to the roles and responsibilities of different actors, productivity and effectiveness of meetings, coordination and communication between vertical and horizontal tiers of government and farmers responsible for irrigation management (Raymond, 2004a; Yildirim & Çakmak, 2004; Pant, 2007).

The seven elements above are applied to this study by examining them from the perceptions of farmers and other actors engaged in irrigation management in Vietnam. The detail of this study's framework is presented in the next chapter.

Chapter 3 METHODOLOGY

To date there has been no singular analytical paradigm by which to evaluate the outcomes of PIM/IMT. The development of a theoretical framework has assisted me in dealing with the limitations of available methods by which to evaluate IMT/PIM and to decide the direction for analysis. This chapter is divided into five main sections. It begins with the philosophical approach to this study as presented in the **Section 3.1** which introduces the roles of mixing quantitative and qualitative approaches used to collect and analyse data. S**ection 3.2** describes the preparation phases for conducting the research from justification for the selection of case studies, the application for ethics approval on human research, and obtaining permission from participants. The process of collecting primary data is covered in **section 3.2.** The chronology of nearly five months of field work, making contact with target participants and pilot tests are presented in the first part of this section. The second part describes the process as to how face-to-face interviews were conducted, questionnaires administered farmers, and focus group discussion. The method of gathering secondary data is explained in **Section 3.4**. **Section 3.5** explains the application of the mixed methods data analysis. Mixed methods have been used to determine the perceptions of various actors in irrigation systems management including IMT officials, WUA members and water users. The process of data analysis closely follows the theoretical framework using seven aspects of IMT including (1) Financial Arrangements and effects of IMT, (2) Water supply management (3) Maintenance of irrigation facilities, (4) Agricultural benefits (5) Economic impact on farmers, (6) Social performance, and (7) Governance and organisation linkages.

3.1 Mixing quantitative and qualitative approaches

Mixed methods research has become a major methodological movement across social research (Bryman, 2006; Clark et al., 2008). Recently, there has been growing recognition of the benefits of integrating qualitative and quantitative approaches in many disciplines such as psychology, health, and education (Bentahar & Cameron, 2015). The advantages of applying mixed methods have been introduced by many scholars (Tashakkori & Teddlie, 1998; Bryman, 2006; Clark et al., 2008; Costa et al., 2013). In using a mixed method approach a researcher combines elements of both quantitative and qualitative methods (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, and inference techniques) for the purposes of improving breadth and depth of understanding and corroboration (Tashakkori & Teddlie, 2010, p.113). Meinzen-Dick et al. (2002) note that mixed methods have been used to create measurable indicators, to develop themes and ideas captured from various data sources including interviews and focus group discussions. The use of mixed methods not only assists researchers to understand more comprehensively the social phenomenon under analysis, but also improves the validity of the research and the analysis processes (Olsen, 2004; Tashakkori & Teddlie, 2010).

Creswell and Clark (2013) said that quantitative methods are weak when trying to give an understanding of participant's perceptions and opinions, and the voice of the participant is not directly interpreted in such methods. Alternatively, the qualitative approach is seen as deficient because it is difficult to illustrate findings of a large group of participants. As a result, the application of mixed methods can provide more depth in responding to research problems; it also assists in answering questions that cannot be answered by singular methods alone. A mixed method approach not only provides a bridge between quantitative and qualitative approaches but also encourages the use of multiple worldviews rather than the typical association of a certain model (Creswell & Clark, 2013). There are different methods of integration between quantitative and qualitative research. Silverman (2006) suggests three main ways to combine quantitative and qualitative methods including:

(1) A particular topic is explored quantitatively first, followed by qualitative studies;
(2) A quantitative study is developed first in order to decide a sample size, consequences, and to establish the broad contours of a study. A qualitative approach follows to investigate in-depth and key issues from a participant's point of view;
(3) Engaging in a qualitative study which also collects quantitative data to help position the results in a broader context.

Mixed methods play an important role in contributing to evaluating the impact of actions or processes. The main advantage of this method is information complementarity between the two approaches. Quantitative research lends itself to generalisations of results and provides relatively standardised information. Qualitative approaches are more likely to capture circumstances and highlight cultural and contextual dimensions (Costa et al., 2013). The combination of quantitative and qualitative approaches blends the advantages of each (Protheroe et al., 2007; Clark et al., 2008) and provides depth to results (Arora & Stoner, 2009).

3.1.1 Qualitative approach

Auerbach and Silverstein (2003, p.3) define the qualitative approach as "research that involves analysing and interpreting texts from interviews in order to discover meaningful patterns descriptive of a particular phenomenon". Qualitative research enables researchers to collect and interpret data, making findings, building new theories and creating a realistic image of social life from the process of collecting and interpreting data and producing findings. The patterns and relationships among themes and broad trends, new concepts and theories are created from specific details (Neuman, 2005; Corbin & Strauss, 2014).

A wide array of disciplines have applied qualitative research from social science to art (Saldaña, 2012). The reasons for its wide application are that qualitative research provides a deep understanding of situations in terms of both context and interaction. Qualitative research results tend not to be used for predicting future scenarios but rather describing a particular reality (Patton, 1990). It is useful to explore participants' experiences; it is also highly appropriate for investigating the nature of particular research problems, and it is a valid approach for exploring new ideas (Corbin & Strauss, 2014). A qualitative approach usually produces a wide range of detailed information even from a small number of participants or cases. This method also assists researchers increase their depth of understanding of case studies but minimises generalisability (Patton, 2002)

The coding process is an essential aspect of transforming raw qualitative data and from theorising social processes to understanding them. Coding is considered a transitional process between data collection and data analysis. Coding enables the researcher to structure and organize similar group codes into the themes and categories or a "family" of ideas where ideas have similar meaning and characteristics (Saldaña, 2012).

"A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (Saldaña, 2012, p.3).

Tashakkori and Teddlie (2010) indicate that coding is a strategy that is used to find themes and patterns in qualitative data. They also illustrate three common types of coding used in qualitative analysis including inductive coding (examining the data, identifying the meaning units, and attaching codes); deductive coding (using a set of codes obtained from sources such as the literature of theory to examine the data to find instances of these codes) and abductive coding (stemming from an interactive process of deductive and inductive reasoning).

Strauss (1987, p.27) indicates that "coding is the most difficult operation for inexperienced researchers to understand and to master". Saldaña (2012) stated that structural coding perhaps is more suitable for interview transcripts than open-ended survey responses. Structural coding applies a content-based or conceptual phrase representing a topic of inquiry to a segment of data that relates to a specific research question used to frame the interview (MacQueen & Guest, 2008). Structural coding is a question-based code that "acts as a labelling and indexing device, allowing researcher to quickly access data likely to be relevant to particular analysis from a larger data set"(Namey et al., 2007, p.140).

3.1.2 Quantitative approach

There is long history of application of quantitative methodologies in Western cultures as early as 1250 A.D (Williams, 2011). A quantitative methodology is defined by Creswell (2013, p.153) as involving "the collection of data so that information can be quantified and subjected to statistical treatment in order to support or refute "alternate knowledge claims". The quantitative method involves a numeric or statistical approach to establish patterns cross-cases or over time, and to create meaning through objectivity uncovered in the data. Hence, quantitative findings usually are predictive, explanatory, and confirming (Williams, 2011).

The quantitative approach is usually employed to examine differences among cases or situations. The aim is to explain co-variation of one variable with another, usually across many cases. This approach is highly developed and builds on a large body of applied mathematics (Neuman, 2005).

The advantage of a quantitative approach is that it is possible to measure the reactions of a large number of people to a limited set of questions, thus facilitating comparison and statistical aggregation of the data. This gives a broad, generalizable set of findings that may be presented succinctly (Bryman, 2006).

3.2 Preparation Phases for Conducting Research

There are many irrigation systems in Vietnam which have been subjected to IMT. Three locations were chosen to present different geographical locations, and different types of irrigation infrastructure and management (see the map, Figure 1-2). The three irrigation systems were also chosen to provide an in-depth understanding of the dynamic relations among the actors involved in the different irrigation systems.

3.2.1 Case Study Selection

The determinants for case study eligibility were that all case studies had to be publicly owned irrigation systems that were later turned over to farmers for management, or, systems that are presently jointly managed by the Government and farmers. To be included in the study a case study needed main and secondary canals to be governed by state-run agencies and for farmers to be managing tertiary canal systems.

Selected case studies represent different aspects of irrigation management:

- Geographical location: The three irrigation systems represent different agricultural and geographical regions in North Vietnam including: the North East Mountainous Region, the Red River Delta and the North-Central Coast of Vietnam. These systems have significant differences in terms topography, climate, type of soils and agricultural products. They range from mountainous regions to flood plains. The selected irrigation systems also represent different traditions of irrigation development and different approaches to farmer participation. Ngoila is representative of irrigation infrastructure in mountainous areas whilst Gia Xuyen is located in the Red River Delta, the second highest agricultural producer. N6 is located in central Vietnam;

- Physical features: Ngoila is supplied from a storage reservoir in Tuyen Quang while the Gia Xuyen and N6 are primarily river-based extraction systems using open channels in Hai Duong and Nghe An provinces;
- Similar irrigation system size: all three case studies are of small-medium size: the Ngoila system irrigaties 392 hectares, Gia Xuyen irrigates 290 hectares, and N6 irrigates 281 hectares of agricultural land.
- Institutional approaches to irrigation management: All three case studies have on-farm canals that are commune-based, owned by local water user groups, on common property. However, the right to use the inter-commune canals is different between cases. The inter-commune canals in Ngoila, and Gia Xuyen are under ownership of the state, whilst the N6 inter-commune canal is common property and under the ownership of the N6 local water user association. In addition, the irrigation system management models in Ngoila and N6 are based on hydrological boundaries and supply water for four communes, whereas civil administrative boundaries are applied in Gia Xuyen systems and water is supplied to single communes.
- All three systems were chosen because they also have various irrigation reform programs in progress. N6 and Ngoila systems were transferred with support from donors including the Asia Development Bank (ADB). The Gia Xuyen system transfer depended primarily on the Japan International Cooperation Agency (JICA) with the participation of a farmer labour force. Table 3-1 summarises the establishment history and physical differences between the three irrigation systems.

Table 3-1: Main features of each location

Study sites Features	Ngoila	Gia Xuyen	N6
Location	Mountainous	Delta	Central
Province	Tuyen Quang	Hai Duong	Nghe An
Topography	Mountainous, steep slopes	Flat, low-lying	Hilly, sloping
IMT funding support	Asian Development Bank	The Japan International Cooperation Agency	Asian Development Bank
Year of establishment	1973-1976	1960s	1930s
Year of transfer	1996	2002	2003
Irrigation control structure	Manual gate (Gravity fed)	Pumping station	Manual gate (Gravity fed)
Irrigated area (ha)	392	290	281
Number of districts	1	1	1
Numbers of communes	4	1	4
Number of households	2,259	2,620	2,312
Agricultural products	Rice, corn, sweet potatoes	Vegetables, Rice, fruits	Rice, corn, potatoes
Soil	Silty clay loam	Silty clay soil	Sandy clay loam
Climate	Relatively humid	Relatively humid	Moderately humid

Source: Created for this study

In all three cases, the transfer process occurred some time ago. The government transfer of irrigation system management responsibility to Ngoila farmers and N6 took place in 1999, followed by Gia Xuyen in 2003. Therefore, the earliest system transfers took place approximately 15 years ago, whilst the most recent occurred 10 years ago. This length of time allows for an evaluation of impacts and effectiveness of the process of transferring responsibility of irrigation systems to local users.

3.2.2 Ethics Clearance for the Research

This research involves people as research participants so it required approval from the Flinders University Ethics Committee for Social and Behavioural Research for low risk assessment. During the approval process, in order to ensure the security of both researcher and research participants during the fieldtrip, concerns raised by the committee were clarified and attended to in shaping the research design. In particular, details of how participants were to be contacted, length of interview and focus group discussions, and consent contacts were clarified. Ethics approval was granted on 22 July 2013.

Flinders University letters of introduction were created by the researcher, the Rector of Thuy Loi University in Hanoi, and the Rector of the Vietnamese Academy for Water Resources Management. These letters were issued to potential participants.

3.3 Primary Data Collection Methods

Four main types of information were collected for the three case studies related to the transfer of the irrigation schemes from the Government (IMC representatives) to local WUAs:

- General data related to IMT/PIM such as: the time of implementation of IMT, the changes of decrees or regulations related to IMT in each location; the highest irrigation unit transferred e.g. head-works, main canals, secondary or tertiary canals; the kind of transfer: partial or full transfer; the amount of money spent on (O&M) each year; whether farmers received training programs during the transfer of responsibility; whether supporting legislation was enacted by the government; satisfaction of water users; and gender issues related to irrigation management;
- Detailed information about WUAs including: the number of WUAs in each area; establishment dates; governance of WUAs including: number of WUA members, gender of WUA members and gendered roles, appointment style of WUA leaders; linkages and the support between central, provincial and local governments to WUAs, the number of households in each WUA; the

contribution recommended by WUA members; the evaluation of WUA operation by water users; and the support for water users in improving the effectiveness of the operational strategy for WUAs; the obstacles and problems that WUAs and water users face due to the IMT;

- Socio-economic and agricultural perceptions: estimated household income; the benefits and outcomes brought by the transfer of responsibility for irrigation management; information about crops grown; the cost of agricultural inputs such as seed/seedlings, fertilizer, labour; water fees; the importance of agriculture to the livelihoods of the people; the average size of landholdings; agricultural productivity; average income per person/hectare;
- Quantitative data were collected about the physical characteristics and engineering features of each small-medium irrigation system; farmer contributions in terms of labour and money; the number of farmers and water users served by irrigation systems; and the farmer's satisfaction before and after IMT.

This study targeted different groups of participants inviting them to complete interviews, participate in focus group discussions, or fill in questionnaires (See Table 3.2). Participants included Managers from the Ministry of Agricultural and Rural Development, and PIM/IMT consultants, Irrigation Management Company officials, members of Water User Associations and Agricultural Committees (including on-farm irrigators), and farmers/water users.

Table 3-2: Data collection techniques and participant groups

Methods	Participants	Numbers of Participants
Interview	MARD consultant, IMC officers, WUA and AC members, on-farm irrigators	19
Questionnaires	Farmers	150
Focus Group Discussion	IMC officers, WUA members and ACs members, on-farm irrigators	6

Source: Created for this study

The following section provides a description of the chronology of field work and the detail of how participants were contacted and the process of collecting information.

3.3.1 Chronology of Fieldwork

Fieldwork took five months from the beginning of September 2013 to January 2014. Activities during fieldwork included contacting participants, undertaking field site observations, conducting interviews and focus groups, and administering the farmers/water user's questionnaire. The detail of the fieldwork chronology is displayed in Figure 3-1.

3.3.2 Field observations

During field visits the researcher observed and documented the physical and geographical characteristics of villages and irrigation systems. The condition of infrastructure was noted such as the opening and closing mechanisms in the headworks in Ngoila, the pumping station in Gia Xuyen, and the gravity fed systems in N6. Observations also enabled the researcher to corroborate details related to irrigation performance raised during the social survey data collection.

No.	Process	September		October		November		December		January	
		From 1th to 10th	From 11th to 30th	From 1th to 15th	From 16th to 31th	From 1th to 15th	From 16th to 30th	From 1th to 15th	From 16th to 31th	From 1th to 10th	From 11th to 20th
1	Making contact	✓									
2	Pilot Tests	✓									
3	**Ngoila**										
	Interview and Focus group										
	Farmer' survey										
	data input and Transcribe										
4	**N6**										
	Making contact and Field site observation										
	Interview and Focus group										
	Farmer' survey										
	Input Data and Transcribe										
5	**Gia Xuyen**										
	Making contact and Field site observation										
	Interview and Focus group										
	Farmer' survey										
	Data input and Trnascrible										
6	**MARD and IMT/PIM consultant**										
	Input Data and Transcribe										

Figure 3-1: Chronology of Field Work in 2013-2014

Source: Created for this study

3.3.3 Pilot tests for interviews and questionnaires

The interview schedule and the farmer's questionnaire were piloted in the Ngoila irrigation system. A short trip was conducted over three days from 25-28 September 2013. The researcher worked with the Director of the Irrigation Management Board of Ngoila to better understand its irrigation systems, to make some contacts, obtain a list of households, and pilot the interview questions on two WUA members, and the farmer's questionnaire on six farmers in this area. The interview schedule and questionnaires were modified accordingly.

3.3.4 Contacting participants

In order to make contact with irrigation company staff and members for the three case studies, many contacts needed to be made.

In Ngoila, with the support from the Vietnamese Academy for Water Resources, the researcher directly contacted the Director of the IMB and made an appointment to meet them. Following this first interview other staff of the IMB and some WUA members were interviewed.

In Gia Xuyen appointments with the vice-director of the IMC and the chairman of the WUA were made by telephone call. The chairman introduced the researcher to other members of the WUA and on-farm irrigators.

In the N6 system, the researcher had to make contact with the Province Agriculture and Rural Development (DARD) member, who then introduced other IMT officials for interviews.

WUAs members and AC staff

WUA members and AC interviewees were also contacted with assistance from IMCs and Board of Tuyen Quang officials in each province. Due to the requirements of irrigation system management there is a good relationship between IMCs, WUAs and ACs, so the researcher could easily make appointments with participants across locations.

3.3.5 Face-to-face interviews

Face-to-Face interviews are considered to have several advantages to other social survey techniques including: response rates tend to be higher; the interviewer actively controls the question order, and ensures all questions are answered by interviewees; the physical and social circumstances can be managed; and the researcher has full understanding of what the respondent really wants to say (Joy, 2007).

Interviews were conducted with four different groups on the basis of their knowledge about irrigation systems in Vietnam: IMC officials, WUA staff, commune leaders (who have accepted responsibility for irrigation management) and MARD officials. The interview schedule is included in Appendix 3. Table 3-3 displays total number of interview in this study.

Table 3-3: Number of interview participants in different management entities

Organisation	Ngoila	N6	GiaXuyen	Total
WUA	3		1	4
AC	2	2		4
IMC	1	2	1	4
Irrigators	1	2	2	5
Ministry of Agricultural and Rural Development and PIM Consultant in Hanoi				**2**
Total				**19**

Source: Create for this study

To ensure that the research was conducted in accordance with an ethical code of conduct prior to conducting individual interviews, the purpose of the research was introduced and an explanation given as to how the researcher was going to manage the data. The introduction letters from Flinders University and the Vietnam Academy of Water Resources were translated into Vietnamese and shown to interviewees before the interview commenced. The information sheet informed participants about the intent of the research and what was expected of the participant. It confirmed that information disclosed during the interviews was confidential and that the participant would remain anonymous. Participants then read and signed a consent form once they understood the purpose of the study and agreed to engage in it.

For this study interviews were conducted in Vietnamese, the native language of both the researcher and participants. The interview began with warm-up questions to facilitate communication. This involved a general discussion about agricultural production or the difficulties that the interviewee had faced in their daily lives; these introductory conversations continued until an understanding was established between the researcher and the participant.

All of the interviews were conducted in the offices of the interviewees and took between 40 to 60 minutes depending on how much time individuals had and how much they had to say. The interviews were recorded with a digital voice recorder and the researcher took notes during the interview. The recordings enabled the researcher to undertake a thorough analysis of the ideas generated during the interviews.

3.3.5.1 IMC staff and Board of Tuyen Quang

Five IMC members were interviewed: two staff from Ngoila, two in N6 system, and one in Gia Xuyen. These people have considerable experience in working for the IMCs. Some of them had knowledge of working for the irrigation system prior to the transfer of management responsibility. IMC staff was asked questions related to:

- Investment capital of irrigation systems; functional condition of irrigation works;
- Cost of irrigation, ratio between cost of O&M and water fees;
- Government funds, the implementation processes of irrigation systems transfer, effectiveness of irrigation system transfer program;
- They also were asked about their evaluations of IMT, how their organisations support to improve IMT.

3.3.5.2 WUA members and AC leaders

Eight members including four WUA members and four AC officials across three locations were asked to provide information related to roles of WUAs; how WUAs help to reduce disputes; and whether or not WUAs bring about improvements in the quality of irrigation O&M. All interview participants were also questioned about their perceptions of the irrigation systems transfer program, the water fee policy, current irrigation management problems and difficulties that their organisations face, and their support for better water management.

Face-to-face interviews were also conducted with AC members. They were asked their perception as to the efficiency of irrigation systems, advantages and disadvantages of the IMT on their household, and their commune. AC members were asked whether their organisation supported the WUA, and in what they and the government needed to do in order to improve the performance of their irrigation system.

3.3.5.3 PIM foundation member

The researcher interviewed one of the foundation members of PIM/IMT in Vietnam who had extensive experience working on PIM with the ADB and WB. This interviewee had participated in the implementation of the IMT of N6 at an early stage of the process. Two interviews were conducted with this person once at the beginning and once at the end of the field work. Both interviews were conducted in an office in Hanoi. Information gathered during the interview included the perception of the advantages and disadvantages of the irrigation transfer, as well as difficulties and solutions to improve the effectiveness of IMT. The Decree (decree 154/ND/CP) was discussed to investigate its advantages and disadvantages.

3.3.5.4 Ministry of Agricultural and Rural Development (MARD)

A more formal and structured interview was conducted with the MARD government officer, the Ministry of Agriculture and Rural development (MARD) manager; this officer was responsible for evaluating the law related to irrigation management and the transfer of irrigation systems in Vietnam. This interview was conducted at the final stage of the field work. Honouring the interviewee’s wishes this interview was not recorded. This interviewee gave their perception about the opportunities and challenges related to current irrigation management and the operation of WUAs. The interviewee also offered solutions and identified policies that MARD has established to solve problems. In addition, this MARD official was also asked about the irrigation service fee policy (decree 154/ND/CP) and its effect upon the O&M of irrigation systems.

3.3.6 Farmers' questionnaire

Questionnaires play an important role in social surveys because they allow participants "to self-report to express their attitudes, beliefs and feelings toward a topic of interest" (Teddlie & Tashakkori, 2008, p.232). Quantitative information can be collected from a large number of participants in a short period of time by using questionnaires. Questionnaire results can be input, and analysed quickly (Neuman, 2011).

The researcher set out to obtain an understanding of irrigation management practices and to gather opinions in regard to water management and effectiveness of IMT from the perspective of farmers. A copy of the questionnaire is included in Appendix 4). The questionnaire investigated:

- Perceptions of irrigation performance before and after the IMT;
- Levels of satisfaction with water management services before and after the turnover from government;
- Crop yields;
- Cost of agricultural inputs;
- Crop production, and
- Socio-economic factors
- Demographic characteristics (household size, farmer's level of education, and income).

Farmer questionnaires were administered after interviews with IMC staff had been conducted. Questionnaires were administered in the three case study locations including Tuyen Quang (Ngoila case study), Hai Duong (Gia Xuyen case study), Nghe An (N6 case study).

3.3.6.1 Selection of participants

The researcher received water user lists from IMCs in Ngoila, the AC in Gia Xuyen, and a WUA in N6. The sample was stratified into three categories according to the position of farms along the irrigation system (the head, middle and the tail). Respondents were selected to provide an even distribution from the headwork to downstream water users to assist the researcher understand the differences created by positioning along the system in terms of water supply. Fifty households were randomly selected from across the various communes in each of the three case study sites.

The researcher approached farmers' houses with a trusted person (such as a member from a WUA in Gia Xuyen, and IMC staff in Ngoila and N6). The trusted person left once the research process commenced. Only the researcher and research participant were involved in responding to the research instruments to ensure that answers were not influenced by the presence of the trusted person. Questionnaires were administered orally to individuals to accommodate illiterate respondents and to ensure that all participants understood the questions before they answered them.

The same information was given to all farmers (the information sheet and consent form) to make sure that all respondents knew their answers were confidential. One hundred and fifty water users (e.g. those who used water from the irrigation network) responded to the questionnaire. Details of the sample are presented in Table 3-4.

The researcher stayed with respondents to help them complete the questionnaires (Figure 3.2). In rural Vietnam many people are illiterate and they needed help to fill in the answers. This approach resulted in a 100% response rate.

Figure 3-2: Researcher administering the farmer's questionnaire

Source: Fieldtrip observation 2013

Table 3-4: Survey questionnaire distribution

Irrigation system	Commune	No. of Households	Sample size	Location
Ngoila	Trung Mon	324	8	Upstream
	Y La, Tan Ha	1348	29	Upstream and Middle
	Kim Phu	330	8	Downstream
	Hung Thanh	196	5	Downstream
	Total	**2259**	**50**	
N6	Trung Thanh	520	20	Upstream
	Bac Thanh	335	13	Middle
	Xuan Thanh	205	8	Downstream
	Bac Long	216	9	Downstream
	Total	**1276**	**50**	
Gia Xuyen	Tranh Dau	996	19	Upstream
	Tang Ha	620	12	Middle and Downstream
	Dong Bao	1004	19	Midle and Downstream
	Total	**2620**	**50**	
Total		**150**		

Source: Farmers' questionnaire survey 2013

Table 3.4 shows that mix of head, middle and end responses were collected for the three case study sites. Althoghter, fifty-three famers from the head of canals, forty-five from the middle and fifty-two from the tail of canals completed questionnaires.

The same information was given to all farmers (the information sheet and consent form) to make sure that all respondents knew their answers were confidential. One hundred and fifty water users (e.g. those who used water from the irrigation network) responded to the questionnaire.

Another method for measuring change is a retrospective survey design in which respondents are asked during a single interview to recall attitudes or behaviours at several previous time periods (Menard 2002). This measurement strategy is distinct from the longitudinal survey because it relies on respondents' retrospection rather than repeated interviews. While this approach allows researchers to measure within-subject change over time, an obvious de- efficiency is that it relies on memory recall, which introduces potential bias given the difficulty that some survey respondents have remembering even basic facts or behaviours (Hillygus & Snell, 2015).

3.3.7 Focus Groups

Focus groups are used to quickly and conveniently collect data from several people simultaneously. This method helps participants to jointly clarify their views, exchange experiences or points of view that would be less easily accessible in a one-to-one interview (Wong, 2008). According to Kitzinger (1995, p.2), there are three advantages for using focus groups. They:

(1) Do not discriminate against people who cannot read or write;

(2) Encourage participation from those who are reluctant to be interviewed on their own (such as those intimidated by the formality and isolation of a one-to-one interview); and

(3) Encourage contributions from people who feel they have nothing to say.

Focus groups were conducted in the three case study sites with different groups of participants. These participants were chosen on the basis of their roles across the different institutional systems for the management of irrigation schemes. Appendix 5 includes the questions asked of N6 IMC officials, Y La AC members, and WUAs members in N6 and Gia Xuyen. Table 3-5 presents the number of focus group discussions conducted in this research including IMC staff, WUA members, AC members and on-farm irrigators.

Table 3-5: Focus group discussions

Participant group	Ngoila Y La Commune	N6	GiaXuyen
IMC		✓	
WUA		✓	✓
AC	✓		✓
On-farm irrigator	✓		

Source: Created for this study

3.3.7.1 Focus group: Y La Commune Agricultural Cooperative, Ngoila

One focus group was conducted in Y La commune in Ngoila on 21 September 2013 in the Y La Agricultural Cooperative office. Y La was selected because compared to the three other communes in Ngoila, Y La had the largest agricultural area supplied by the Ngoila irrigation system. In addition, Y La's irrigation performance has been evaluated by WUA members as being effective and efficient compared to the other three communes in Ngoila. Investigating the factors that affect irrigation performance and the reasons why this commune has achieved better results than other locations in Ngoila is important. Twelve people from Y La Commune were invited to attend the focus group, including the two leaders of the commune, one agricultural production planning designer, and seven leaders in seven villages of Y La.

Nine main questions were discussed during this focus group including the group's perceptions of the achievements of IMT in regard to water supply management, maintenance of canal systems, crop productivity, input production costs, changes to income, how to improve farmer's participation in irrigation management, water user's responsibilities in irrigation management. Figure 3-3 shows participants in the focus group discussion in Y La AC commune.

Figure 3-3: Focus group, Y La commune AC, Ngoila

Source: Y La commune, Ngoila 21 September 2013

The focus group discussion lasted for 90 minutes and was recorded on a digital voice recorder and later transcribed into a word processing file.

3.3.7.2 Focus group: on-farm irrigators Y La Commune Agricultural Cooperative, Ngoila

Initially, the researcher did not plan to conduct focus groups with on-farm irrigators or WUAs members, however, during field work, with support from the WUA in Ngoila, instead of interviewing individual irrigators in Ngoila, group of four irrigators were conducted in Y La commune (Ngoila). Contact with farmers was made by telephone by Ngoila WUA leaders who arranged a suitable meeting time. These on-farmer focus groups lasted approximately one hour.

On-farm irrigators were asked about the opportunities and difficulties that they are facing in relation to irrigation systems management, water supply, the ISF waiver and O&M; and, support they need from government agencies or local government. They were also asked about social aspects of irrigation management. The focus group discussion was recorded and later transcribed.

3.3.7.3 Focus group IMC officials, N6 system

A focus group with four IMC staff in North Nghean was conducted on 25 November 2013. It was organised with the support from the vice-director of the IMT. Invitations were made by a telephone call. The focus group discussion was conducted in a government office in Yen Thanh district (Figure 3-4). Information gathered included the history of the IMT in the N6 system, opinions about the roles of IMT and WUA in irrigation systems, and the main constraints to improving the effectiveness of WUAs in irrigation infrastructure management.

Figure 3-4: Focus Group of IMT staff in N6 irrigation system

Source: Yen Thanh, Nghe An 25 November 2014

3.3.7.4 Focus group WUA members, Gia Xuyen and N6

Two focus groups with WUA members were conducted in N6 on 24 November 2013 and Gia Xuyen on 10 December 2013. In both locations invitations to participate were made by telephone with the support from IMC managers. The meeting with Gia Xuyen WUA took place in Gia Xuyen AC rooms, while in N6 the meeting took place in the Long Thanh AC office (one of the four communes irrigated by the N6 system). These focus group discussions took around 80 minutes. Members were asked about how their organisations were established, how they implemented O&M, and their role in water delivery. They were also asked about distribution of finances between government agencies and the WUA, and what could be done to improve the effectiveness of the WUA. They were asked about the barriers to effective irrigation management and what might be done to improve performance. The focus group discussion was recorded and later transcribed.

3.3.7.5 Secondary data collection

Secondary data was gathered from many sources both before the field trip and in conjunction with the social surveys. To gain understanding about the three case study sites, secondary data was accessed in the form of reports produced by donor funded infrastructure projects (e.g. Asian Development Bank (ADB) in N6 system and Ngoila, Japanese International Corporation Agency (JICA) in Gia Xuyen) and the Government. This offered context into the history of the irrigation management transfer, irrigation management models, and the process of establishing WUAs in each field site location.

During the field trip, regulations/decrees and reports of WUA congresses and local organisations (e.g.ACs) were collected in regard to irrigation and water supply fees, WUA establishment and regulation for their operation. For the state level perspective policies and reports created by MARD were accessed covering institutional and water-related laws (such as: Irrigation Service Fee allocation, Land use change, evaluations about irrigation management, the pathway of PIM, O&M of irrigation systems, and evaluation of irrigation management models across the whole country.

3.4 Data Analysis

3.4.1 Data analysis

The basis of qualitative data analysis "involves examining, shorting, categorising, comparing, synthesising, and contemplating the coded data as well as reviewing the raw and recorded data" (Neuman, 2011, p.517). Assessment of impact of the impact of IMT is a complex task; many variables need to be considered. To help make sense of the perceptions of participants in this study an evaluation framework has been developed based on previous studies from other countries in regard to WUA/IMT/PIM.

3.4.2 Evaluation Framework

The framework was developed to identify key variables by which to analyse the IMT. In this research, the literature review guided the creation of the evaluation framework for IMT in Vietnam. Information relating to the influence of the IMT/PIM/WUA was reviewed from many publications and case studies from different countries. By doing a systematic investigation of previous evaluations from other places critical elements suited to the purpose of this study have been used to evaluate IMT. The review process produced seven main elements by which to closely investigate IMT across the case studies. These elements are presented in Table 3-6.

The perceptions of various actors engaged or affected by irrigation management were captured and coded using the evaluation framework.

3.4.3 Qualitative approach applied in data analysis

Data collected on digital voice recorder from interviews, focus groups, and qualitative sections of the farmers' questionnaires were transcribed and saved as word files. To make sense of the large volume of textual information collected in the field the data need to be organised through deductive coding. Figure 3-6 shows how themes and subthemes were identified and refined in this study. Data was categorised by allocating or labelling according to the codes or themes (Creswell, 2013).

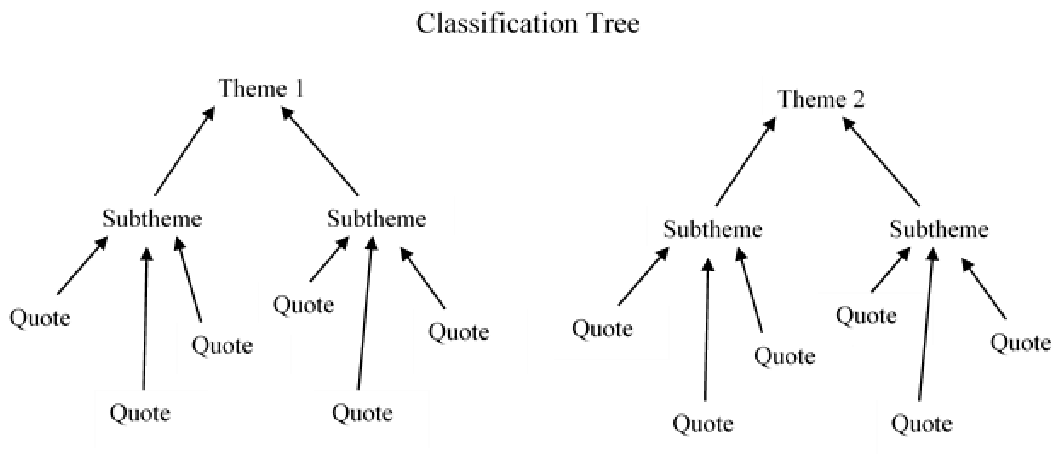

Figure 3-5: Data coding method to achieve the subthemes and themes

Source: Modified from Saldaña (2009, p.12)

A qualitative data analysis program NVivo was used to organise the data. This is more efficient than manual coding. NVivo software allows for the construction of a coding frame that can be readily applied across all survey instruments, allowing for comparison and theme building. Nvivo software allowed for ease of data management and retrieval.

Table 3-6: The evaluation framework

	Indicators/Themes
I	**Financial Arrangements**
	Allocation of government subsidies
	Reduction of government expenditure
	ISF collection
	Financial management (e.g. to cover shortage)
	Transparency (e.g. disclosure of spending to water users)
II	**Water Supply Management**
	Timeliness of water distribution
	Adequacy of water supply
	Equity of water supply
	Reliability of water supply
III	**Operation and Management of Irrigation Facilities**
	O& M headworks and main canal systems
	O& M on-farm canal systems
IV	**Agricultural benefit**
	Change in crop cycles
	Change in crop yield
	Increased crop diversity
	Expansion of irrigated area
V	**Economic impact on Farmers**
	Change to farmers' income
	Benefits from using water and paying fees (production costs)
VI	**Social effects of IMT**
	Farmer participation in irrigation management
	Leadership capability
	Meeting frequency and productivity
	Conflict resolution
	Roles of women
VII	**Governance aspects of IMT**
	Rights, roles and responsibilities
	Vertical linkage/coordination/communication between tiers of government
	Horizontal links/coordination/communication between WUAs
	Accountability
	Shared decision-making

Source: Created for this study

3.4.3.1 Interpreting not translating

This research was conducted in Vietnamese and the audio recordings were transcribed in Vietnamese. Word files of interviews, focus groups and farmer questionnaires were uploaded into Nvivo version 11, a qualitative data analysis software program. The coding frame was developed in English. Verbatim quotes were translated from Vietnamese into English during the coding stage.

For ease of reference, each transcription was numbered as shown in table 3-7 according to participant group.

Table 3-7: Transcription numbering

Type of qualitative question	Participant	Numbering
Interview	Irrigation Management company (IMC) staff	[Interview, ID ( ), IMC staff, Location]
	Water User Association (WUA)	[Interview, ID ( ), WUA member, Location]
	Agricultural corporative (AC)	[Interview, ID ( ), AC member, Location]
	Ministry of Agricultural and Rural Development (MARD)	[Interview, ID ( ), MARD member]
	On-farm irrigator (WUA)	[Interview, ID ( ), On-farm irrigator, Location]
Group discussion	Water User Association	[Focus Group, WUA members, Location]
	Agricultural corporative	[Focus Group, AC members, Location]
	On-farm irrigators	[Focus Group, On-farm irrigators, Location]
Structured questionnaire	Farmers	[Farmer, location, ID (1) to (50)]

Source: Created for this study

3.4.4 Quantitative approach applied in data analysis

The farmer questionnaires consisted of a number of Likert scales by which to measure levels of satisfaction. This numerical data was input into a statistical software program, SPSS. Quantitative methods were used to illustrate the frequency of responses in the farmer questionnaire. The descriptive statistics have allowed to show comparisons across the three case studies and to distinguish similarities and differences in perceptions.

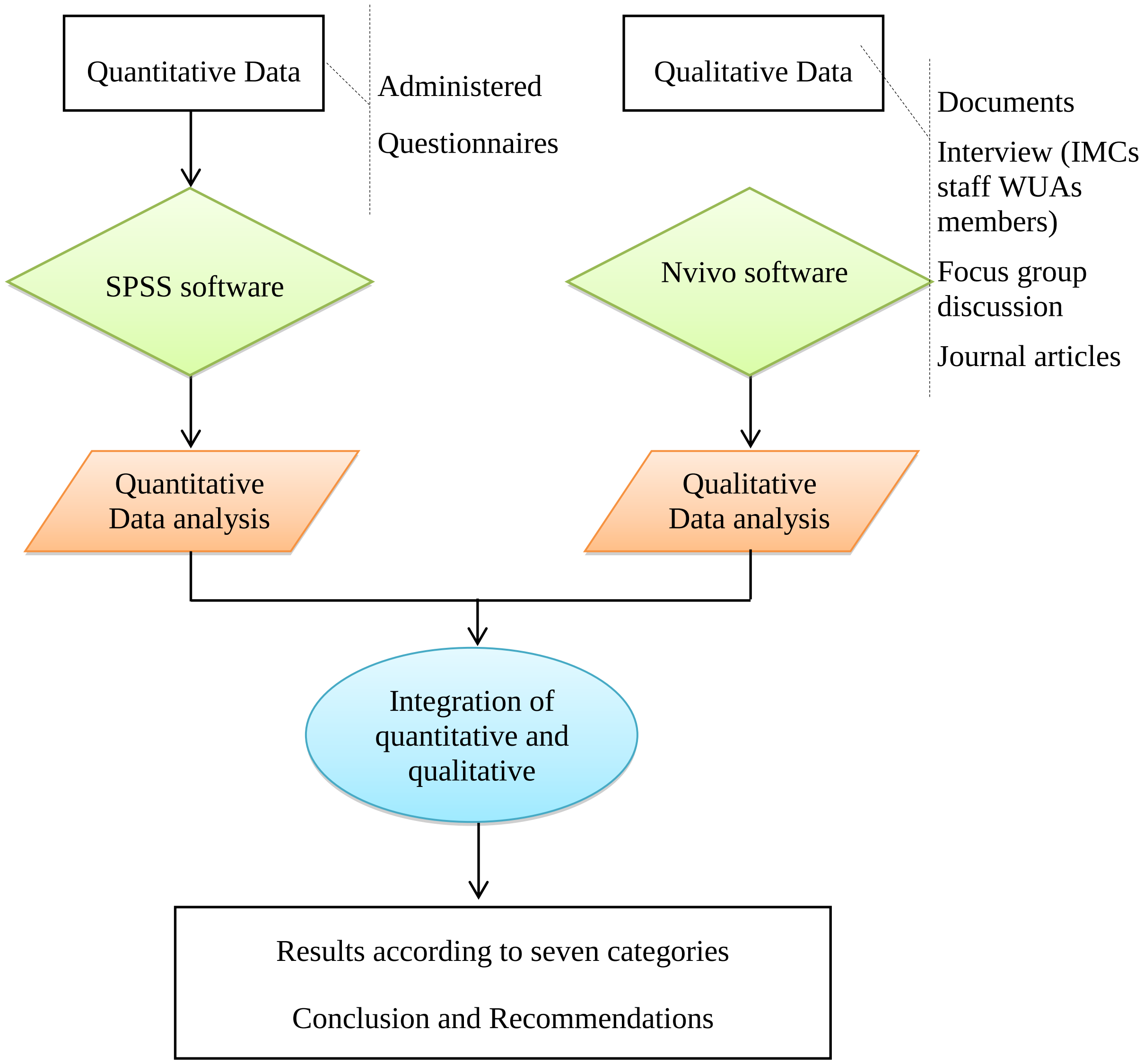

Figure 3-6: Data Analysis Process

Source: Created for this study

3.5 Limitations of the research methods and approach

For logistical reasons this study is based on three case studies all in the North of the Vietnam. It was not possible given time and funding constraints to visit all eight regions. Acknowledged here is that the story from the south or centre of the country would very likely be different given those areas different histories and environments and in this sense the findings can only be attributed to this singular region rather than for the whole of the country.

Five months were allocated for the field research meaning that field work time and effort was spread rather thinly, just six weeks for each site. In hindsight it would have been perhaps more valuable to have concentrated on one or two sites, and with greater focus on one type of irrigation system. This would have permitted a more in-depth engagement with the sites and their characteristics and the capability to pay closer attention to more nuanced features within a system that shape success including changes or interventions beyond the transfer such as wider political reform, changes in governance – more broadly speaking than irrigation management, money, technological effects and so on.

This study has relied on participant's recollection of conditions of irrigation performance in the past. According to Moser and Kalton (1971, p.255) asking people their opinions based on past events may introduce bias or inconsistencies in the findings due to memory distortion (Hillygus & Snell, 2015, Moser and Kalton 1971, p.225). This study made every effort to speak to farmers who had been engaged in farming along the canals under investigation at the time of transfer. As such the researcher attempted to ask questions of those people who were most likely to be able to answer them accurately. Given the significance of the transfer it was reasonable to expect farmers to be able to recall their experience before the transfer. The researcher was confident that participants understood and were able to give meaningful answers.

3.6 Conclusion

This chapter has presented the logic behind the research design, a chronology and overview of the field work processes, and the approach taken for analysing the data. The analytical framework based on seven evaluative elements (based on the literature review findings) was presented. This framework forms the structure through which the case studies in future chapters are presented.

Chapter 4 IRRIGATION SYSTEMS MANAGEMENT IN VIETNAM

Vietnam has one of the largest networks of irrigation infrastructure in the world. Managing irrigation and maintaining the network in Vietnam is highly complex. One of the aims of the thesis is to provide context for the three case studies by explaining the history and process of devolution of irrigation responsibility, and to describe different roles and responsibilities for irrigation management. This chapter presents the history of agricultural production in Vietnam over the last 50 years from the time it became an independent country in 1954. Agricultural reforms are directly connected to the construction and governance of irrigation systems. The mechanisms of irrigation systems management, the process of IMT implementation, funding policies and institutional arrangements related to the IMT/PIM in Vietnam are explained. **Section 4.1** introduces information about water availability, the role of irrigation systems and irrigated agricultural production in Vietnam, particularly the role of agricultural production in terms of contribution to the economy, employment and poverty reduction. **Section 4.2** presents the evolution of agricultural production and its relationship to irrigation infrastructure management, governance and financing. This section also emphasises the various models of irrigation management systems in Vietnam, typical features of irrigation system management including the role of state, provincial, district and commune management entities. The concept of Participatory Irrigation Management (PIM) and Irrigation System Transfer (IMT) in Vietnam is presented. **Section 4.3** introduces the different regions of Vietnam and provides an overview of the three case study locations.

4.1 Availability of Water Resources, Roles of Irrigation System and irrigated agriculture in Vietnam

Vietnam is a country highly dependent on agricultural production. Agriculture not only brings significant economic value from exports such as rice, coffee, and cashews but it also plays an essential role in ensuring food security for the Vietnamese population. It also creates jobs for large numbers of the population living in agricultural areas. Vietnam is located in a tropical monsoon region with high rainfall averaging approximately 1,800 mm per year. However, 80-85% of annual rainfall is received during only three to four months from August to November.

Water shortages occur during the remaining eight months (Malano et al., 1999; Harris, 2006). As a result, irrigation systems are vitally important. They provide a guaranteed water supply which helps to increase food supply and meet the food demand for Vietnam's rapidly expanding population. There is a diverse array of irrigation systems across Vietnam functioning at various scales from regional to local. A variety of management and governance models have evolved over time to manage irrigation systems.

4.1.1 Water Resources in Vietnam

Vietnamese farmers identify four main factors affecting agriculture production. Water is the most important: "first is water, second manure, third industriousness, fourth variety" (Tiep, 2001, p.226). Water is the most important because a sufficient quantity of water plays a crucial role in quality and yield of agricultural production and sustainable rural development (Tiep, 2008a).

Vietnam has several water resources but river basins and ground water are two main sources for water supply. 70% originates from its river basins. Surface water accounts for 835,000 million m^3 per year of supply and ground water approximately 60,000 million m^3 per year (FAO, 2001). The river network consists of 2,360 rivers (of more than 10 km length), and eight large basins with a catchment area of more than 10,000 km^2 (Hansen & Phan, 2005; Giang et al., 2012). The Mekong and the Red river Basins are the two most important international rivers in Vietnam. Water from these catchments provides two thirds of Vietnam's water resources (Waibel, 2010). However, Vietnam lies downstream from China, Lao, Myanmar, Thailand, and Cambodia. As such it lies at the end of major river systems such as the Mekong, Red, Ma, Ca, and Dong Nai Rivers. Thus, the availability of river water is often beyond Vietnam's control. This is especially so during the dry season (December to July) when upstream countries withdraw large amounts of water (Pilarczyk & Nuoi, 2005). Agricultural production demands the highest volume of water compared to other sectors (e.g. industry, aquaculture and domestic) (Figure 4-1).

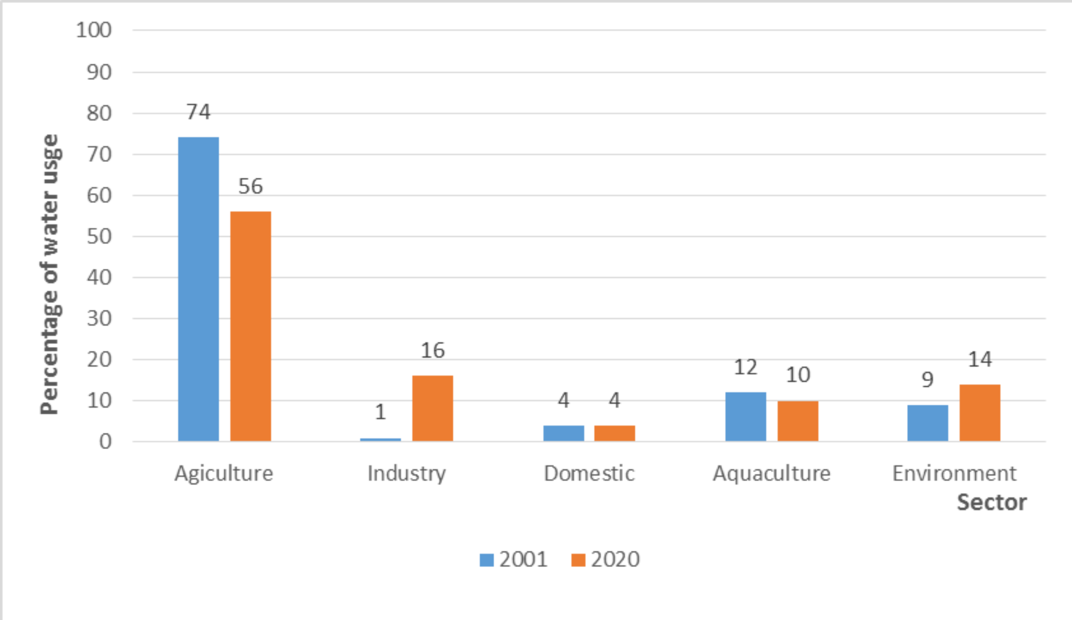

Figure 4-1: Water usage by different industries actual (2001), and predicted (2020) in Vietnam

Source: Adapted from (Diep et al., 2007, p.5)

Under climate change, the frequency of drought and flood are predicted to increase in Vietnam (Giang et al., 2012). Due to the unpredictability of water supply, irrigation systems in Vietnam play a critical role in the storage of water. Water is captured in the summer months when rainfall is heavy, ensuring an adequate supply of water supply during dry seasons.

4.1.2 Importance of agricultural production in Vietnam

According to the World Bank (World Bank, 2016, p.xi)

> *Vietnam's agricultural sector has made enormous progress. Steady advances in smallholder rice productivity and intensification through the 1990s and beyond have played a central role in Vietnam's successes in poverty reduction, national food security, and social stability, bringing significant income from exports Vietnam once experienced hunger yet its per capita food availability now ranks among the top tier of middle-income countries.*

Like many Asian countries, the majority agricultural production in Vietnam is based on the rice industry. Rice production, while it accounts for the bulk of the irrigated area, it also consumes a large proportion of agricultural water usage. Rice land accounts for 60% of the area planted with total annual crops; rice production is an important source of livelihood for around 9 million rice-farming households and for millions of rural poor (Thang & Linh, 2015). In addition to rice, Vietnam produces a variety of agricultural crops including coffee, pepper, and many fruits such as lychees, and pineapples (FAO, 2001).

4.1.2.1 Contribution of agriculture to the Vietnamese economy

Agricultural production accounts for 20% of GDP, and 30% of Vietnam's exports (World Bank, 2013, 2016). Vietnamese agricultural productivity grows approximately 3% every year with total production rising from 33 million tons in 2000 to 40 million tons in 2010 (Hanh et al., 2010).

The result of the "Doi Moi" reform (a process adopted to replace the central planning model of socialism in a shift to a "market-oriented socialist economy under state guidance" (Beresford, 2008, p.1) boosted Vietnam's economy from a country importing rice in 1980s to the world's second largest exporter after Thailand in the 2000s (Nielsen, 2003). This is taken up in detail later in this chapter. Vietnam has consistently been one of the top ten rice exporters since that time. In 2011 Vietnam ranked as the world's largest rice exporter (VnEconomy 2011) and as second largest in 2012 (World Bank report). Figure 4-2 shows rice export-import production from 1962 to 2010.

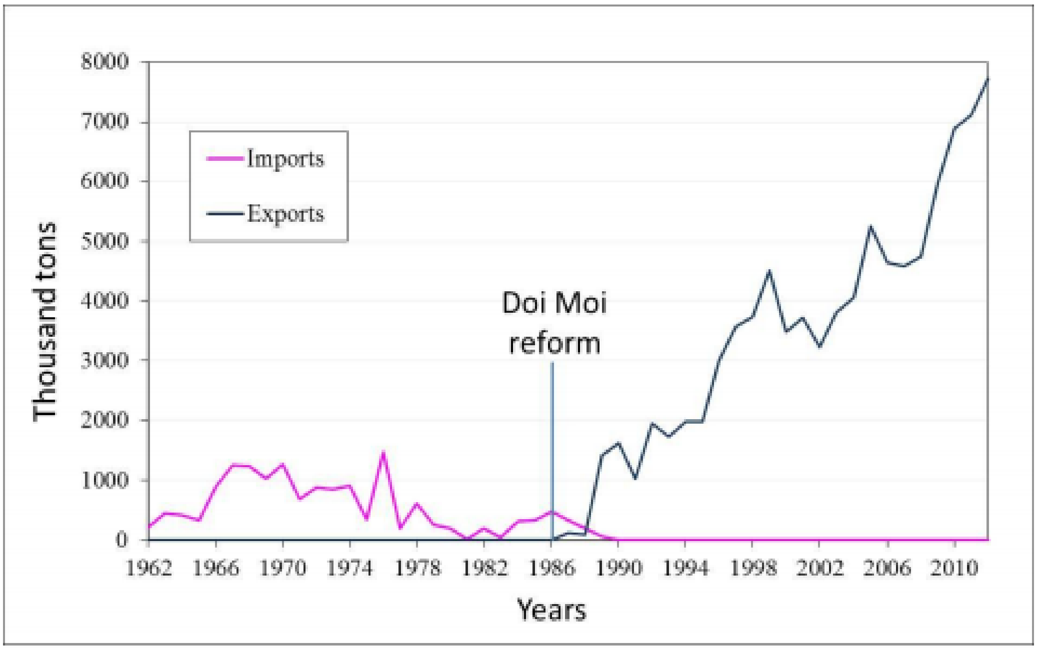

Figure 4-2: Vietnam rice export –import during decades

Source: Adapted from Vu (2013, p.2)

4.1.2.2 Employment Creation

Although employment in the agricultural sector has steadily declined from 70% in 2000 (George, 2003) to 47% in 2012 (World Bank, 2016), the sector is the main employer and driver of development for rural regions in Vietnam creating jobs for four-fifths of the rural Vietnamese population (Thinh, 2009).

4.1.2.3 Poverty reduction

The result of the “Doi Moi” reform also transformed Vietnam from one of the poorest countries in the world to a lower-middle income country (Barker, 2004). The share of income from agriculture (including forestry and fisheries) in household income declined nationally from 28.6% in 2002 to 19.9% in 2012 (World Bank, 2016). For rural households though, primary income from agriculture was 43.4% in 2002 rising to 31.8% in 2012 (World Bank, 2016). The success of increasing agricultural production has played an important role in reducing rural poverty (Food and Agricultural Reviews, 2015), the number of households in poverty declined 1% per year since 1998 to 2015. Rural poverty had significantly reduced from 45.5% in 1998 to 27% in 2010, the problem of food security is considered to be resolved (World Bank, 2003; Hoanh et al., 2014).

4.1.3 The role of Irrigation Systems

Agricultural production in Vietnam relies heavily on irrigation, drainage and flood control. Irrigation systems play a central role in agricultural cultivation supplying nearly 8 million hectares or 70% of arable land (Evers & Benedikter, 2009). Irrigation has allowed agricultural intensification, productivity and diversification (World Bank, 2015a).

The development of irrigation systems is closely correlated with the evolution of agricultural development in Vietnam. Irrigation systems were first built by settlers in the Red River Delta several centuries BC. Enormous large-scale hydraulic constructions (such as dykes and canal systems) were built to cope with the repeated flooding of the Red River. Irrigation systems have been continuously developed since the 11th Century in the North of Vietnam, and from mid-15th to the 19th Century in the South (Porter, 1993; Evers & Benedikter, 2009).

Besides China and the United States, Vietnam has one of the largest network of dams and hydraulic infrastructure worldwide. This network comprises over 7,000 dams of different types and sizes. More than 750 can be classified as ‘large’ dams (over 15 m in height or between 5 and 15 m with reservoir storage in excess of 3 million $m^{3.}$ There are more than 6,000 small dams, largely earth embankment dams (of less than 15 and more than $3m^3$) (World Bank, 2015b). The Mekong and Red River Deltas provide for almost 70% of irrigated water for the whole country; these two deltas are largely devoted to rice production based on surface irrigation (Fontenelle, 2001). In 2008, Vietnam has more than 75 large scale irrigation systems and thousands of small- medium irrigation systems including 1,957 water reservoirs, 1,017 dams, 4,172 gravity-fed (culverts) and 1,970 pumping stations that provide steady irrigation for 6,600,000 hectares of land (Tiep, 2008a). Water control is regulated by large pumping systems in Northern Vietnam while small private pumps are popular in the South (Barker, 2004; Evers & Benedikter, 2009). Gravity-fed irrigaiton systems are dominate in the mountainous areas (MARD, 2013).

Irrigation systems infrastructure usually includes headworks (reservoirs, pumping stations, or gravity offtakes), and a series of canals including main, secondary and tertiary ‘on-farm’ canals. Figure 4-3 is a stylised irrigation system. In Vietnam, irrigation systems are defined in the Decree No 32/2001PL-UBTVQH10, 04.04.2001 as “infrastructure works built to tap the usefulness of water, to prevent and combat harms caused by water, protect the environment and balance the ecology” (Tiep, 2008a, p.227)

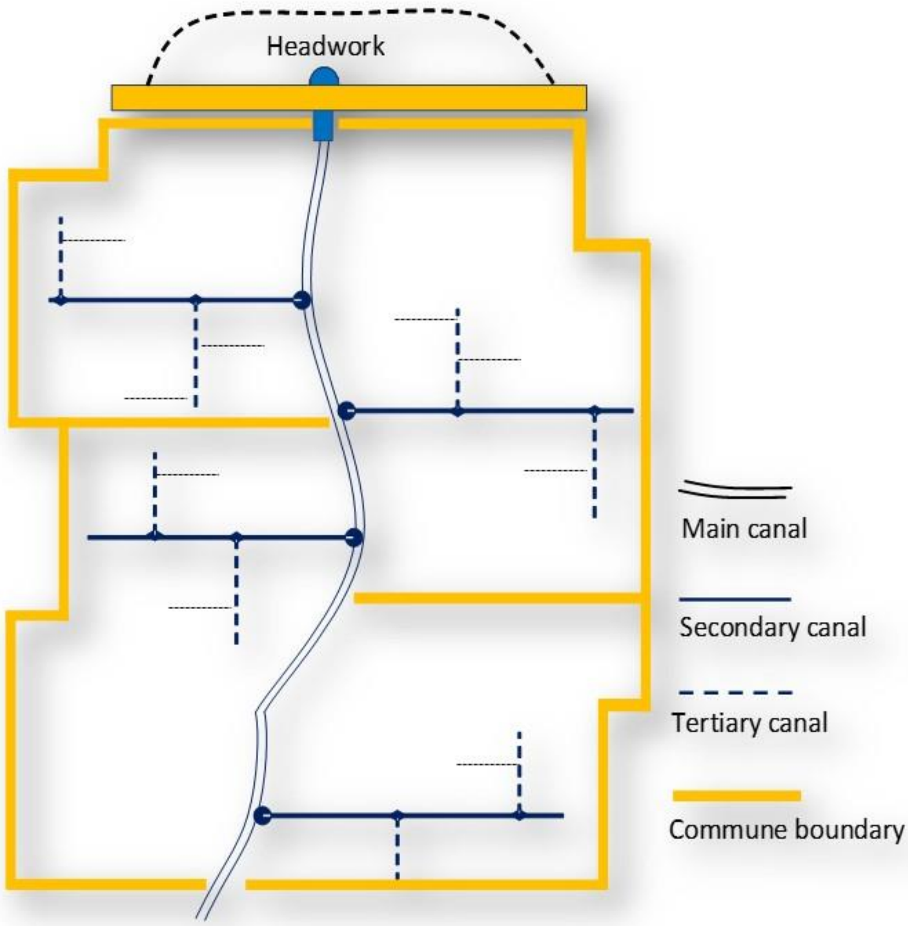

Figure 4-3: An irrigation system

Source: Created for this study

Throughout Vietnam there are irrigation systems at various scales. Large-scale irrigation systems are complex and require sophisticated technologies. Small-scale irrigation technologies (usually referred to as micro-irrigation technologies serving less than 150 hectares) are accessible to and managed by farmers (Trung et al., 2005). Large irrigation systems may provide water to several provinces such as Bac Hung Hai in the Red River Delta or Bac Vam Nao in the Mekong River Delta. Small-scale irrigation infrastructure supplies communes (sometimes a single commune or several communes).

4.1.4 Institutional arrangements for Irrigation System Management in Vietnam

In Vietnam irrigation management schemes have been and are still variously managed, from national government agencies to local (community) organizations, representing layered or tiered administration. In summary there are four levels of administration: State (national), Provincial, District, and Commune. Figures 4-4 and 4-5 illustrate irrigation management both before and after implementing the policy of irrigation service fee (ISF) waiver.

4.1.4.1 National level management

The national Ministry of Agriculture and Rural Development (MARD) has responsibility for water resource management. According to Decree No 199/2013/NĐ-CP, 26.11.2013, MARD has responsibility for:

- High-level policy, planning, including the formulation of regulations and procedures for the protection, exploitation and development of major water resource projects;
- Directly supervising national Irrigation Management Committees through the Inter-Provincial Irrigation Management Companies;
- Water resource development and management;
- Formulating high-level policies on water resources management in general and on irrigation management in particular;
- Establishing the limits of the Irrigation Service Fee (ISF).

4.1.4.2 Provincial level management

There are 63 provinces in Vietnam. The management of irrigation systems is varied across them. Based on high-level policies formulated by MARD, each province has established its own detailed regulations to guide provincial management policies. Irrigation management is typically organised through IMCs (the naming of these entities is different between provinces e.g. IMC in Gia Xuyen and N6 and BoT in Ngoila). IMCs are responsible for the O&M irrigation systems.

The implementation of MARD policies at the province level is the primary responsibility of Province Peoples Committees (PPCs). To implement agricultural policies and irrigation systems management, PPCs have set up provincial

Departments of Agriculture and Rural Development (DARD). These DARDs work under provincial funding and are responsible for designing and planning small irrigation projects of less than 150 hectares. In addition to setting up DARDs, PPCs also created irrigation management agencies to manage all province-wide public irrigation systems under DARD. These agencies include Irrigation Management Companies (IMCs) and water management departments (Trung et al., 2005).

Provincial IMCs may generate revenue from five different sources:

(1) The government subsidy to cover the ISF (described in detail later in this chapter);

(2) Fees collected from other sectors using water e.g. industry and aquaculture;

(3) State budget for maintenance of irrigation systems;

(4) Renting equipment/machinery;

(5) Additional Government subsidies (e.g. for natural disaster recovery).

The expenses of the IMC include:

(1) IMC staff salaries and related staff costs including health insurance and union funds;

(2) Infrastructure depreciation and electricity costs;

(3) Irrigation system operating costs including supporting local WUAs and ACs to maintain tertiary canals;

(4) Administrative costs including telephone, meeting organization, and office equipment;

(5) Staff training, research and technology (Circular 11/2009/TT-BTC dated 24.01.2009.

PPCs must follow the technical guidelines of MARD. Through a provincial DARD, PPCs establish specific strategies and regulations. PPCs decide on exact amount farmers have to pay for their water (within the limits set by MARD), and the balance of charges to be paid by water management organisations (such as Water User Associations and Irrigation Management Companies). PPCs play a coordination role for these other water organisations and agencies and undertake conflict resolution for districts over water disputes.

4.1.4.3 District Level

Three types of management structures are responsible for O&M of irrigation systems at the district level including: Irrigation Stations, District Divisions of Agriculture and Rural Development, and Irrigation Management Boards (operated under the authority of provincial agencies).

Irrigation Stations are subsidiaries of province level Irrigation Management Companies (IMCs). District Irrigation Stations are managed directly by province level IMCs for financial, personnel, technical, and management support.

District Divisions of Agriculture and Rural Development (DARDs) usually manage small schemes whereas sub–schemes of a large irrigation system are run by Irrigation Stations.

4.1.4.4 Commune level

Before the 1990s when IMT was not yet implemented in Vietnam, the most popular commune models for managing irrigation systems were Agricultural Cooperatives (AC). Each commune established an AC. ACs were/are farmer organizations responsible for all general agricultural duties including productiveness, pest control, land management, and maintenance of on-farm irrigation schemes. During the 1960s it was assumed that by involving farmers in irrigation, participatory institutions could provide a good framework for improved O&M of irrigation systems (Bryan, 1997).

Agricultural Cooperatives changed significantly after the Doi Moi. By 1988, ACs controlled all inputs for production and managed production, circulation and distribution. The 1996 Cooperative Law transformed roles of ACs, from being a government instrument implementing socio-economic and cultural activities at the local level, to economic institutions based on voluntary membership (Tien, 1999).

According to the AC Law 18/2003/QH11—26.11.2003, ACs have the following features:

- They are based on the voluntary participation of members who have the same right in terms of leader election, and informing the public;
- They are managed by a cooperative board; the leader of board is elected by farmers;

- They have their own internal financial management rules. They can decide autonomously on services and responsibilities of members. The implementation of this rule must be informed to farmer members in congress ensuring that individual water users are aware of expenditure and repair planning.

Water management or on-farm irrigators in every village are farmers appointed during an AC annual meeting. There are several irrigators in each village depending on the scale of the irrigated area. This group of irrigators are paid by farmers. The tasks of the on-farm- irrigators include:

- formulating the seasonal irrigation schedule prior to the commencement of the crop season; and formulating the water delivery calendar for each village, to receive water released from the main canal systems, and to distribute water to individual farms;
- maintaining and operating on-farm irrigation facilities including cutting grass, removing silt, and domestic and agricultural rubbish that obstructs and blocks water flow;
- undertaking small repairs on infrastructure, protecting and preventing infrastructure from damage, and operating diesel pumps;
- attending training programs conducted by the IMC or engaging in projects to understand and improve their technical and management skills (Trung et al., 2005).

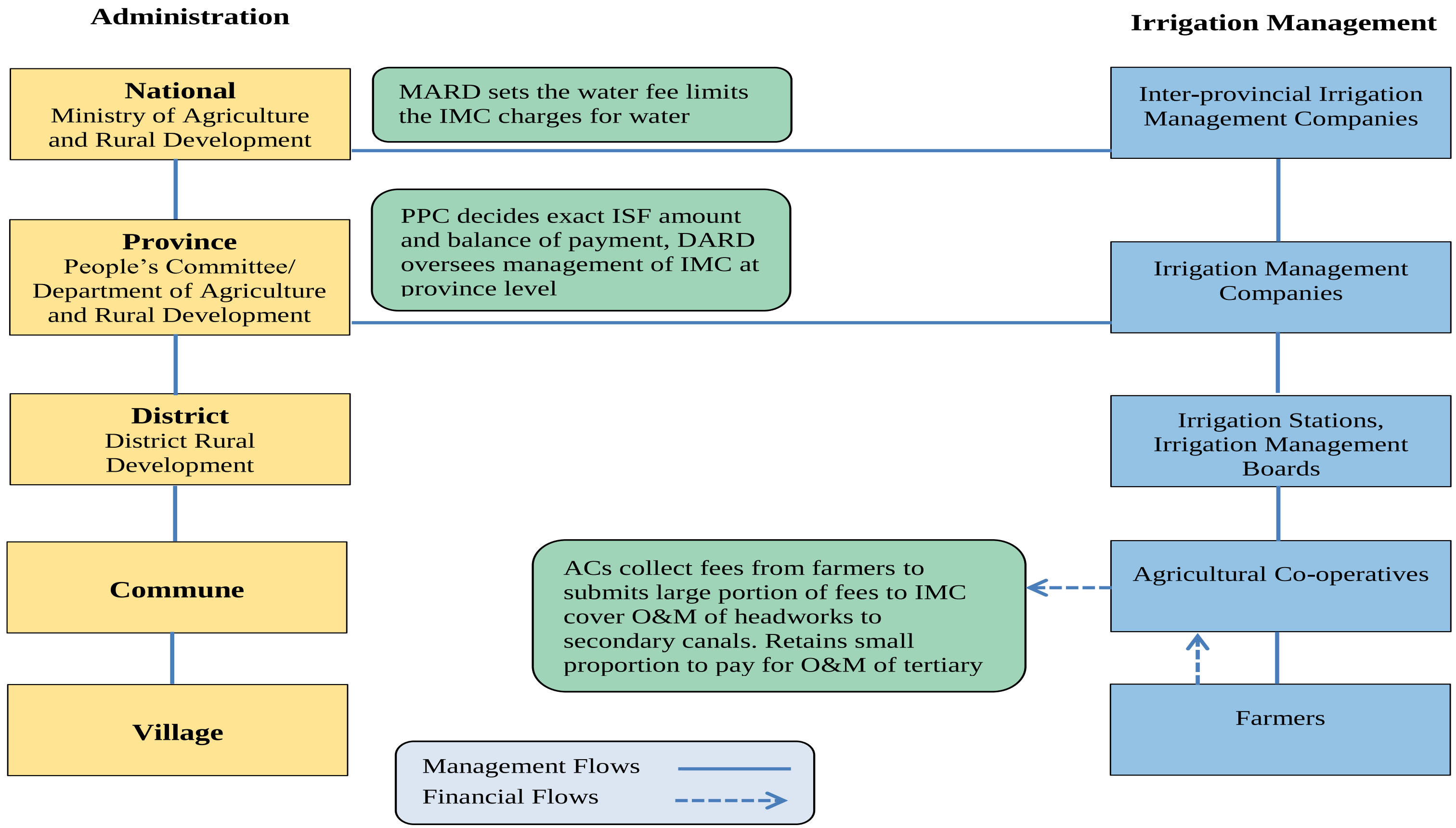

Figure 4-4: Irrigation management both before implementing the policy of irrigation service fee (ISF) waiver

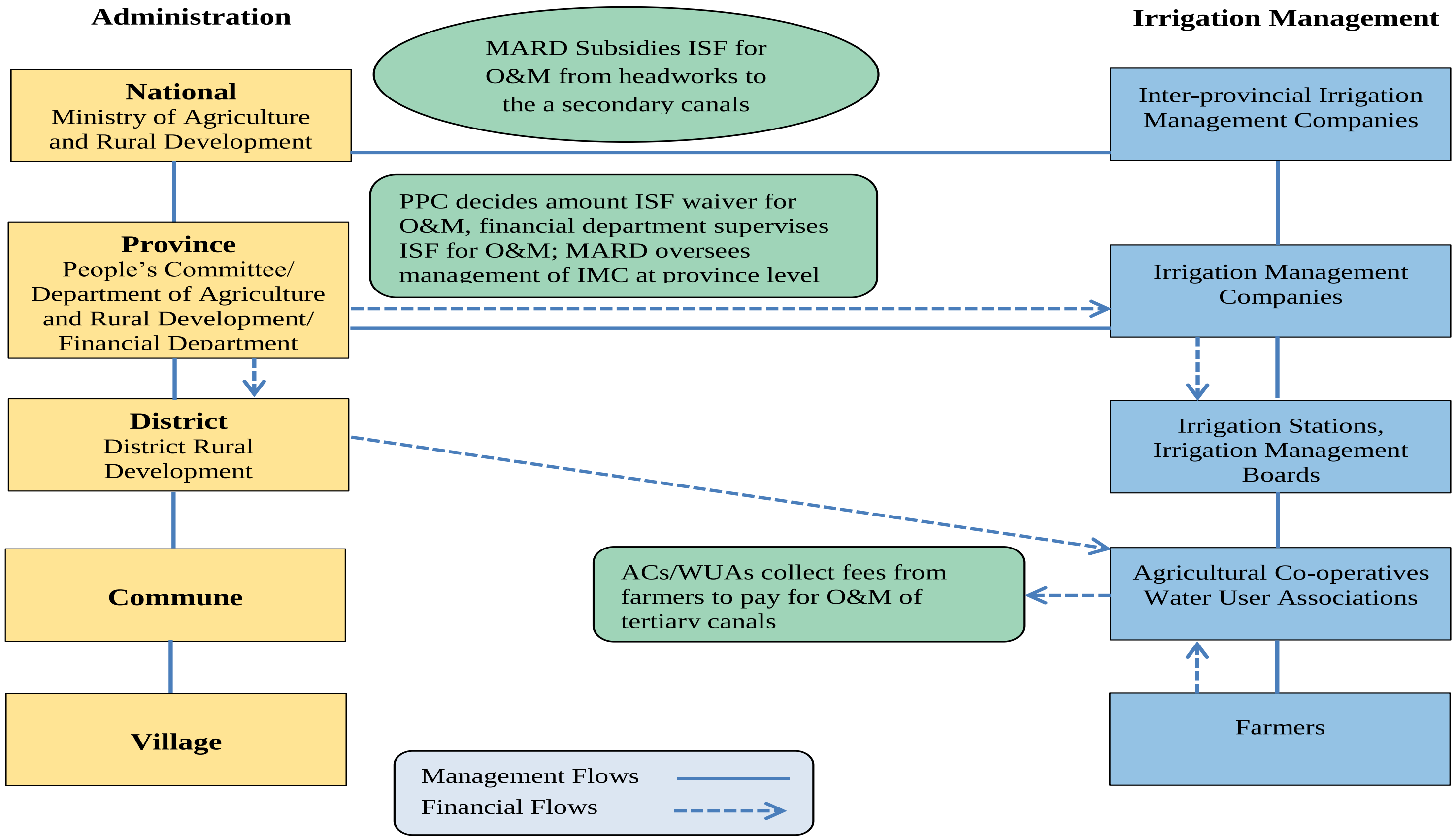

Figure 4-5: Irrigation management both after implementing the policy of irrigation service fee (ISF) waiver

4.2 History of Irrigation Management in Vietnam and Participatory Irrigation Management (PIM) and Irrigation Management Transfer (IMT) in Vietnam

This history of the development of irrigation management in Vietnam is directly connected to the development of agricultural production. This section outlines four key phases in the development of agriculture from the time Vietnam became independent in 1945. Significant reforms introduced by the Communist party of Government of Vietnam in turn directly affected irrigation systems. The four periods include: 1945-1960; 1960-1980; 1980-1996; and from 1996 to present. The following discussion provides an overview of the transformation of irrigation management from the commencement of PIM. It provides an explanation of the changing roles and responsibilities for irrigation management in chronological order, illustrating the shift from government to local control and management. The financing of irrigation systems has evolved accordingly.

The management process was transformed from collectivized to democratization (as show in the table 4-1).

Table 4-1: History of Agricultural and Irrigation system management

Timeline	Agriculture management	Management of irrigation infrastructure
1945—1960s	Fully collectivized by Vietnamese government. Import rice	Heavy investment in hydraulics infrastructure by government Majority of large schemes built
1960s— 1980s	*Khoan 100* Farmer households decide agricultural practices and manage agricultural production Export rice	Provincial water management companies are established (Irrigation Management Companies) Small pumping stations managed by Agricultural Cooperatives Farmers started paying fees for irrigation services
1986—1996	*De-collectivization of agriculture* *Doi moi (renovation)*” *Khoan 10* Farmers decide their production activities on an individual basis	Support from NGOs (JICA, WB) for irrigation management
1996—present	Cooperative Law launched Increased commercial crop production	Implementation the IMT Issued the ISF waiver policy

Source: Created for this study

4.2.1 1945—1960s: Agricultural and Irrigation system management

A feudal system of land ownership prevailed over much of Vietnam until 1954. During this period, the country was ruled by the Nguyen dynasty and French colonial forces which had fundamental interests in collecting revenue and maintaining law and order. Vietnam achieved independence from France in 1954. After the defeat of the French the Geneva Accords divided Vietnam into two parts with opposing philosophies. North Vietnam became the Democratic Republic of Vietnam and adopted a socialist ideology influenced by China and the Soviet Union. South Vietnam became the Republic of Vietnam, and followed a capitalist ideology influenced by the United States (Tuan, 2010). The rural economies of the north and south Vietnam were therefore very different. North Vietnam pursued collectivized agriculture, whereby groups of households formed production ‘brigades’ or ‘cadres’, responsible for meeting government set quotas for agricultural production (Stacey, 1999; Tiep, 2008b). Agriculture in South Vietnam, was highly commercialized and more oriented to export markets; tenant farmers cultivated land owned by landlords (Trang, 2004; Tuan, 2010)

Early Irrigation system construction in Vietnam is recorded in the 18th Century. At this time there was a significant increase in the number of large dams and “Dutch dikes”. However, wars (1945 to 1960) restricted the building of irrigation systems (Hoanh et al., 2014). During this period the construction of irrigation systems was planned and directed by provinces financed by the Vietnamese government. Farmers provided materials and labour. Hydraulic constructions of the government included reservoirs, dams and canals. Farmers built small-scale tertiary canals in the whole country (Tiep, 2008).

4.2.2 1960s—1980s: Agricultural and Irrigation system management (the collectivisation period)

By the end of 1960, in a bid to collectivise, Agricultural Cooperatives (ACs) were established throughout North Vietnam. 76% of agricultural land and 86% of households were mobilised (Trang, 2004). ACs played a very important part in agricultural production (and still do). In the mid-1960s the cooperatives were seen as ‘an essential means for mobilising personnel, food, and other resources, for the country’s war against the United States and the Republic of Vietnam’ (Trang, 2004, p.130). They allowed for a bigger labour force and a means of specialising groups to concentrate on particular tasks such as irrigation or production tasks. These ACs controlled all cultivated land, and agricultural inputs (such as seed prepartion, fertilizing and pesticides). However, at the end of the American war (1962-1975), this new model was struggling to perform (Trang, 2004, p.130). Centralization of agricultural management led to uneven contribution of effort between farmers, inequities and poor motivation. There was a steady decline in agricultural output leading to a crisis in agricultural production and widespread food shortages by the end of the 1970s (Fontenelle, 2001; Ngoc, 2013; Thang, 2014). At this time there were no private land owners in Vietnam; all agricultural land belonged to the government (Ninh, 1994).

In 1975, after reunification of North and South Vietnam, the Vietnamese Communist Party attempted to extend its centrally planned system to the whole country. Large-scale agriculture was a central part of the collectivization process (Tiep, 2008a, p.3). However, collectivization did not take hold in the south. By 1980, only one quarter of farm households belonged to a collective, and in many cases, farms in Southern Vietnam were only ‘paper’ collectives (Tuan, 2010, p.3). Collective agriculture did not achieve the goals anticipated and agricultural production slumped. Vietnam was forced to import grain and food supply dwindled due to Government procurement laws. By the early 1980s Vietnam faced an economic crisis (Kerkvliet, 1999; Tuan, 2010). Foreign aid to the country was declining, government food procurements were failing, and a ‘food crisis’ began to emerge. This crisis prompted a series of agricultural and water resource management reforms.

Funding O&M of irrigation schemes in Vietnam at this time was generated from a number of sources including government and donor funding. However, ISF became a principal source of revenue for O&M of irrigation infrastructure (Stacey, 1999) when farmers were required to pay for their water use. The first Irrigation Service Fee (ISF) was charged in 1963. MARD announced its fee structure in Decision 141-CP dated 26/09/1963 and Circular 31 dated 08/10/1963. The ISF was charged by the area of land under irrigation and was further differentiated by crop and season and type of water supply (e.g. gravity fed or pumped irrigation). ISFs were expressed in kilograms of paddy rice and converted to cash (based on official rate for a kilo of rice). PPCs in each province determined the exact price (Small, 1996; Bryan, 1997; Marsh et al., 2006). The ISF was collected from farmers/water users by ACs after the harvest of the two main crop cycles.

When North and South Vietnam were reunited under the new socialist regime in 1975, the Vietnamese government gradually built more dykes and irrigation infrastructure to meet the expansion of agricultural areas (Kono, 2001). In this period, many large and small pumping stations and large canals were built (Hoanh et al. (2014).

4.2.3 1980—1996: Agricultural and Irrigation system management (the liberalisation period)

From 1980-1996 the Communist Party and the State of Vietnam instigated a series of institutional reforms related to land (land ownership) and issued hundreds of documents and policies designed to lessen the role of central government and cooperatives in the whole country were forced to reform their organization and activities (Thang, 2014). A central aim was to reduce the cost burden of constructing irrigation systems. According to the reforms, MARD was responsible for planning, construction, O&M of large irrigation systems. Irrigation Management Companies (IMCs) were established in many provinces to manage the main components of systems to the secondary canals within provincal bounderies.

To deal with crisis of the collectivised co-operative system in 1981, Vietnam initiated a process of de-collectivization of agriculture moving toward a market economic system. The “Khoan 100” reform was launched (Decree 100/CT/TW January 1981). According to this Khoan 100 policy, agriculture was de-collectivised and individual households were directly involved in agricultural production. Agricultural-cooperatives assigned paddy fields and unused land to individual households through production contracts (Trang, 2004, p.139). Instead of controlling all cultivated land as before, when ACs assigned land to individuals or groups of farmers, they expected them to take responsibility for cultivation. Contracts dictated specialised tasks by groups of farmers (brigades) such as ploughing and water control and household basic production tasks such as transplanting and harvesting. Individual households were contracted to produce a certain amount of agricultural goods and could then sell any surplus they produced in the private market or to the state (Tuan, 2010). At the end of a season, farmers received their income based on the labour they had contributed. This policy is attributed to creating a 6.3% increase in agriculutral productivity from 1981-1985 (Marsh et al., 2006).

Decree 112, 25/08/1984 was issued to encourage farmers to share the financial burden of O&M of irrigation systems. This decree specified that all organizations and individuals benefiting from irrigation, drainage and other hydraulic public services, must pay an irrigation service fee to the IMC (Fontenelle, 2001). ISFs paid by water users were collected by ACs and returned to IMCs for O&M (Fontenelle, 2001). Decree 112 is considered the first ISF policy applied across the whole of Vietnam after independence.

However, by 1983 Vietnam's agricultural growth had slowed, followed by a decline in food production, and by 1987 growth was in reverse; inflation was high and famine struck parts of the country (Tuan, 2010). Reasons for the short-lived success of Directive 100 were due to failure of the reforms to give farmers real incentives to produce more (Tuan, 2010). This situation prompted the Vietnamese Communist Party at the Sixth National Party Congress in December 1986 to enact a series of reforms that would ultimately transform Vietnam from a centrally-planned economy to a market-oriented one (Tuan, 2010, p.2). This is referred to as the "Doi Moi" reform. Collectives were dismantled, land-use rights were assigned to farmers, agricultural markets were liberalized, and wider economic reforms were implemented. The outcome of Doi Moi did not really take hold until 1988 when Vietnam's economy grew impressively (Tuan, 2010).

In 1988 the Communist Party issued the "Khoan 10", or Directive 10, which introduced a Land Act that shifted the focus of rural development from collectives to household production; cooperatives were enabled to distribute land to households (Trang, 2004; Tuan, 2010). Directive 10 included a new bill that replaced the compulsory quota system of the Khoan 100 policy with a land tax directly connected to productivity. Under Directive 10 farming families became the main units of agricultural production replacing ineffective cooperatives and state farms (Thang, 2014). Directive 10 created new conditions for agricultural production. The 1993 Land Law leased to farmers agricultural land for periods of up to 20 years (for annual crops) or 50 years (for perennial crops). This 1993 policy also gave individuals or households the capacity to buy and sell animals, equipment and machinery. Individual households were free to decide on the organisation and marketing of their agricultural production (e.g. choice of cropping, fertilisation etc.) (Fontenelle, 2001). Production quotas were maintained but with greater certainty through fixed five-year contracts. Co-operatives played a supporting role and collected taxes (Trang, 2004). There was an associated expectation that improved agricultural productivity would also reduce Vietnam's dependence on foreign aid (Kono, 2001).

Late 1980s and early 1990s government reforms that opened markets and encouraged entrepreneurship resulted in a rapid improvement in agricultural performance—largely attributed to household-level incentivisation. By 1989 Vietnam was exporting rice, food shortages had been alleviated and the economy was growing. This growth in agricultural productivity in turn prompted an increased demand for construction (Tuan, 2010). During the period from 1980s to 1996, there was a steady increase in the construction of new irrigation systems and a significant increase in area of land irrigated. Across Vietnam 4,976 irrigation systems were constructed, of which 496 were major or large-scale and 2,420 were medium-scale (Ninh, 1994; Evers & Benedikter, 2009). The remainder were small scale enterprises.

Flow of foreign aid into Vietnam stymied in 1990-91 due to the collapse of the Eastern European socialist system but Vietnam experienced a full recovery from this shock collapse by 1992 with strong and continued economic growth (Tuan, 2010). The reforms of the 1980s economic liberalisation policies proved to be beneficial for sustained economic growth (Trang, 2004). According to Trang (2004) however, there was an increasing intensification of inequality both within and between regions and communities, largely a result of income-inequality. Farmers did not have sufficient land-use rights and were unable to control farming practice. Those working in non-agricultural sectors were better-off. At the same time there was rapid population growth. Vietnam's population increased from 50 million in 1980 to 79 million in 1993 (Ninh, 1994).

4.2.4 1996—present: Agricultural and Irrigation system management (integration period)

The mid-1990s through to 2000 are labelled as the 'golden age' of the market economy in Vietnam. The agricultural sector continued to grow. The Vietnamese government also continued to introduce reforms to maintain high levels of performance. Many of these reforms are directly related to water resource management (see table 4-2 for example).

Table 4-2: The legal and policy framework for PIM/IMT in Vietnam

Year	Title	Description
1998	Decree 29	MARD instructed People's People Committees (PPCs) to promote the role of farmers in irrigation management by allowing farmers to set up management organizations.
2001	Decision 15	Instructed the creation of rural water-use organizations and irrigation management organizations. Encouraged technological development of irrigation systems to protect water resources.
2003	Decree 143/	**Article 20:** Water users encouraged to participate in O&M of irrigation works in accordance with the Law on Public Labour Obligations. **Article 21**: IMCs and local organisations required to sign irrigation and drainage contracts with water users at the beginning of seasons Set the basis for collection of irrigation water fees for IMCs. Provided an irrigation fee framework
2012 to present	Decree 67	Encouraged participation of water users by sharing of water fees between government and farmers. Government subsidies cover O&M costs from headworks to end of secondary canals. Water-user fees cover costs of managing tertiary canals.

Source: Created for this study

The 1996 Law on Cooperatives, transformed old collectivist bodies into new efficient service organizations, largely in north. By 2006 there were 7,237 ACs throughout Vietnam (Tuan, 2010). ACs became independent economic organisations open to the market economy. ACs became service organizations for the provision of agricultural inputs to households (Kono, 2001; Trung et al., 2005). These organisations have palyed a central role in the transfer of responsibility for irrigation management in Vietnam.

4.2.5 Irrigation Management Transfer

Agricultural reforms directly affected the governance of irrigation systems. IMT forms a key part of the evolution of Vietnam's agricultural transformation. Successful pilot models of IMT/PIM eventuated in Vietnam after 1996. Water users were encouraged to participate in irrigation management through a variety of means such as joint or sole management such as renting pumping stations, transfer of ownership. Flow of support to the Vietnamese economy, including for irrigation infrastructure management and agricultural production, recommenced in 1993-2000 through schemes such as Official Development Assistance (ODA), and international Non-Government Organisations (NGOs) and other donor funding from the World Bank (WB) and Asian Development Bank (ADB).

With support from the ADB, JICA and the WB the concept of IMT and PIM were introduced in a workshop about PIM in 1997 in Nghe An province. More than 10 international organisations and officials participated including the World Bank manager, ADB, Danish International Development Agency (DANIDA), MARD managers, and more than 100 representatives from many IMCs representatives and four WUA members from four communes who had implemented IMT (Tiep, 2008b; Ngoc, 2013). A number of IMT pilot projects commenced and with support from both the Vietnamese Government and financial donors, large numbers of Water User Associations (WUAs) were established. Most of the WUAs were established as part of new construction or during the upgrade of existing irrigation systems. The WB, JICA, and ADB projects assisted in the development of a legal framework and guidance by organising detailed steps to establish WUAs, and creating vocational training programs for WUAs members. They also financed WUA members' salaries (Van Riessen & Nguyen, 2004). IMT was mostly applicable to commune-base systems (Trung et al., 2005).

Since the 1990s, the government has promoted IMT for small-scale schemes. This program has resulted in 0.8 million hectares managed solely by farmer organizations, covering 27% of all irrigated land. Nearly 73% of irrigated land remains under joint management between IMCs and farmer organizations (Tiep, 2008b).

4.2.5.1 Water User Associations

The operation of WUAs has played an important role in improving irrigation systems performance. WUAs encouraged the participation of water users in irrigation management. Different types of WUAs were established: pre-existing ACs were strengthened, and Water User Organisations (WUOs), and Irrigation Management Boards (IMB) were created. Each type of WUA has functions differently. Variations in how WUAs are managed and operate is a function of the different supply characteristics of irrigation systems including, the reliability of water supply, condition of infrastructure, and the size of the irrigation distribution network (to single or multiple-communes). The variation in supply characteristics also has an impact on the capability of WUAs.

ACs have responsibility for O&M of irrigation systems as well as other aspects of agricultural production. The operation of ACs is based on agricultural administrative borders of communes. Irrigation systems managed by ACs are usually located within one commune. Water User Associations were established independently under different names such as Water User Organisations (WUOs) and Irrigation Management Boards (IMB). The establishment of WUOs and IMBs is different and more complex than for ACs.

WUOs are farmer organizations distinct from ACs. WUO's responsibility is solely for the O&M of irrigation systems within hydrological boundaries. WUOs manage irrigation infrastructure across multiple communes.

IMBs are quasi-state organisations; the members of IMBs include both government staff and farmers. Table 4-3 summarises the main differences between the WUA types.

Table 4-3: The main differences between WUAs include ACs and WUOs and BOIMs

Concepts	ACs	WUOs/IMB
Responsibilities	Multi- function	Sole (Irrigation System Management only)
Basis for Management	Administrative boundaries	Hydrological boundaries
Funding	On-farm Irrigation Service Fee (ISF) and waiver	Fee waiver
Establishment	Before IMT	After IMT

Source: Created for this study

The roles of WUAs vary depending on the scale of the irrigation system. In large irrigation systems the headworks and main channels are managed by the state through IMCs which are responsible for managing the supply of water to farmers. ACs tend to operate and manage the tertiary canals. The ACs act as a bridge connecting IMCs and farmers. The ACs represent the farmers signing water supply contracts with IMCs.

For small irrigation systems it is typically WUOs and IMBs directly managing and operating whole irrigation systems from headworks to individual farms.

According to (MARD, 2013), by 2013 between 49 and 63 provinces had issued policies to support IMT; nearly 30 provinces had implemented IMT with 16,238 WUAs established. Table 4-4 gives an overview of both the number and the type of WUAs in 2013: Agricultural Co-operatives (AC) (39%); Water User Organisations (51%); and Irrigation Management Boards of (10%).

Table 4-4: Number of WUA in Vietnam

Regions	Total	Number of WUAs		
		AC	WUO	IMB
Northern Mountainous Region	4,982	774	3,330	878
Red river Delta	3,447	2,970	471	6
Northern Central Region	1,702	1,403	26	273
Coastal Central Region	1,290	574	559	157
Central Highland	481	52	201	228
East Southern Region	567	50	460	57
Mekong River Delta	3,769	447	3,294	28
Total	**16,238**	**6,270 (39%)**	**8,341 (51%)**	**1,627 (10%)**

Source: Adapted from (MARD, 2013, p.3)

Effective WUAs are critical to irrigation system functioning. Weak co-operatives are considered a significant bottleneck to agricultural development in Vietnam. According to (Thang, 2014), a lack of concrete regulations ‘on pushing up the reform of cooperatives, mostly in terms of resource allocation and restructuring process, many agricultural cooperatives are still passive in reforming and adapting to the market economy and economic integration’ (Thang 2014, unpaginated). According to Thang there is an ongoing need to focus policy effort on reforming agricultural cooperatives (in their broadest sense).

4.2.5.2 Funding irrigation management

From 1962 to 2008, ISFs were collected from farmers/water users by ACs. Multiple amendments have been made to the ISF since the first 1963 Decree. The amendments made to the ISF deal with inflation and a change was made to the unit of payment from rice to monetary units.

Prior to 2008 funds for the O&M of irrigation systems were generated through farmer contributions called ISFs. After 2008 under Decree 115 significant changes were made to the ISF. The Vietnamese Government subsidised farmers through an ISF waiver. The subsidy is determined by the area of agricultural land under irrigation and type of irrigation system (i.e. gravity-fed or pumped). To protect farmers the Vietnamese government took over the O&M costs of IMCs and WUAs from headworks to the beginning of tertiary canal intakes. In the latest national decree an adjustment was made to the ISF waiver. Under Decree 115 the ISF increased by 2.31 times that of the lowest previous rate, and from 1.4 to 1.7 times more than the highest rate. The subsidy is delivered to province level finance departments. It is at the provincial level that decisions are made as to how the subsidy will be dispersed between provincial level and lower level irrigation management entities.

Figure 4-6 illustrates the shift in financial responsibly after the transfer. Before 2008, farmers paid all of the ISF to O&M irrigation systems from headworks to the end of tertiary canals. After 2008, farmers paid only a small amount for the O&M of tertiary irrigation systems. The ISF was subsidised by the Vietnamese government for O&M from the headworks to the end of secondary canal systems.

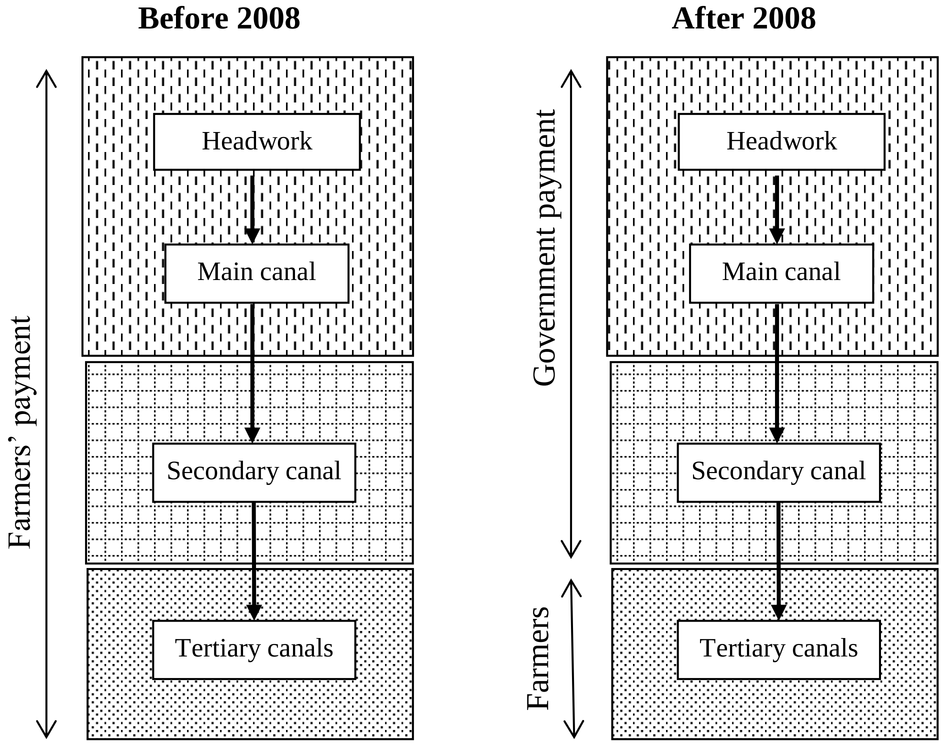

Figure 4-6: The O&M costs and responsibilities sharing between farmers and government before and after 2008

Source: Created for this study

The on-farm ISF is based on negotiations between local water user associations and farmers. This fee cannot be higher than the ceiling price decided by provincial authorities. This fee is used to pay on-farm irrigators to deliver water through the tertiary canals systems and to dredge canals when needed. ISFs vary by area depending on the location of communes (e.g whether pumping is needed) and the scale of the irrigation systems (if it incorporates headworks and secondary canals, or only tertiary irrigation canals). On-farm ISFs are higher when farmers in areas where it is difficult to access water. ISFs may change after one crop or one year depending on the previous season/year's agricultural productivity, or how effective on-farm irrigators worked on a previous crop.

4.2.5.3 Water supply contracts

Water supply contracts are signed between local farmer Associations (WUAs) and individual farms every season, identifying areas to be irrigated and the associated fee (Fontenelle, 2001). These contracts gave WUAs responsibility for water supply to individual farms. WUAs developed detailed water supply schedules for individual villages to ensure timeliness and adequate quantities of water. The water supply contract also identifies groups of irrigators (farmers from villages) located in each commune who will manage the tertiary canals flowing through their villages. These irrigator groups are responsible for delivering water to farms. The contracts are critical in imposing the obligations of IMCs, WUAs and farmers and act as the guarantee that the needs of irrigators will be met. Penalties apply to individuals who are non-compliant with the water supply contract rules.

Contracts are terminated between WUAs and ACs at the end of a cropping season once the AC is satisfied that water supply has been sufficient.

4.3 Typical irrigation regions in Vietnam

Vietnam is divided into eight regions based on the differences of geographical, social, economic, and agricultural practices. The regions are: Northeast and Northwest Mountainous Regions, the Red River Delta, North Central and South Central Coast, Central Highlands, Southeast, and Mekong River Delta (Figure 4-7).

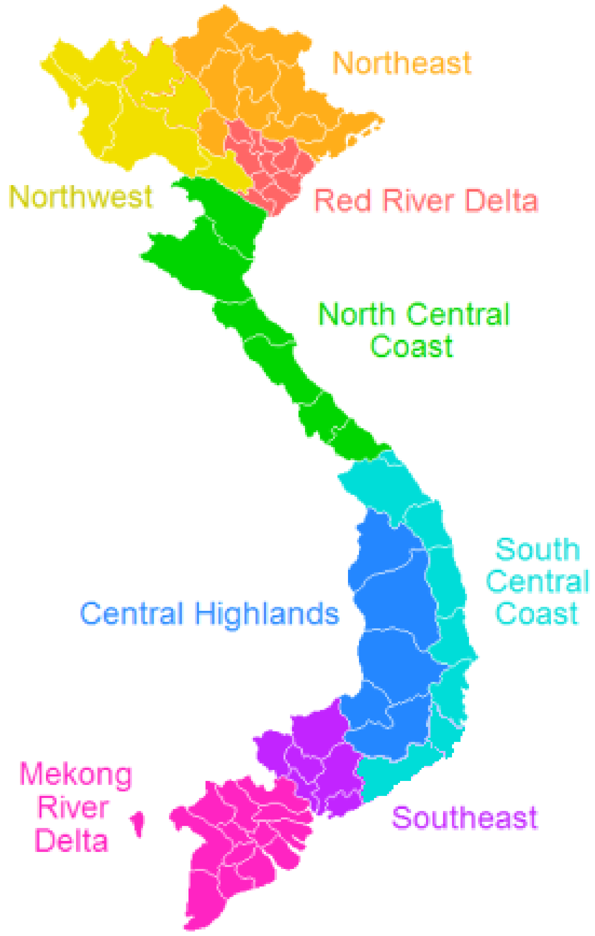

Figure 4-7: List of regions of Vietnam

Source: Adapted from Wikipedia (2016)

Three locations were chosen to answer the research questions of this study: Northeast Mountainous, Red River Delta and North Central Coast regions.

4.3.1 Irrigation Systems of the Northeast and Northwest Mountainous Regions

The Northeast and Northwest Mountainous Regions had a population of approximately 11 million people in 2011. Small-scale gravity fed irrigation systems dominate (90%) the mountainous provinces and these systems cover large areas. In some places, a single irrigation scheme supplies water for only one village covering several hectares. Large investments have been made into these systems (Dinh, 2006). There are 1,750 reservoirs, 40,190 spillways 379 small on-farm pumping systems. Currently, approximately 200,000 agricultural areas are irrigated by irrigation systems.

Ngoila, the first case study, is a gravity fed system located in the Tuyen Quang province. Ngoila is one of the two largest irrigation systems in the province. Currently, there are 2,826 irrigation systems in this province. These irrigation systems supply nearly 17,000 hectares of winter crops, 19,000 hectares of summer season crops, and 8,500 hectares spring crop (MARD, 2013).

4.3.2 Irrigation Systems of the Red-River Delta region

The Red-River Delta had a population of approximately 20 million people in 2011. This delta is one of the second most important basins followed by Mekong Delta which produces for the highest agricultural production in the whole country. Pumping stations are considered the main water supply headworks for this area suppling for 500,000 ha. There are 1,700 large and 35,000 small on-farm pumping systems taking water from main natural rivers suppling for agricultural production. Currently, approximately 80% of agricultural land (1.12 million of 1.4 million in total) is irrigated by pumping stations. Total canal length is about 76,119 km in which there are 15,161 km of main canals, 25,001 km of secondary canals and nearly 35,957 km of on-farm (tertiary) systems. Nearly 30% (22,780 km) canal schemes were concreted.

Gia Xuyen, the second case study, is a pumping station located in Hai Duong province. Currently, there are 1,576 irrigation systems in this province consisting of 752 reservoirs, 563 pumping stations and 248 dams. These irrigation systems supply 130,000 hectares of irrigated agricultural areas.

4.3.3 Irrigation systems of the North Central Coast region

The North Central Coast had a population of approximately 10 million people in 2011.

According to the MARD report (2011), there are 7,502 irrigation systems located in the North-Central region of Vietnam. These contain 1,458 spillways, 3,100 pumping stations and 520 small irrigation systems. Total canal length is 22,628 km in which 11.2% of the length (2,387 km) of main canals, 15.5 % (3,549 km) of secondary canals and (73.3%) 16,594 km of on-farm (tertiary) systems. These irrigation systems are irrigating 655,000 ha out of 944 million ha of agriculture. Nearly 331,000 ha of spring crop, and 250,000 ha of summer season are supplied by irrigation systems. In the summer season, irrigation systems are working at nearly 69% design capacity. The proportion of irrigation systems lined with concrete is approximately 30% for the main and secondary canals and about 50% for tertiary canal systems.

N6, the third case study, is gravity fed system located in Nghe An province. N6 is one of the two largest systems in the province. Nghe An is one of the provinces of Vietnam experiencing severe climate conditions and subject to frequent flood and drought happening events. There are an average of three to five strong storms per year and four months with frequent heat waves in this province. Currently, there are 1,576 irrigation systems in this province containing 752 reservoirs, 563 pumping stations and 248 dams. These irrigation systems supply 192,460 hectares in which 45,000 ha are supplied sustainably because irrigation systems have worked with 70-75% their capacity.

4.4 Conclusion

Vietnam has carried out impressive agricultural reforms since the ‘Doi Moi’ in 1986. Vietnam has transformed from a country devastated by war and famine to being one of the most important food exporting countries of the world. The transformation of the governance of irrigation management is part of the reason for this outcome.

This chapter has presented a comprehensive overview of the history of agriculture and development of irrigation system management in Vietnam from 1945 when Vietnam became independently to the present. It has illustrated the considerable challenges faced by both Government and farmers in constructing the network of irrigation systems and adapting to new modes of governance with limited funding and overcoming the devastation of war.

This chapter presented the policies and institutional arrangements in place for irrigation management, with a chronology of the development of changes to governance over time. The transfer of responsibility for irrigation management, which allowed local communities to participate in decision-making for irrigation systems management, is presented.

It has been the expectation that the IMT process will help Vietnamese Government overcome the financial burdens of building irrigation systems and to improve the efficiency of irrigation performance. However, it is unclear as to whether the results of IMT have brought the positive impacts anticipated. It is claimed that despite Party and Government support, the role of ACs remains insignificant. The following three chapters will help answer this question by evaluating the performance of irrigation management across three different irrigation systems and locations in Vietnam.

Chapter 5 IRRIGATION MANAGEMENT TRANSFER IN NGOILA SYSTEM

The Ngoila irrigation system is located in the Tuyen Quang Province in the Northeast Mountainous region of Vietnam (See Figure 4-9). It is the largest system in Tuyen Quang Province. Infrastructure for the irrigation system commenced constructed in 1973 and started supplying water in 1975. The implementation IMT in Ngoila took place in 1996 after an infrastructure upgrade (concreting of canals) by the Ministry of Agricultural and Rural Development (MARD).

This chapter is divided into two main parts. The first part, **Section 5.1 and Section 5.2** present the roles of irrigated agricultural production in Tuyen Quang Province, and outlines the geography and governance of the Ngoila irrigation system. **Section 5.3** onwards presents the results of this study in regard to the evaluation of the impacts of IMT in Ngoila. The chapter will examine the current status and perceived efficiency of O&M of Ngoila’s irrigation system and will present the perceptions of water users regarding the effectiveness of ongoing management and the effectiveness of irrigation systems and present farmers’ perceptions in relation to the transfer of irrigation management responsibility in Ngoila. The chapter concludes with an overview of the barriers to effective irrigation management in Ngoila.

5.1 Geographical location Ngoila Irrigation System

Ngoila is a complete irrigation system comprising two storage reservoirs that gravity feed water supply to 7,000 km of canals (see Figure 5-1 illustrating one of the reservoirs). The canal system includes a main canal 3,100 m long, 2 secondary canals of 6,850 m, and 40 tertiary canals. Ngoila is an inter-commune system based on its hydrological boundaries. It irrigates four communes: Trung Mon, Kim Phu (Yen Son district), and Y La and Hung Thanh communes (Tuyen Quang centre), including 2,259 households (See Figure 5-2 for Ngoila’s location).

Figure 5-1: One of two reservoir's supplying water to Ngoila

Source: Field trip observation 2013

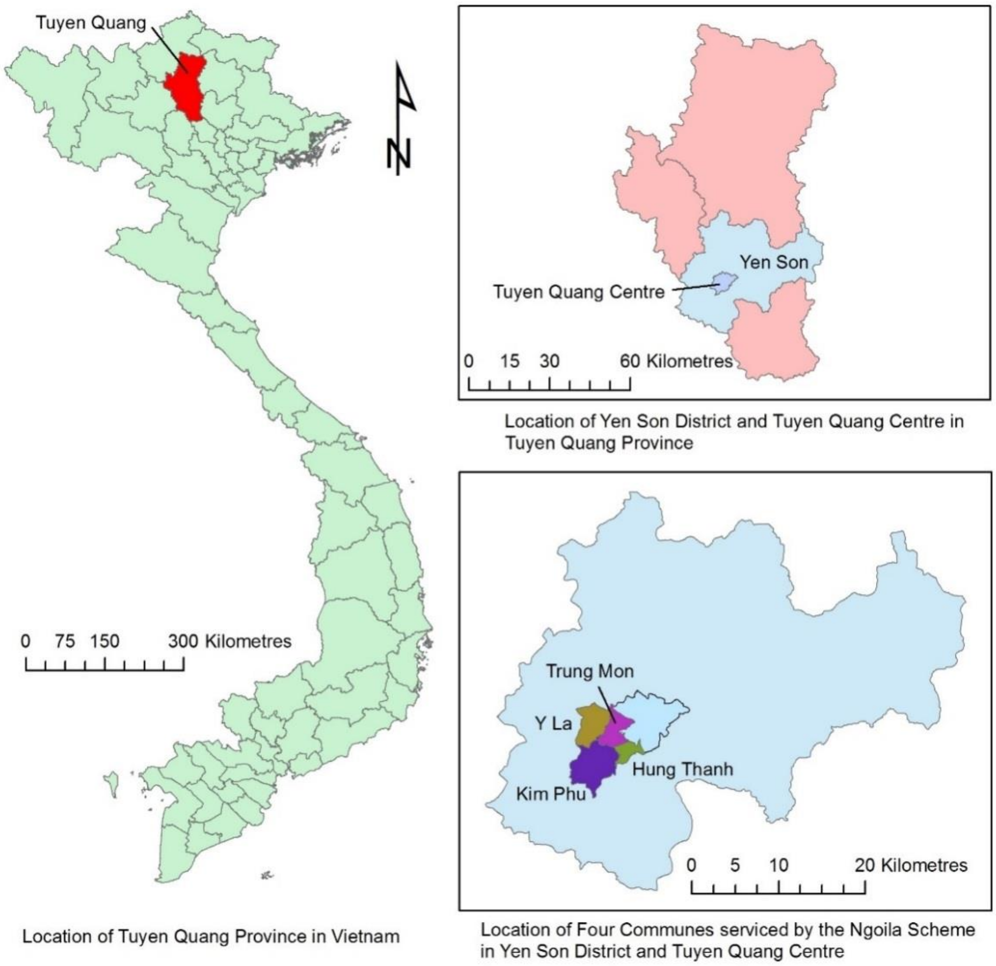

Figure 5-2: Location maps of Tuyen Quang province, the Ngoila irrigation System and four communes irrigated by the Ngoila irrigation system

Source: Created for this study

The IMT in Ngoila resulted in the concreting of all headworks, main and secondary canals and 90% of tertiary canal systems.

Prior to the IMT, Ngoila's irrigation capacity was 351 hectares. Today Ngoila's irrigation system supplies 392 hectares of agricultural land including 2,259 households in four communes, 342 hectares of rice fields, and nearly 50 hectares of vegetables, and 14 hectares of aquaculture and livestock every year. Details of irrigated areas and the number of household is presented in table 5-1.

Table 5-1: Water supplied by the Ngoila irrigation system

Irrigation system	Commune	Agricultural Cooperative	Area (ha)	Number of households	Location
Ngoila irrigation system	Trung Mon	Trung Mon	52	324	Head
	Y La	Y La	110	1,348	Middle
	Hung Thanh	Hung Thanh	6	196	Tail
	Kim phu	Kim Phu	90	330	Tail
Total			**392**	**2,259**	

Source: Focus group discussion with IMB (WUA) members

There are two distinct seasons in Ngoila. The wet season from August to November provides the main inflow of water for the two reservoirs. The dry season lasts for nearly eight months from December to July.

There are two main rice crops grown in Ngoila which include a winter rice crop (Jan to May), and summer rice crop (Jul to Dec). Farmers also grow a spring crop of vegetables and corn. Rice production is the main produce of Ngoila.

5.2 Ngoila Irrigation System Management

The IMT process in Ngoila took place in 1996 following an upgrade of infrastructure (concreted) by MARD and support from an ADB project.

5.2.1 Background

Prior to 1996, there had been a lack of budget to rehabilitate and maintain the irrigation infrastructure. Degraded infrastructure led to poor water supply to farms. Farmers, dissatisfied with the service they were receiving refused to pay the ISF. As a result, there was a high level of outstanding and unpaid debts in Tuyen Quang province. Bad debts led to funding shortfalls for maintaining infrastructure. Almost all irrigation schemes in the province are small and widely dispersed, thus, it was difficult for the The Tuyen Quang irrigation Management Board (BoT) to ensure the efficiency of its canal systems across the whole province. To solve this situation the Tuyen Quang PPC issued Decision No. 142/QD- UB, 19/01/1996 to decentralise all irrigation schemes. Responsibility was devolved to communes and Ngoila Irrigation Management Board (IMB) (Dinh, 2006). For nearly 20 years since the implementation of the IMT this program has been consolidated and adjusted in Tuyen Quang.

Figure 5-3 provides an overview of irrigation management for the whole of the Tuyen Quang province. There are many different levels of governance and many departments with various management responsibilities for irrigation in the province. The Ngoila irrigation system falls under the management of the provincial Board of Tuyen Quang. In Ngoila the local WUA responsible for managing Ngoila's irrigation system is the IMB. The IMB manages from the headwork to the end of secondary canals that run between four communes. Each commune has an AC which manages water distribution from secondary weirs to the end of tertiary canals, which then deliver water to individual farms.

The main departments and entities engaged in the management of Ngoila irrigation system, along with their roles and responsibilities are described in full below.

5.2.1 The Tuyen Quang province Irrigation Management Board (BoT)

The irrigation management Board of Tuyen Quang (BoT) was established (consolidation) in 2011 by the management restructure of two former irrigation systems: Hoang An Luong and Ngoila irrigation systems under Decision N° 397/QD, 31/10/2011 of the Tuyen Quang PPC (see Appendix 7). The BoT is a self-sufficient organization belonging to the provincial DARD with the responsibility to appoint commune level IMB head.

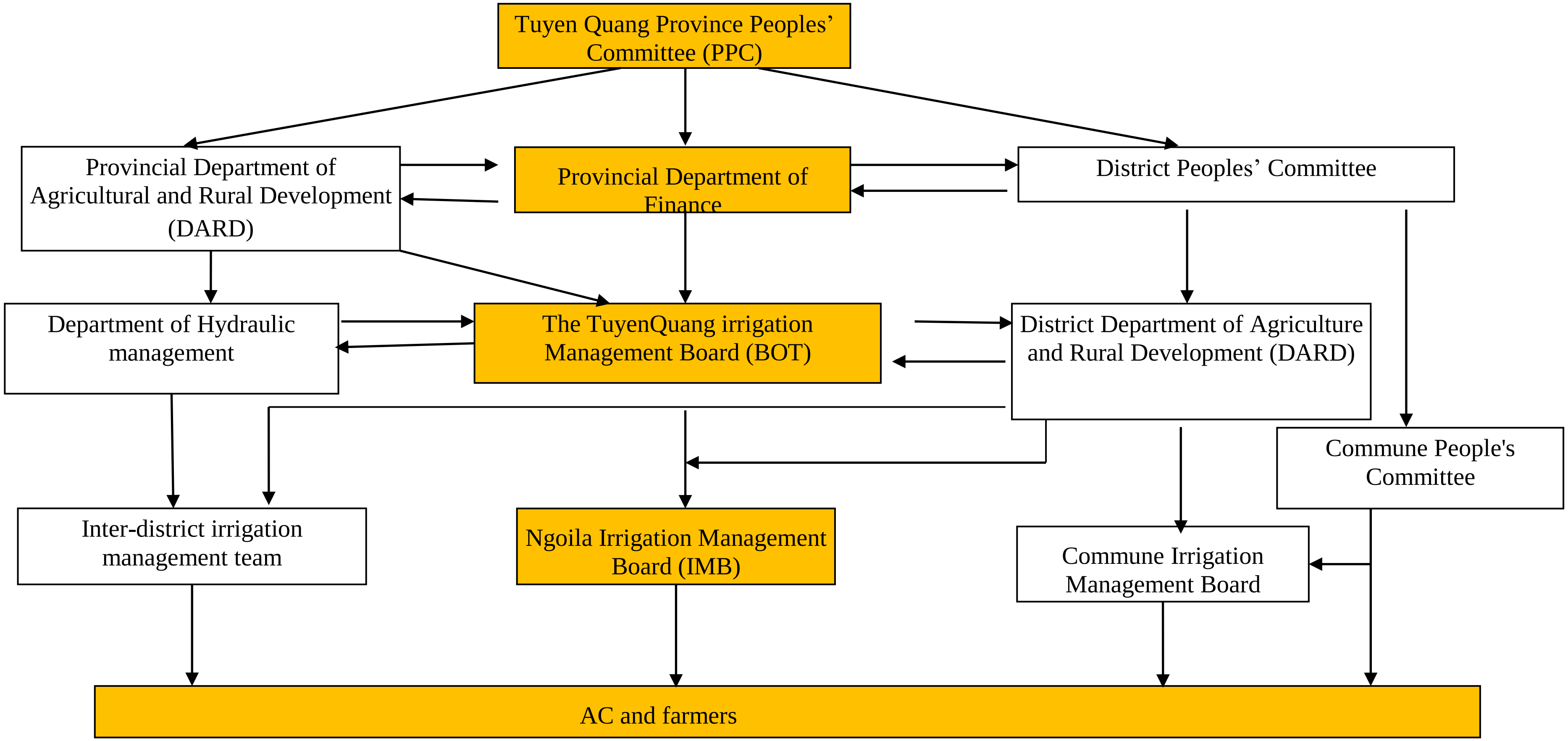

Figure 5-3: Governance of Irrigation System Management in Tuyen Quang Province

Coloured box refers to Ngoila management

The BoT is a quasi- state not-for profit (but expected to be solvent) organisation. The BoT is based on irrigation system boundaries. There are 25 officials in the BoT including two departments: the Department of Technical Management and the Department of Planning and Finance. The BoT is responsible for supplying water in Tuyen Quang Province to 2,727 irrigation systems, for 36,304 hectares agricultural land for two rice seasons. The main responsibilities of the Board of Tuyen Quang are to:

- Manage irrigation systems for the whole province, including the establishment of a water supply plan for each irrigation system. The BoT also signs water supply contracts for inter-communal or communal irrigation management with other sectors (e.g. industry or tourism);
- Manage and operate headworks and main canal systems;
- Receive, synthesize, and evaluate O&M costs and other expenditure plans from lower irrigation management institutions (e.g. IMBs) during the fiscal year;
- Establish drought and flood management plans;
- Approve ISF waivers for IMBs and ACs.

5.2.2 The Ngoila Irrigation Management Board (IMB)

The water supply contracts between IMB and individual communes have been signed based on detailed water supply schedules and the required irrigated areas to ensure adequacy and timeliness of water delivery. The contract also identifies groups of irrigators (farmers from villages), located in each commune who will manage the tertiary canals flowing through their villages. These irrigator groups are responsible for delivering water to farms. The contract is critical in forcing the obligations between the IMC, the BoT and farmers. This arrangement guarantees that the needs of irrigators are met. Penalties are applied against individuals for non-compliance of contract rules. These contracts are terminated between the BoT and the ACs and individual households at the end of a cropping season when the AC is satisfied that the timeliness and quantity of water supply has been sufficient.

The IMB is a type of WUA composed of a management board, three technicians, two irrigators, and an accountant (as presented in Figure 5-4). The management board consists of a head, four chairmen (one for each respective commune) they are the heads of the four ACs which receive a water supply in Ngoila. The head, who is appointed by the PPC (based on the approval of the provincial DARD), is responsible for the overall management of the organization. The head of communes together with the WUA head, make decisions on all aspects of O&M for the Ngoila irrigation system. The three technicians are responsible for setting the irrigation schedule and opening the intakes. Irrigators in each AC take responsibility for the delivery of water in tertiary canal systems. The accountant is responsible for finances and accounting.

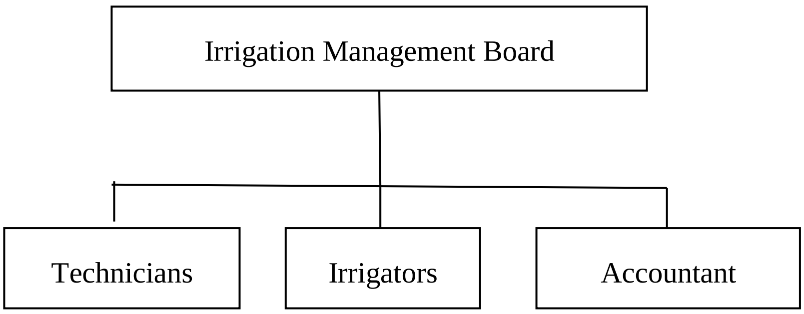

Figure 5-4: Ngoila Irrigation Management committee (IMC)

Source: Created for this study

The main responsibilities of the Ngoila IMB (WUA) are to:

- Manage and maintain the Ngoila irrigation system from reservoir to the end of the secondary canals systems. Based on water supply contracts signed with BoT, the IMB delivers water for agricultural production, as well as other consumption;
- Sign water supply contracts with individual households with assistance of on-farm irrigators and ACs. At the end of each season the IMB implements the acceptance contracts with households;
- Fulfil O&M plans using allocated BoT funding during the fiscal year;
- Develop a water supply calendar for the two secondary canals (N1 and N2) to cover day and night time water supply;
- Assess the water level of Ngoila's reservoirs to accurately manage water volume.

5.2.3 On-farm irrigators

On-farm irrigators are farmers responsible for O&M of the on-farm irrigation systems (i.e. the tertiary canals). They are appointed by peers from every village in a commune. On-farm irrigators work in teams.

There are four ACs in the Ngoila system. Each village appoints or elects one farmer to join the team of on-farm irrigators in an AC. So in Ngoila there are from 3 to 4 on-farm irrigators in each AC.

The main responsibilities of on-farm irrigators are to manage water allocation and distribution to different parts of the irrigation system (from the end of secondary to individual farms). The AC cropping calendar water allocation schedule is followed closely by irrigation teams. On-farm irrigators operate and maintain the tertiary canal systems which include cutting grass and removing silt and domestic and agricultural rubbish obstructing and blocking water flow in the canals.

5.2.4 Government Subsidies

Prior to 2008, funds for the O&M of irrigation systems were generated through farmer contributions called ISFs. After 2008 the Vietnamese Government subsidised farmers through an ISF waiver; the subsidy is determined by the area of agricultural land under irrigation and type of irrigation system (i.e. gravity-fed or pumped). The Government funds are to assist with the O&M of headworks to end of secondary canals across Vietnam. The subsidy is delivered to province level finance departments. It is at the provincial level that decisions are made as to how the subsidy will be dispersed between provincial level and lower level irrigation management entities.

Subsidies relieve farmers from having to pay fees to help with O&M of the headworks and secondary canals. When government subsidies covering the ISF commenced in 2008 through Decree 115 there was a significant increase to Tuyen Quang BoT IMC’s budget. This is because the fees charged for O&M of the headworks to tertiary canals almost doubled (as explained in Chapter 4). There is a 100% ISF waiver for farmers in Ngoila. Table 5-2 indicates the total amount of funding subsidy provided by MARD for the Tuyen Quang province from 2008 to 2011.

Table 5-2: MARD funding subsidy for the Tuyen Quang province

Year	ISF funding (10^3 VND)
2008	12,659.851
2009	18,991.919
2010	20,087.942
2011	20,046.669

Source: Adapted from BoT (2012)

For the IMB (WUA) to receive the government (MARD) subsidy at least three steps are followed.

Step 1: Ngoila IMB (WUA) submits to the district Department of Finance a report that identifies the total areas that were irrigated in the previous financial year in order to receive a fee waiver. This Department examines the IMB report and decides if the information provided by the IMB is correct.

Step 2: The district Department of Finance forwards the report to the provincial Department of Finance which makes its assessment, and subsequently forwards it onto the national Ministry of Finance.

Step 3: The national Ministry of Finance decides the amount it will provide in subsidies (and hence providing a fee waiver for farmers). MARD’s subsidy is sent to the Province Department of Finance, which then sends the funds onto, which then sends funds to the BoT, which then distributes funds to individual IMBs (WUA).

5.2.5 ISF collection —on-farm irrigation fee collection

On-farm irrigation systems are managed by Ngoila’s four ACs. Farmers are required to pay for the O&M of tertiary canals. The on-farm ISF is collected in two steps: (1) ACs give an updated list of farmers receiving a water supply, then (2) the AC ISF bills are distributed promptly to each of farmer. This bill itemises agricultural costs, including water. The amount of the on-farm ISF is different between communes (See Table 5-3). Farmers in Kim Phu refused to pay their ISF, which is why the amount is 0. This matter is taken up in later discussion.

Table 5-3: On-farm Irrigation Service Fee in Ngoila irrigation system

Irrigation system	Commune	Water service fee (VND/360m^2/crop)
Ngoila	Trung Mon	24.000
	Y La	20.000
	Hung Thanh	34.000
	Kim Phu	0

Source: Farmers' questionnaire survey 2013

5.3 Results—Analysis of Irrigation Management Transfer in Ngoila

This section describes the results from 50 farmers who were questioned. More women than men were at home when the researcher called. Almost three quarters of respondents were women (n= 31; 62%). The age of respondents in Ngoila ranged from 25 to 61 years of age, over half of respondents were middle-aged (aged 41-60). The majority of households estimated they received an average income. Table 5.4 indicates the characteristics of participation in terms of ranges of age, levels of education and canal locations. The majority of participants were situated at the head of the canals. The decree 09/2011/QĐ-TTg dated 30th January 2011 regulates the range of income in the agricultural areas. According to the decree, average income is lower than 520.000 VND/month/person is called Low; Middle range from 750.000 VND/month/person to 1.050.000 VND/month/person; High income is over than 1.050.000 VND/month/person.

Table 5-4: Demographic information about participants

Age (In Years)	N	Education	N	Canal locations	N	Income	N
21-30	5	Primary	7	Upstream	24	Low	9
31-40	14	Secondary	26	Middle	14	Middle	30
41-50	19	High School	22	Downstream	12	High	11
51-60	8	Tertiary	6				
61+	4						
Total	**50**		**50**		**50**		**50**

This section also includes perspectives from interviews and focus group discussions. Interviews were conducted with two BOT staff, two WUA members (current and former), two AC members, one on-farm irrigator. Two two focus group discussions were held, one with farmers in Y La commune, and one with on-farm irrigators.

Following the evaluation framework (see methodology chapter) seven categories were used to evaluate IMT in Ngoila. They include: financial arrangement, water supply management, maintenance of irrigation facilities, agricultural benefits, the economic impacts on farmers, social effects, and governance aspects of IMT. They are discussed in turn following the evaluation framework.

5.4 Financial Arrangements for irrigation system management

5.4.1 Allocation of government subsidies

The IMB receives 100% of the ISF waiver subsidy from the Government based on the total agricultural areas under irrigation. The subsidy is the main source of funding for the headwork, main and secondary canal systems in Ngoila.

5.4.2 ISF collection—on-farm irrigation fee collection

Before 2008 when farmers had to pay the full ISF to the IMB (WUA) and IMC (Province), the water supply mechanism worked like a market. Farmers paid when they were satisfied with service. If the IMC and WUA wanted to receive a high rate of return for the ISF from water users, they had to provide a good water supply service. If the service provided was poor, farmers refused to pay their fees and there was considerable debt truancy. Under existing arrangements, whether farmers are satisfied or not, they receive funding from government. WUAs have signed contracts with individual households and these contracts are terminated at the end of every crop. WUAs then use these contracts as proof to claim payment of the ISF. However, these contracts are easily approved by farmers or commune leaders because they do not have to pay ISF. The concern was raised that this will lead to the prevalence of low quality irrigation systems and the degradation of irrigation systems.

Participants in this study explained that there are problems with the on-farm ISF. Problems were identified during the interviews with irrigators in the Hung Thanh and the two focus groups in Y La. One of the most serious problems is that not all farmers are paying the irrigation service fee for the tertiary canals. In particular, famers in the Kim Phu commune have not paid their on-farm ISF since the Government (MARD) began to subsidise O&M of the headworks to the secondary canals. There is a misunderstanding by these farmers about why they need to make a payment. Farmers assume that the Government is subsidising the whole system from the headwork to the tertiary canal. This lack of funding contribution by farmers has a knock-on effect with irrigator teams (group of irrigators) being paid low wages. The outcome of this situation has serious implications for O&M and efficiency of the tertiary canal systems in all four of the Ngoila's communes. The negative impact of unpaid on-farm fees results in inefficiencies in on-farm irrigation system O&M. This will be discussed further in Section 5.6.

Part of the ISF goes to paying on-farm irrigators for their work. On-farm irrigator participants in the focus group discussion stressed that their wages as on-farm irrigators were very low; lower than that of wages paid for basic jobs in their village, such as working in garment or construction companies. It was considered that on-farm irrigation tasks were of a higher order and therefore demanded a higher payment.

> *Another and very important thing is that my salary is too low compared to other jobs in my area. I could work in construction and earn 150.000 VND per day compared to 30.000 VND [Focus Group, on-farm irrigators, Ngoila]*

During the focus groups it emerged that after two or three terms some irrigators wanted to withdraw from their responsibilities in the WUA and from the on-farm irrigator teams. On-farm irrigators complained that even though they have many times requested at annual meetings for an increase to their salaries, their situation has not changed.

> *Three out of five irrigators in our group will withdraw in the next period because although we work very hard in order to deliver water to individual farmers, we received many complaints when they did not have enough water (due to water shortage from the headwork). It is not our fault. Our jobs are very hard. We work from early morning and spend the whole day on the farm, even the whole night, in the rush to meet water requirements, to ensure there is enough water for cultivation. As a result, my health is badly affected. I have difficulty sleeping. I did speak at AC meetings many times but there has been no change from year to year. [Focus Group, on-farm irrigators, Ngoila]*

The difficult and demanding nature of work was raised numerous times. On-farm irrigators said that they regularly work through the night (See Figure 5-5) because the ACs often supply water at night. Electricity companies encourage those using electricity for production to do so at night, to save day-time electricity use for domestic users. This approach reduces the burden of supply for electricity providers. It also reduces the electricity costs of ACs, and it is also minimises unlawful withdrawal of water by farmers.

Figure 5-5: Irrigators working at night to deliver water to farms

Source: Chinh 2015

An additional problem in paying wages of on-farm irrigators are the insufficiencies of the WUA budget. On-farm irrigators are not always paid the amount due to them:

> *I have been in this position of [on-farm irrigator] since 2010. It is only me who is responsible for the delivery of water from the Ngoila system and dredging tertiary canals for the Hung Thanh commune. I was paid 7 million VND for the whole crop. In some cases, I had to hire someone to help, so at the end I received around 30,000VND/day. Fifty percent of the AC budget was used to pay for on-farm irrigators and 50% was used to pay for electricity costs. I did not receive any support from ACs or other organisations [Interview, ID (1), on-farm irrigator, Ngoila].*

The BoT is aware of this discontent. To lessen the difficulties for on-farm irrigators and to encourage them to stay in these management positions, the BoT has supplied extra money especially for on-farm irrigators after every crop. However, interviewees warned that this additional 'reward' payment was not stable or guaranteed.

> *My BoT and I know about the difficulties that on-farm irrigators face. Every year, we spend a small amount of money or gifts to support on-farm irrigators. I know it is still low but we try to encourage them to stay in this job [Interview, ID (2) BoT member, Ngoila].*
> *Every year, BoT also receive about 500.000 VND from BoT because I am the leader of on-farm irrigators in Y la. Other on-farm irrigators only get paid from on-farm ISF [Focus Group, on-farm irrigator, Ngoila].*

5.4.3 Financial management

Respondents from the BoT and Ngoila IMB confirmed that the IMB receives 100% of ISF waiver subsidy from the Government. They said that there have been no financial shortages in Ngoila, and that the IMB has adequate funds to implement the major repairs of its canal systems.

5.4.4 Delay in funding subsidy payments

According to interviews with the BoT and IMB (WUA) staff, there is a lag in receiving payments after the Ngoila IMB has submitted its financial reports and requested the fee waiver. This lag in funding has a negative impact on O&M of irrigation systems.

> *This year (2013) we were funded about 47 billion VND as planned, but until November 2013 we received just 37 billion. The rest of the funding (10 billion) will probably be provided next year. It is very difficult for us to operate and manage irrigation systems on time [Interview ID (1) BOT member, Ngoila).*

Reasons specified for the lag were that the process for receiving funding is slow and the process is confusing to both BoT/IMB staff.

> *There are too many steps and long processes (from district to provincial and national level) to get the ISF waiver. In addition, it is confusing for ACs staff to prepare the documents according to the circulars 56/2010/TTBNNPTNT. I think national government should simplify the process to reduce the difficulties to us [Interview ID (2) BOT member, Ngoila)*

5.5 Water Supply Management

One of the objectives of this thesis was to investigate whether the IMT resulted in an improvement in the quality of irrigation supply service. Following the evaluation framework water supply management performance is assessed following three indicators: (1) timeliness of water distribution, (2) adequacy of water supply and (3) equity of water supply. Figures 5-6 and 5-7 illustrate the farmers' satisfaction in regard to water supply management in Ngoila system before and after IMT.

Figure 5-6 shows perceptions of respondents in regard to their satisfaction with water management before the IMT. Just over half of respondents were dissatisfied across all three measures (timeliness, adequacy, and equity). Figure 5-7 indicates that 81% of respondents were either satisfied or very satisfied across the three measures after the IMT. Table 5-5 and 5-6 provide an overview of attributes of respondants rating satisafaction regarding water supply management. Household income is not included in the table 5.5 as it is for table 5.6 because the majority of farmers could not recall exactly their imcome at the time of the IMT. Rather, they had only a sense of an increase or decrease.

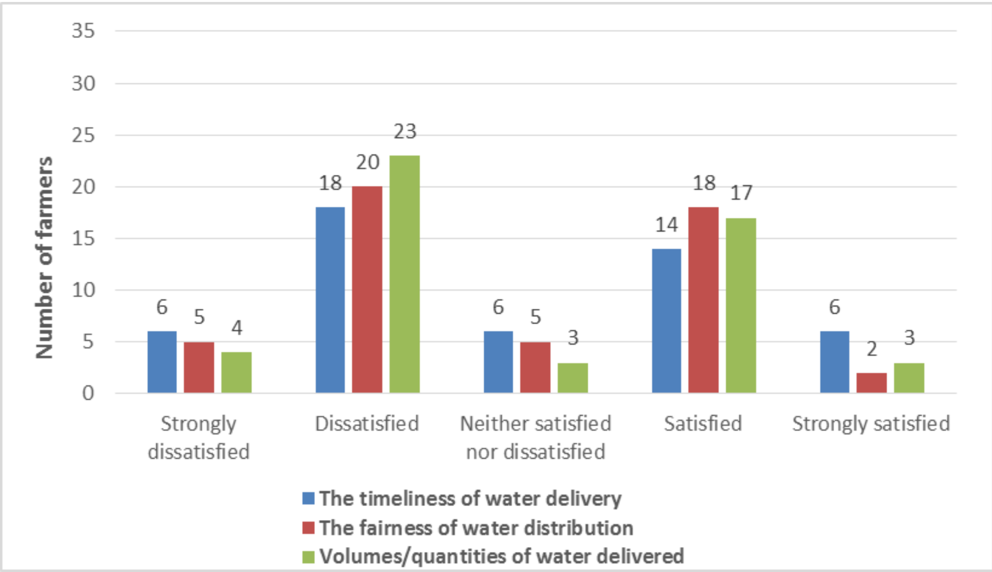

Figure 5-6: Ngoila Farmer's perceptions about water supply management before IMT

Source: Farmers' questionnaire survey 2013

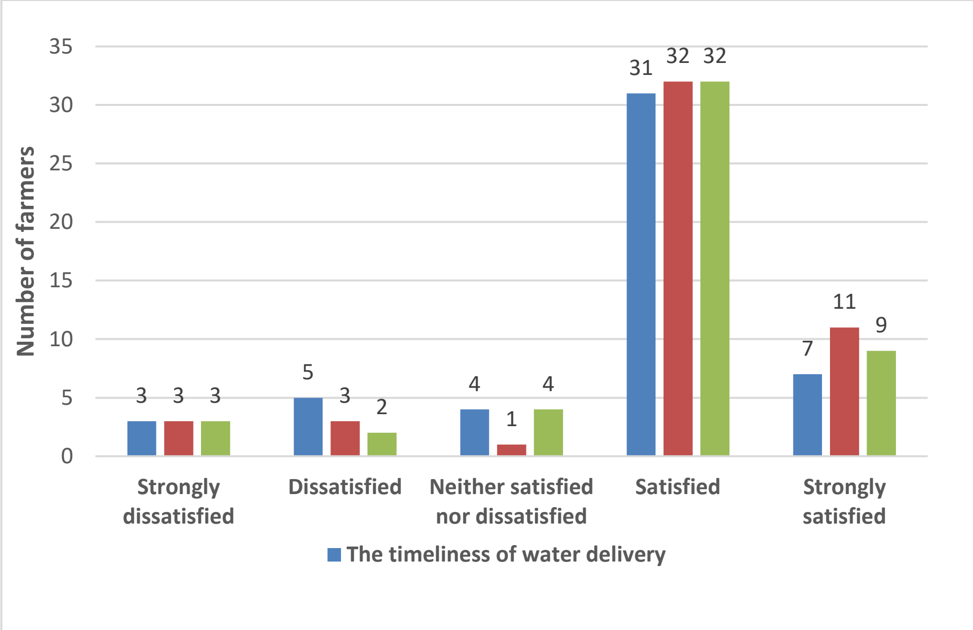

Figure 5-7: Farmer's perceptions about water supply management after IMT

Source: Farmers' questionnaire survey 2013

Overall, in terms of water supply management, education, gender, and household income did not affect respondents' satisfaction. The most important variable influencing satisfaction was the location of the respondent's farm of the respondent along the canal. According to the table 5.6 there are larger numbers of dissatisfied farmers situated centrally and tail of canals compared to those situated upstream. Surprisingly, in Ngoila, there was a number of farmers who were either 'very satisfied' or 'satisfied' before the IMT but were less satisfied after the IMT. This was so for all three of the water management measures of timeliness, adequacy and fairness of supply.

5.5.1 Timeliness of water distribution

The farmer questionnaires (n=38/50) and focus group discussions confirm that farmers were either satisfied or strongly satisfied with the timeliness of water supply. They stated that prior to the IMT water supply was haphazard. Farmers did not know when to anticipate the arrival of water and this was frequently a problem for them. This problem was solved after the IMT for two main reasons: foreign aid support for projects and enhanced responsibilities of WUA members and on-farm irrigators.

Table 5-5: Attributes of respondants rating satisafaction regarding water supply management before the IMT

Indicators	Farmer's satisfaction	Number of farmers	Gender		Canals Location		
			Women	Men	Head	Middle	Tail
The timeliness of water delivery	Strongly dissatisfied and dissatisfied	24	14	11	5	9	0
	Neither satisfied nor dissatified	6	2	4	1	3	2
	Strongly satisfied and satisfied	20	23	15	15	3	2
The fairness of water distribution	Strongly dissatisfied and dissatisfied	25	13	11	9	9	7
	Neither satisfied nor dissatified	5	3	2	3	1	1
	Strongly satisfied and satisfied	20	15	5	12	5	3
The volume of water deliver	Strongly dissatisfied and disatisfied	27	16	12	8	10	10
	Neither satisfied nor dissatified	3	2	1	2	1	0
	Strongly satisfied and satisfied	20	13	6	15	2	2

Table 5-6: The description of respondants about water supply management after IMT

Indicators	Farmer's satisfaction	Number of farmers	Gender		Canals Location			Household Income		
			Women	Men	Head	Middle	Tail	Low	Medium	High
The timeliness of water delivery	Strongly dissatisfied and disatisfied	8	5	3	0	3	5	2	5	1
	Neither satisfied nor dissatified	4	3	1	1	2	1	1	0	3
	Strongly satisfied and satisfied	38	23	15	22	11	5	7	23	8
The fairness of water distribution	Strongly dissatisfied and disatisfied	6	4	2	0	2	4	0	4	2
	Neither satisfied nor dissatified	1	0	1	0	0	1	0	1	0
	Strongly satisfied and satisfied	43	26	17	23	12	8	10	24	9
The volume of water deliver	Strongly dissatisfied and dissatisfied	5	5	0	1	3	1	2	2	1
	Neither satisfied nor dissatisfied	4	2	2	1	3	0	2	1	1
	Strongly satisfied and satisfied	41	22	19	20	11	10	8	25	8

Respondents explained that when the IMT was implemented in Ngoila, as a consequence of assistance from development projects (through the ADB) it had increased the number of concreted canal systems for both main and secondary canals and for nearly 90% of tertiary canal systems.

When the Ngoila system was transferred to farmers the maintenance of irrigation infrastructure required significant improvements. The IMB (WUA) and groups of on-farm irrigators and AC members in each village worked closely together to ensure irrigation infrastructure was well- protected.

The second reason for the improvement in the timeliness of water delivery was due to responsibilities of WUA members and on-farm irrigators. Respondents explained that WUA members inspect canals daily and collect rubbish. This is especially so in the water supply period which helps to ensure timely delivery of water to individual communes. Groups of irrigators play an important role in ensuring timely water delivery for individual farms. They take responsibility for water delivery according to the water delivery schedule signed with the WUA. When water supply schedules are finished but farms have been not supplied the volume of water they need, small pumping stations in villages are used to supply water to farmers from local water courses.

> *Prior to the IMT it was really hard to get water on time. Sometimes, we were informed the time that water will be delivered to our villages but water usually arrived one or two days after that. It was extremely difficult for downstream farmers. [Farmer, Ngoila, ID (27)].*

> *I can say it is a much better water supply [after IMT]. Groups of on-farm irrigators have been given responsibilities to deliver water to the farm. On-farm canals were concreted after transfer which has resulted in saving a lot of time in delivering water [Farmer, Ngoila, ID (29)].*

> *In order to ensure timely water delivery for farmers, if water from the headwork is not sufficient, we encourage ACs to use the pumping stations to take water from small reservoirs, natural rivers, ponds to supplementally supply for the farm [Interview, ID (1), BOT member, Ngoila].*

Respondents also stated that during the water supply period in order to ensure timely water delivery in their communes, on-farm irrigators tried to hire more people or work longer hours to deliver water on time. This meant someone was always present in the field to make sure that water supply was moving smoothly through the canals.

> *We have tried our best to deliver water to farmers in our communes, we work not only during the day but also extensively at night to ensure farmers' production has not been affected by water delivery [Focus group, on-farm irrigators, Ngoila]*

> *Water from Ngoila system is gravity fed, Hung Thanh is the downstream commune of Ngoila system, some cases if water is insufficient I directly call the IMB (WUA) and they will extend the time of water supply or they will open the gate to allow maximum flow. In some situations we use the small pumping stations to pump water from the river to the farm [Interview, ID (2), On-farm irrigators, Ngoila]*

5.5.2 Equity of water supply

Figures 5-6 and 5-7 show that 86% of farmers (n=43/50) were satisfied with the equity of water supply after the IMT compared to 40% before (n=20/50). Two-thirds of farmers (n=21/32) explained that the IMB (WUA) has ensured equity between communes and between farms along the canal from head to tail. In the past, Trung Mon commune was advantaged because of its location at the head of the canal system. Although the Tuyen Quang BoT water delivery schedule was developed with a "downstream priority" in reality, farmers in Trung Mon commune usually accessed water first, even though the timetable was shared with the three other communes. In some cases, Trung Mon commune withdrew volumes of water exceeding its requirement for its crops. Consequently, three downstream communes experienced insufficient water supply.

One respondent (Hung Thanh AC leader) described the BoT and the IMB (WUA) as 'the centre of the water supply action'. These organisations are not only responsible for managing and operating irrigation systems but they also ensure that every farmer's rights are respected to allow access to water for agricultural cultivation. These organisations achieve this goal by developing detailed water allocation schedules for individual communes. Water users located towards the tail end of canal are supplied a better share of water available.

> *We have tried our best to deliver water to every village in our commune. I can say IMT is successful because farmers at every village have the same right to access water. As a result, in the AC meeting, some farmers speak*

> *and they appreciate our roles in trying to deliver water equally between upstream and downstream farmers [Focus group, on-farm irrigators, Ngoila]*
>
> *WUA and irrigators ensure upstream and downstream farmers have the same rights to access water; our village is located downstream in the canal but it is much better than before [Focus group, Y La AC members, Ngoila]*
>
> *It was very difficult to get water before IMT and we are located downstream of canal systems. We only get water when upstream has adequate water. After the transfer, we have the right to access water when it is our turn. IMB (WUA) and on-farm irrigators ensure water delivery to our commune [Farmer, Ngoila, ID (32)].*

Along the secondary canal, water intakes that deliver to farm canals are well protected and this minimized the number of farmers withdrawing water when it is not their turn (Figure 5-8 shows control water intake from secondary canal to tertiary canal systems, and Figure 5-9 illustrates the concreted tertiary canals).

Figure 5-8: Concreted secondary canal systems with manual off-take in Ngoila

Source: Field trip observation 2013

Figure 5-9: Tertiary canals in Ngoila

Source: Fieldtrip observation 2013

Figure 5-10: Protected water valve controls water

Source: Fieldtrip observation 2013

During the fieldtrip investigation, water control valves were visible at the beginning of each secondary canal and the beginning of tertiary canals. These junctions were well protected and locked (Figure 5-10). Only WUA members had a key and permission to open the lock and manage water delivery. Under these circumstances it is very difficult for farmers from neighbouring communes to unlawfully withdraw water.

However, focus group discussions raised concerns about unfair water delivery experienced at the commune level. There is a problem of bureaucracy between managers of ACs. Basically, the water supply schedule was developed at the commencement of every crop. During each water supply period the leader of on-farm irrigators has the right to decide the volume of water to be supplied to individual villages. The "downstream priority" is to be applied. Villages located furthest from the headwork are to be irrigated first. However, on-farm irrigators said that water supply and distribution was often controlled by AC members and not the on-farm irrigators. Instead of supplying water following the schedule, the on-farm irrigators were instructed to deliver water to places designated by AC members. Respondents also stated that if this problem is not solved it will have a negative impact on the roles of on-farm irrigators; farmers will not trust them, and it directly effected the fairness of water supply between farmers in the commune.

> *One of the reasons that three out of four on-farm irrigators do not want to take this job in the next term is because AC members are frequently controlling water delivery. They sometimes control the right to deliver water and require us to supply water for their commune first even if their village is located upstream. As a result, farmers located in the other areas were not happy and complained about us [Focus group, on-farm irrigators, Ngoila].*

5.5.3 Adequacy of water supply

Eighty-two percents of farmers are either satisfied or strongly satisfied with the volume of water supplied to them (n=41/50). Prior to the IMT only 40% stated they were satisfied with water supply volume.

Three main reasons leading to the improved attitude about the adequacy of water supply are: an improvement in farmers' awareness about the finite availability of water, the improved quality of irrigation infrastructure, the heightened responsibilities assigned to the IMB (WUA), on-farm irrigators and ACs.

5.5.3.1 Improvement in farmers' awareness

The focus group discussions indicated that in the past people believed that "water supplies were unlimited". As a result, farmers did not follow water supply allocations and broke water channel walls and withdrew water to take as much as they could into their farm. These farmers did not take into consideration the effect of these actions on downstream households. Additionally, in some cases, more water than was required for cropping was taken. This action was counterproductive and led to lower crop productivity. Both of these problems occurred in Trung Mon commune before the IMT. However, farmers now, after the IMT, understand that water is finite and they try to withdraw it in appropriate quantities. They think about other farmers' needs and, they are careful to protect their farm borders from leakage or seepage. A typical farm in North Vietnam is divided into small square plots owned by individual farmers (Figure 5-11). Protecting borders will therefore help farmers to avoid water loss from one farm to the next or from farms to drainage canals.

> *Farmers were much more understanding about water saving, and how much water is enough for cultivation, especially farmers in Trung Mon commune. Prior [to the IMT] they took water whenever they wanted. After the transfer, farmers were reminded and trained by AC meetings or on-farm irrigators. Even we [WUA members] came to farms and explained to farmers how to minimise water loss by protecting their farm border [Interview, former WUA, Ngoila]*

> *There was a significant increase in farmers' responsibilities in terms of saving water when irrigation systems were transferred. So basically water is delivered adequately for farmers [Focus group, Y La AC members, Ngoila]*

> *Actually, I can say after or before IMT, it was easy to access water because my farm is located in the head of the canals. However, before the IMT I did not care about the limit of water resources. I could withdraw as much as I wanted. However, when the IMB was established I was reminded by the IMB (WUA) members that I need to save water and protect farm borders carefully and save water for downstream farmers. The messages of water saving are also remained in ACs meeting [Farmer, Ngoila, ID (2)]*

Figure 5-11: Typical paddy rice farming in Ngoila system, showing farm borders

Source: Fieldtrip observation 2013

5.5.3.2 Increased responsibilities for IMB (WUA) and on-farm irrigators

The increased responsibilities of IMB (WUA) and on-farm irrigators was confirmed by respondents. IMB (WUA) developed water supply schedules and rotational plans designed on the basis of crop seasons, and on the availability of water from the headwork. The leader of the IMB (WUA) is responsible for specific aspects of water distribution to individual farms (such as timing, and volume). The IMB (WUAs) and on-farm irrigators actively deliver water from the headwork to the end of tertiary canal systems. On-farm irrigators closely follow the general water supply schedule and then they insure a more detailed water supply for each village.

The Hung Thanh commune is located nearly 6km from the headwork, and there are about one hundred intakes along the canals. Compared to other communes it is more difficult to deliver the intended quantity of water to farmers. When the available water supply is only just sufficient, this commune is in a problematic situation. ACs have devised three solutions to solve the problem. First, they inform and asked the IMB (WUA) to maximize water intake from headwork. Second, they ask assistance from upstream communes, such as Y La and Trung Mon, to shorten their water delivery time in order to provide more supply time for Hung Thanh. Third, their on-farm irrigators stay longer in the field and pump additional water from rivers to obtain an adequate quantity of water for all farmers.

> *When we receive farmers' complaints I directly contact the IMB of Ngoila. The Ngoila IMB manager supplied an extra 2 or 3 hours of schedule for this area. However, Ngoila is gravity fed and our area (Hung Thanh) commune is at the tail of the Ngoila system (through Trung Mon, Yla, Kim Phu communes) so a water shortage sometime happens. In some urgent cases we pump water from Ngoc Kim pumping system in to canals [Interview ID (2) AC member, Ngoila].*

> *We receive the plan and general water supply schedule from Y La commune and work with the IMB of Ngoila, and then we work the detailed water supply for each village. The leader of the IMB (WUA) is responsible for water distribution. In the water supply period we meet with other members every morning to learn from experience and discuss next plan [Focus group, on-farm irrigators, Ngoila].*

> *Only one man in our village is responsible for water delivery and for dredging canals. I sometimes see his wife come to help him and both of them take care of water delivery to meet the requirements of water supply in the rush hours [Farmer, Ngoila, ID (33)].*

5.5.3.3 Addressing water loss

Prior to the IMT almost all canals systems in Ngoila were earthen. It took a long time for the four ACs to deliver water to their communes, partly because this old infrastructure led to significant water loss from water seepage along the canals and from unlawful breaks made by farmers. These problems have been solved through the concreting the canals and by protection afforded by WUAs and on-farm irrigators.

> *The reduction in the amount of water loss is another successful result of the irrigation system transfer. The canal schemes were built with soil and earth and weir systems were not protected well before the turnover [Focus group, Y la AC members, Ngoila]*

> *Honestly, it is undeniable that it is much easier now because irrigation canals were concreted. It has minimised the unlawful breaking of canals by farmers. This has greatly reduced the volume of water loss [Farmer, Ngoila, ID (36)].*

Respondents were concerned however about a new source of water 'wasting' in Ngoila due to a change in the land ownership.

According to participants, the previous Vietnamese Government's Agricultural Land Use Law was responsible for the management of agriculture and it was stipulated that land belonged to the Vietnamese Government. Management rights have changed over time, but in general there were strict rules regarding a change in management rights from one farmer to another. However, in 2004 a new Agricultural Land Use law was implemented. Under this 2004 law agricultural land was considered to be a “special product”. According to this law, farmers have the right to lend and sell their land to other farmers or organisations. Participants in the focus group discussion in Ngoila with the Y La AC claimed that under this law many farmers have extended their farm area by narrowing their farm borders. This has resulted in water not being as well protected, and water loss is occurring from this practice.

> *Actually, I need to tell you that due to the change of the agricultural land law there have been some changes in land use. As a result, farmers are tending to leave a very narrow border between farms. Water loss is now a problem in many villages [Interview, ID (1), WUA members].*

> *Many families keep very narrow borders so it is easy for water to run from one farm to other farms. It is really difficult for on-farm irrigators because it takes time for them to go and check during the water supply period [Focusgroup, Y la AC members, Ngoila].*

However, seven farmers in Kim Phu (downstream) and one farmer in Y La (the middle) have complained about the inadequacy of water delivery for their spring crop and they complained about untimely water supply in their villages. They said that many farmers in their villages were not at their farms when water arrived. Ngoila is a mountainous area; farms are steeply sloped. Each village was supplied water at a certain time; if the borders of farms are not well-protected, and farmers are not present or ready to cultivate when water is delivered, the water easily runs from one farm to another or drains to drainage canal systems. This has an impact on farms furthest from the water source. This problem was confirmed by on-farm irrigators who stated that there were a number of farmers who left all of the water delivery responsibility to on-farm irrigators, so they did not care about protecting their farm borders and keeping the water supply on their farms.

> *Some people are not aware of the importance of saving water, they go to do other jobs or forget the water supply schedule for when their farm was being*

> *delivered water. Generally, one ditch is supplied in two or three days so if they do not have water on that day, they could not cultivate their farm. Then they complain or require more time [Focus group, on-farm irrigators, Ngoila].*

> *Some households may not be at the farm when water is delivered. Farms in Ngoila are very steep and water easily drains into the lower farms or springs so it affects our farm at the end of canals [Focus group, Y La AC members, Ngoila].*

They also indicated that they were completely satisfied with the volume of water supply in the main crop, but in the spring crop they needed more water for cultivation and husbandry.

Farmers explained their needs when participating in AC meetings, but this problem has yet to be solved.

> *We still pay for water supply in order get water for the spring crop, but in recent years water has not been delivered. Our pond does not have water to grow fish or water for buffaloes to drink. We only need water to be supplied one day in ten. It has been very difficult [Farmer, Ngoila, ID (23)]*

> *More than 10ha of corn has not been supplied water in Tanha (Yla) commune, WUAs only focus on delivering water for the two main crops and neglect the spring season. We are waiting for rain but it is very difficult. Although our commune has discussed this already many times with the IMB (WUA) this situation have not improved [Farmer, Ngoila, ID (21)].*

5.6 Operation and Management of Irrigation Facilities

Overall, the quality of irrigation infrastructure has been significantly improved since the Ngoila irrigation system was transferred. The stability of government budgets, heightened responsibilities of WUA members and an increase in farmers' participation have all contributed to an improvement in irrigation maintenance.

The timely repair of irrigation infrastructure was confirmed by farmers in focus group discussions, all interviews with BoT, WUA and AC participants. Respondents claimed that the canal systems are well maintained and are rehabilitated or upgraded regularly. Two thirds (n=33/50) of farmers said that irrigation infrastructure has been maintained frequently in recent years. According to an Y La report (Y La, 2013), Y La AC has concreted and built 2,187m of tertiary canals during from 2010 to 2013.

5.6.1 Operation and management of the headwork and secondary canal system

Before the IMT, repair and maintenance from the headwork to the end of secondary canal systems was considered to take a long time and was ineffective. After the IMT, the IMB (WUA) took over responsibility from the IMC for repairing the headwork and secondary canals. The IMB (WUA) actively mobilized all farmers' resources including labour, and finance. Canal systems were frequently inspected. Daily works commenced such as collecting grass and rubbish disposed into canals.

There has been a considerable increase in total irrigation budget of up to two to three times since the transfer, and since the Government began to subsidise infrastructure O&M for the main and secondary canals. As a result, with this increased budget major repairs and concreting of irrigation infrastructure has been completed for headworks to the end of secondary canals. Respondents perceived that the combined government subsidies and other government funding in Ngoila has led to considerable improvement in infrastructure maintenance.

After the transfer, farmers reported to have gained a sense of ownership and they have greater awareness about their roles and responsibilities for managing and protecting the infrastructure. This has reduced the damage to infrastructure and therefore lessened some of the reparation tasks needed in the past.

> *I can say that O&M of irrigation systems is much better than before. Subsidised funding can cover full O&M costs. If the money collected from farmers is enough to dredge and clean the canals, we [IMB] can upgrade and concrete canal systems and build new systems when we have ISF waiver. The headwork was checked and maintained every year to ensure dam safety [Interview, ID (2), BOT member, Ngoila].*

> *We are responsible for the headwork and main canal systems, however, in some cases, we are happy to send our staff to help ACs to deal with technical problems, especially after a natural disaster to deal with flood control or drought management [Interview, ID (2), WUA member, Ngoila].*

> *Farmers have to pay for many kinds of expenses [input costs] such as breeding and fertilizer so the subsidy has reduced their burden. Subsidies from the government are very helpful for the BoT. They help the BOT to solve the problem of delays in paying farmers. Nearly 25-30% of total ISF was not paid by farmers in Ngoila irrigation system [before 2008][Interview, ID (1) BOT member, Ngoila].*

5.6.2 Operation and Management of tertiary canal systems

Maintenance of tertiary canals is supported by funding from ISF paid by farmers and additional technical support from the IMB (WUA). There is usually a shortfall in the ISF budget to complete O& M work. Therefore, ACs encourage farmers in addition to their ISF payment, to contribute their voluntary labour and financial support to do major repairs or concrete the remaining earthen tertiary canals systems.

Farmers thought that works implemented by groups of on-farm irrigators, such as irrigation and drainage, usually were reliable and appropriate. The majority of farmers (n=35/40) mentioned that the dredging of canal systems undertaken by ACs was basically completed in time.

Interviewees from the IMB (WUA) and BoT indicated they send their technical staff to assist ACs when repairing tertiary canals.

> *Since irrigation systems were managed by us [on-farm irrigators], when problems such as canal or water intake wings have been broken we will inform the ACs and then co-operate with them to solve the problem as quick as we can in order to ensure water deliver for every village [Focus group, on-farm irrigators, Ngoila]*

Groups of irrigators usually implement repair and dredge canal systems before every crop in order to ensure canals are clean for water delivery. [Focus group, Y la AC members, Ngoila].

Now the maintenance of the canal is more frequent. Before they [IMB] only dredged the canal at the beginning of water delivery, but now they [IMB/WUA] do it both after harvesting and before the water supply schedule to ensure canal systems are protected [Farmers, Ngoila, ID (35)].

However, a small number of farmers (four farmers in Kim Phu, and six farmers in Y La) said that they were not satisfied with the maintenance of their tertiary systems. They thought the quality of maintenance was poor, and that some sections of the canals were old and degraded and had been operating for a long time with no repair.

Two main reasons were given by farmers in Kim Phu to explain the poor quality maintenance of on-farm irrigation infrastructure. First, six farmers confirmed they did not agree to pay the on-farm ISF. This is because of their misunderstanding about what the Government subsidy covers. These farmers assume that the Government subsidy will cover the O&M costs from the headwork to the end of on-farm irrigation systems. As explained above, this is not so. Government subsidies only cover O&M costs from the headwork to the end of secondary systems. O&M of the tertiary canals is funded through the on-farm ISF. As a result, tertiary irrigation systems O&M have been ignored by both the ACs and farmers. Failure to pay fees has resulted in a lack of funding to carry out works on tertiary systems. This in turn has led to degradation of on-farm canals. This problem is particularly acute for earthen canals. Grass covers channels and impedes flow.

My household does not have to pay for any ISF because I think the government funds are to maintain and upgrade canal systems. This problem has been happening since 2008, and I do not know when it will be solved. I am happy to pay for the ISF if I receive better water delivery and irrigation systems will be well-managed [Farmer, Ngoila, ID (42)]

Canal irrigation systems under-supplied by Ngoila systems have terribly degraded. As there are no on-farm irrigators in our village, water delivery is usually implemented by the leader of the village or sometimes he appoints two people [Farmers, Ngoila, ID (35)].

Second, in Kim Phu there is no one to take care of the canals. There is no on-farm irrigation team in this commune responsible for taking care of on-farm systems (as a result of their failure to pay their ISF). As a result, many concreted segments of on-farm canals in this commune were broken or covered in grass that blocked canals (see Figure 5-12).

Figure 5-12: Former staff of WUA show the degradation of on-farm irrigation systems at Kim Phu commune

Source: Fieldtrip observation 2013

In focus group discussions with farmers, five of eight farmers said that they were willing to pay the on-farm ISF if it meant they would receive better irrigation performance.

> *We do not have to pay on-farm ISF, I know that Kim Phu AC does not have funds to maintain and upgrade canal systems. This problem has been happening since 2008, and I do not know when it will be solved. I am happy to pay for the ISF if I receive better water delivery and irrigation systems will be well-managed [Farmer, Ngoila, ID (42)]*

> *You can see canals were covered by grass or broken. There is no on-farm irrigators in our village, water delivery is usually implemented by the leader of the village but in other villages, famers have to deliver water by themselves [Farmer, Ngoila, ID (45)].*

5.6.3 Waste management

In Ngoila a large amount of waste is disposed into canals. Some solutions have been implemented but it is a persistent problem. Rubbish and waste in the canals is from three sources including agricultural by-products, discarded road materials and new residential construction materials, and household waste. Waste in canals impedes water flow and therefore directly affects water supply to farms.

5.6.3.1 Agricultural Waste

Pesticide containers, plastic bags, bottles and solid rubbish from agricultural practices have been thrown into canals as a means of disposal. To overcome the problem concrete tanks have been placed in convenient places by ACs close to canals and main roads, encouraging correct disposal. Waste is collected by the AC from bins (Figure 5-13) and placed in the concrete tanks. With funding support from the Provincial Government many concrete waste container tanks have been built in Y La commune. The content of the tanks is emptied and transported to waste treatment plants (Figure 5-14). This waste management program was implemented between ACs, farmers, and the Women's' Association from the local commune.

Figure 5-13: Concrete waste container in Ngoila system

Source: Fieldtrip Observation 2013

Figure 5-14: Waste treatment system in Ngoila System

Source: Adapted from Thuy (2013)

This waste management solution has played an important role in minimising farmers' bad habits of "throwing anything everywhere as long as no one sees it" – a statement by one of the twelve members in the focus group discussion. As a result, a large amount of solid rubbish from agriculture production, including plastic bags and bottles, has been collected and this has reduced the negative impact of waste on the environment.

> *Currently, in one crop, use pesticides about 10 times to deal with crop diseases so we can count how many plastic containers and bottles are thrown into the environment in my village. In 2008 ACs built a number of bins to collect this kind of rubbish which has reduced a huge amount of rubbish disposed into the canal system [Farmers, Ngoila, ID (18)].*

5.6.3.2 Household waste

It has been estimated that the volume of unmanaged waste is increasing by nearly 10% every year in Tuyen Quang province (Hong, 2015). This will have a negative impact on the environment generally and irrigation systems maintenance in particular. There is a lack of household waste collection in Ngoila leading to pollution. When asked the question what is "the greatest challenge to the current irrigation system for your community", ten farmers said rubbish. Waste thrown into canals by upstream farmers was preventing them from withdrawing water.

According to the Provincial Department of Natural Management and Environmental Protection, although a waste collection company has been appointed to service the whole province, they only collect waste from cities or town centres. They do not collect waste from villages. It is difficult to collect rubbish from individual villages because of transportation difficulties.

> *Almost all of our canals are open systems and go through communes so a number of households still throw household waste into the canals. A temporary solution is that we have to inspect and collect rubbish every day and clean canals [Interview, ID (2), WUA members, Ngoila]*

> *There are still a number of households at the head of the canal that usually throw rubbish into canals. This activity not only effects water delivery by preventing downstream farmers from withdrawing water but also the environment [Focus group, Yla AC members, Ngoila]*

> *Some headwork farmers still throw their household rubbish into canals. They do not care about us [tail end farmers]. Rubbish blocks water supply to our villages and leads to more work for on-farm irrigators [Farmer, Ngoila, ID (36)].*

5.6.3.3 Housing and road construction waste

The Tuyen Quang city centre is undergoing development. More roads and new residential areas are being constructed. Solid waste generated from construction works was mentioned as a problem by some respondents. They mentioned that some negligent construction companies disposed of their solid waste into the canals.

> *Actually, we face the problem of rubbish disposed from building roads and new housing, especially in Y la commune (the centre of the city). It not only costs money to collect the waste but it also seriously affects the life of irrigation systems. Sometimes my WUA had just finished dredging and came back to see many rocks and gravel dumped in the canal systems [Interview, ID (2) BOT member, Ngoila].*

5.6.4 Quality of irrigation systems maintenance

Figure 5-15 shows farmers' perceptions of the improvement to irrigation performance after the IMT. More than 90% of respondents (n=46/50) thought that there had been an improvement in terms of the quality of O&M of irrigation systems. Of these, two-thirds thought the improvement was either significantly better or better.

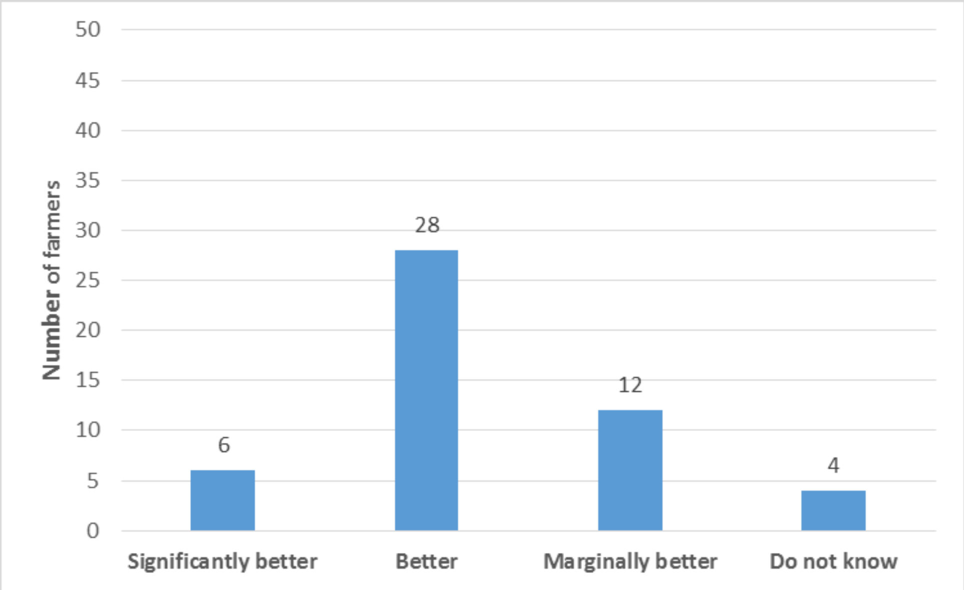

Figure 5-15: Farmers' perceptions about irrigation maintenance after the IMT

Source: Farmers' questionnaire survey 2013

5.7 Agricultural Benefit

When asked if agricultural productivity had improved as a consequence of IMT and hence WUA management of irrigation systems, the farmer questionnaires also gathered details about farmers' perceptions to changes in productivity of their main crop before and after transfer of irrigation systems management. Almost all respondents (n=48/50) thought it had (See Figure 5-16). Only two farmers said their production fluctuated, so they chose to answer “neither agree nor disagree”.

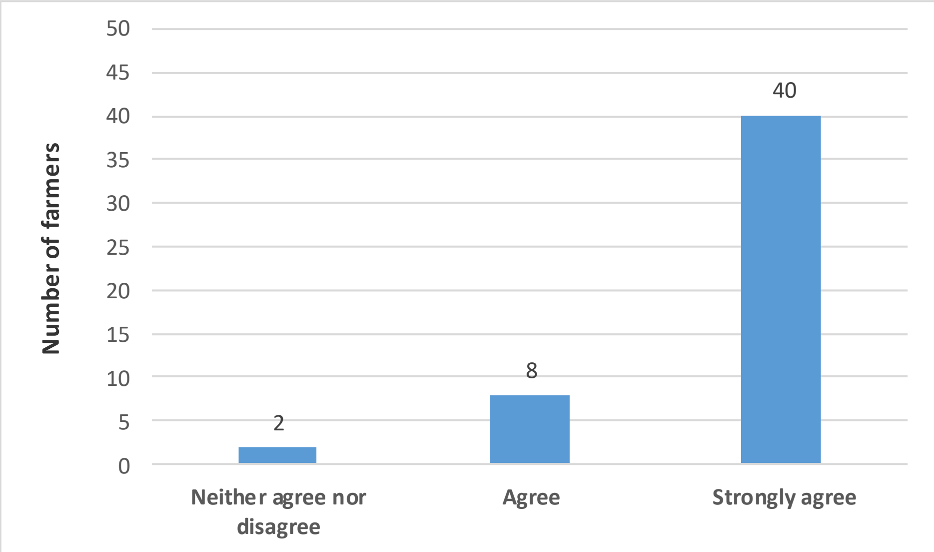

Figure 5-16: Respondent perceptions about the impact of the IMT on increasing agricultural productivity in Ngoila system.

Source: Farmers’ questionnaire survey 2013

Respondents identified two main reasons as to why the IMT has been beneficial for agricultural productivity. Improvements in water supply had led to associated improvements in crop yield, frequency of cropping and diversification of crops. In addition, the area of irrigated land has increased.

5.7.1 Change in crop yield

All 12 farmers in focus group discussions and 27 farmers indicated that their crop yield and frequency of cropping have increased as a result of the improvement of water supply after the IMT. The increase in crop yield and cropping frequency was also confirmed by IMB (WUA) and BoT. They thought the problem of water supply deficits has been reduced.

> *My field productivity significantly increased from 180kg/sao to 250kg/sao in the main crop and from 200kg/sao to 280kg/sao in the spring crop after the irrigation system was managed by WUAs. We actively cultivate due to sustainable water supply from Board of Ngoila and delivered by on-farm*

irrigators. As a result, our family income has increased [Focus group, Y la AC members, Ngoila]

I can say if water is not sufficient rice production will be extremely affected. Before [IMT] we cultivated nearly 7 "saos" [of rice] but it was insufficient to feed my family. Now we cultivate two or three "sao" and it is enough for my family. I also sell rice to earn money [Farmer, Ngoila, ID (36)]

In addition, the IMB (WUA) beside their main duty of irrigation management, have assisted farmers improve their knowledge on growing other kinds of vegetables that require less water using fields that had previously been abandoned.

5.7.2 Increased crop diversity

With a stable water supply 25 farmers (n=25/50) said that instead of growing rice, tomatoes, corn and potatoes as before, they are now growing other agricultural products with high cropping intensities such as flowers and beans. As agricultural production has increased it has provided an opportunity to develop the livestock sector, extending to husbandry of pigs, fish, buffaloes, and ducks. This leads to further increase in agricultural production.

It is much better in terms of water delivery to our location not only for my family but also for my community. We have increased the spring crop to include flowers and vegetables on what was the rice square before. This kind of production brings a much higher profit than rice [Farmer, Ngoila, ID (19)].

5.7.3 Expansion of irrigated areas

Four interviewees from the IMB (WUA) and the BoT were positive about the impact of IMT. They stated that prior to 1996 almost all agricultural areas used to cultivate rice for only two seasons. There were two to three months during which farmers could not grow any crops because of water shortages. As a result, food shortages occurred between seasons, and farmers' lives were very difficult. BoT members said that when responsibility for managing irrigation systems was transferred to farmers, there were significant improvements in water supply capacity from the Ngoila system. With the exception of Y la commune, instead of 5 ha before 1996, it has now reached 90 ha of irrigated area in the Ngoila system. Only Y la commune has experienced a reduction of irrigated agriculture as a result of land conversion from agriculture to industry and housing.

Twenty- eight farmers agreed that the IMT has assisted agriculturalists to increase their irrigated areas and indicated that there have been two kinds of agricultural expansion. First, due to improvements in the quality of the irrigation service, water is delivered to areas that could not be cultivated before. Secondly, those agricultural areas that farmers only cultivated one crop move to two or three crops now.

5.7.4 Economic Impact on Farmers

This research has found that the IMT has had a positive impact on economic performance in Ngoila in terms of increased household income and reduction of agricultural production costs.

When asked if household income had increased as a result of the IMB (WUA) management of irrigation systems overall, responses were very positive, as illustrated by Figure 5-17.

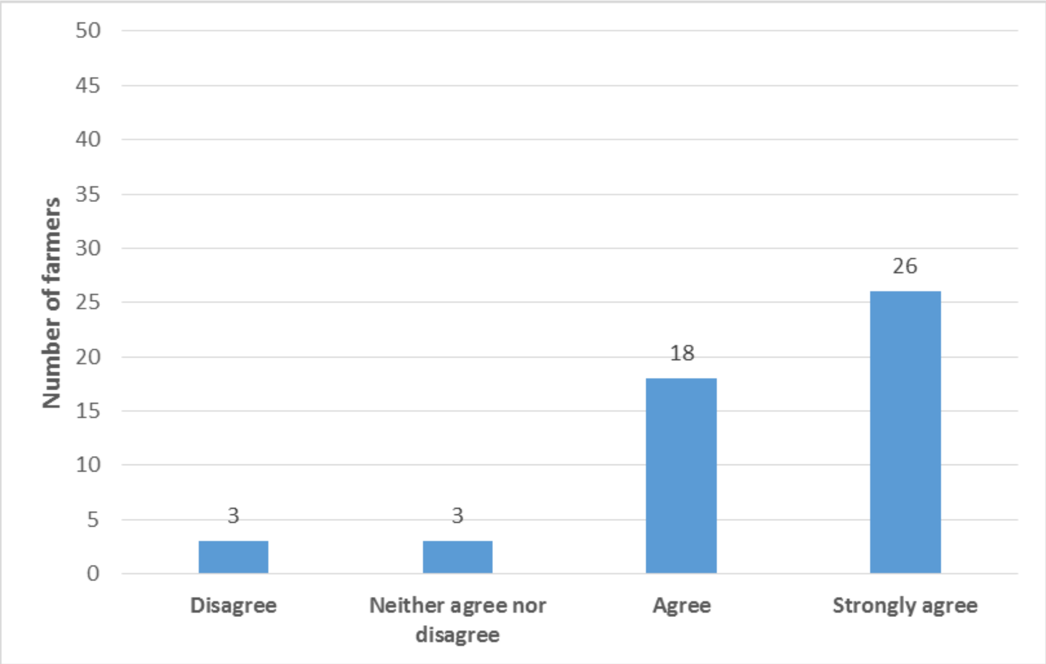

Figure 5-17: Respondent perceptions about the impact of the IMT on increasing household income

Source: Farmers' questionnaire survey 2013

The majority of respondents (n=44/50) either 'strongly agreed' or 'agreed' that their household income increased after the transfer. Details of household income were gathered in the farmers' questionnaire. The number of family members directly working on farms was also investigated. The average income/person was estimated by respondents both before and after the transfer.

The questionnaire asked farmers to explain why their income had increased. Two main themes were found. First, the rise is from an increase and diversification of agricultural production such as additional rice fields, livestock and poultry (chicken and cattle). Second, when management of irrigation systems became the responsibility of the IMB (WUA), farmers were released from working on the farm which meant they could earn money from other jobs.

5.7.5 Change to farmers' income

5.7.5.1 Increased income from agricultural production

Almost all participants (n=38/44) indicated that their household income increased because of improved agricultural productivity. Famers explained that when their farm and ponds were supplied with sufficient water they were able to gain additional income from fish and livestock.

> *Definitely, agricultural productivity currently is two or three times higher than before. Many households' income has risen due to increased cropping frequency in their field, or a change of the kinds of crop or development of livestock [Focus group, Y la AC members, Ngoila]*
>
> *We grow vegetables, and farm fish to increase our income in the remaining agricultural square. My family's agricultural income has increased from nearly 20 million VND to 30 million VND per year [Farmer, Ngoila, ID (29)].*
>
> *Generally, the Board of Ngoila creates water supply delivery in a 10 day cycle. Besides the rice field my family has water in my pond to grow fish, and increase the number of buffaloes, so we earn much money than before (Focus group, Y la AC members, Ngoila].*

5.7.5.2 Increased income from diversification to other industries/sources

Participants in the focus group discussion explained that improvements to water delivery after the IMT have introduced greater flexibility for farmers. Farmers need only be present on their farms when water is delivered to make sure that the adequate amount of water has been delivered and to ensure that their farm boundaries are well protected (watertight) to prevent wasting water. This means the amount of time farmers need to be on their farms has reduced and so families can earn money from other non-agricultural employment (n=28/44). Respondents (n= 9/44) explained that families having been freed from agricultural production had been able to open small businesses including tofu production to sell in local markets, or grocery shops. Instead of staying in their villages they were able to go to other places or cities to find new jobs in garment manufacturing or construction companies located in their area. As a result of the saving time from agricultural production, farmers also have chances to create small businesses In addition they also have chances to work for garment companies or construction projects when rice production is not in season. Nineteen households (n=19/44) said that their family members go to work in other fields because of the reduction in the need for labour on their own farms.

Reasons provided to explain this change included being given information about the water supply timetable by WUAs members and ACs.

> *It is easy for farmers to work on the farm. For example, prior to IMT, my household needed three days to prepare for cultivating including withdrawing water, and soil preparation. Now we need only one day to do all the work due to the convenience of the water delivery [Focus group, Y la AC members, Ngoila].*

> *Agricultural production now does not require so much labour as before so I am the main family member responsible for farming practice. My wife opened a small grocery shop to sell some necessary items for this commune because my house is located in the central community [Farmer, Ngoila, ID (17)]*

> *My husband is now responsible for 5 "saos' rice production. I opened a clothing shop in the local market and I sometimes help him to grow vegetables for the spring crop to sell in market [Focus group, Y la AC members, Ngoila].*

> *Not only me but also some other people in my village go to work for private construction companies in my areas. I have just come back to help my wife over the harvesting season. Due to sustainable supply of water, we also grow fish and harvest twice a year instead of one like before [Farmer, Ngoila, ID (41)]*

> *Just my wife can afford to work with the square so I go to work in the city and earn some money from construction work. I go home to help her during intensive harvesting. I think it is a much better financial situation than before. My children have the chance to go to school. [Focus group, Y la AC members, Ngoila].*

5.8 Social Effects of IMT

Numerous social benefits have been reported on the basis of the IMT. Farmers' participation in decision making; more productive meetings and leadership building; reduction of conflicts between farmers; and sharing roles between men and women are discussed below.

5.8.1 Farmer participation in irrigation management

When farmers participate in irrigation infrastructure management and decision-making the 'ownership' of irrigation systems improved. Farmers in the focus group discussion and all the interview participants explained that famers now have been given more responsibility to protect irrigation systems and to resolve water shortages.

> *According to the transfer program, farmers have a sense of ownership. Water users have a greater awareness of their responsibilities for managing and protecting the irrigation system. It means that destruction of irrigation works and unrestrained water withdraw is controlled [Focus group, Y La AC members, Ngoila]*

> *Farmers cooperate with IMB staff directly to manage the irrigation system. Farmers have a strong sense of ownership with irrigation schemes leading to lower degradation of irrigation schemes [Interview, BOT officials, Ngoila]*

Many respondents (n=23/35) said that participation had increased because farmers elected representative members to become on-farm irrigators to deliver water in their villages.

> *On-farm irrigators now represent us to implement all O&M of irrigation infrastructure. When we have any problems in terms of water supply, we directly inform on-farm irrigators and then they adjust it [Farmer, Ngoila, ID (30)].*

> *Farmers are encouraged by contributing their ideas through the water management and village meetings for every crop. They give their opinions about water management policy and the on-farm water fee [Focus group, Y La AC members, Ngoila].*

5.8.2 Leadership capability

In the Ngoila system farmers are represented on the IMB (WUA). They are elected to the Board by leaders of the four ACs who can appoint two people to sit on the IMB. The managers of ACs are elected by Congress participants who represent farmers from every village. They are allowed to take the manager position for no longer than five years. At the village level during village meetings, village leaders and on-farm irrigators are elected by farmers.

5.8.3 WUA meeting frequency and productivity productive meetings

At the village level, all farmers said that village meetings are typically organized around each crop cycle, of which there are two meetings per year. Meetings are organized by village leaders. In addition, a meeting between irrigation teams also takes place each morning and afternoon to ensure the water is delivered according to the supply schedule. Outside of the busy periods meetings occur monthly.

> *The meeting between WUA members is organised once a month, however in the water supply period we meet every morning to learn from experience and discuss the next plan [Focus group, on-farm irrigators, Ngoila].*

5.8.4 Conflict resolution

According to participants in this study, the most significant benefit the IMT has brought to Ngoila is a reduction in conflicts. Figure 5-18 shows the percentage of farmers' responses across four locations. The majority of respondents (n=38/50; 76%) thought that the IMT has helped to reduce the number of disputes between the four communes and between upstream and downstream farmers. There are a number of reasons why conflicts have subsided.

After the IMT the IMB (WUA) developed their "downstream priority" calendar. According to this calendar, downstream farmers were enabled to withdraw water first and farmers at the head of canal, last. The basis for this ordering is that at the beginning of the water delivery period the volume of water is usually high, and so is water pressure, so water is delivered faster to places furthest from the headworks. This approach appears to be working. Attitudes to water supply management show farmer satisfaction. The disputes between farmers have significantly reduced in Ngoila.

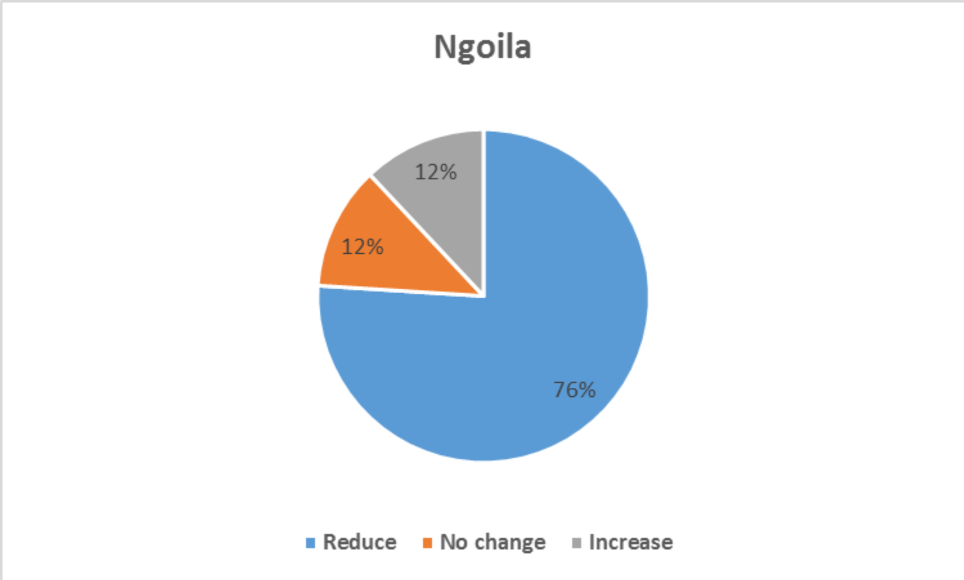

Figure 5-18: Respondent perceptions about the impact of IMT on reducing conflicts between farmers by percentage in Ngoila

Source: Farmers' questionnaire survey 2013

If WUA members are present in the field when water is delivered it means that every AC has the chance to access water. It also avoids the problem of everyone being able to withdraw water at whim.

> *Prior to the IMT there was no-one representing ACs to distribute water to communes (Y La, Trung Mon, Kim Phu, and Hung Thanh), so each commune had a representative go to the headworks and open the offtakes by themselves to deliver water to their farm. As a result, when one headwork commune was supplied adequate water to their farms they wanted to close the main offtake. The tail commune had not got sufficient water yet so they still needed to open the gate. So conflicts happened. However, when the IMB (WUA) was established, the members of the WUA took over the role of managing water delivery from headwork offtake and the other intakes along the main and secondary canals. As a result, there has been a reduction in both the number and intensity of conflicts [Focus group, Y La AC members, Ngoila].*

> *There was a significant reduction of conflicts between communes in terms of the number and intensity of conflicts. The Board of Ngoila created a water supply schedule for every commune. Communes can share water supply time when other communes need more water. [Interview, ID (2), AC members, Ngoila].*

Farmers reported the relationship between farmers within their villages is better now. They reported greater cooperation expressed through the exchange of labour. Families help each other. For example, when one farm completed cultivation but another needed more labour, families send members to neighbouring farms. Only 8% (n=4/50) of respondents said there was no change in the number of conflicts before and after the IMT. Conflicts sometime happen between communes in the secondary level.

> *At the beginning of crop season ACs and on-farm irrigators were informed about the timetable of water supply so on-farm irrigators can manage tertiary canal systems to supply water to individual farming. I could say it is much better for us now in terms of reduction of the number of conflicts and intensity of problems [Farmers, Ngoila, ID (3)].*

Four farmers in Kim Phu and Hung Thanh communes said that compared to before the IMT, the number of conflicts between farmers has significantly reduced but some tensions remain. Arguments continue between farmers in Hung Thanh and Kim Phu communes. Farmers in Kim Phu do not follow the water supply schedule, so when it is time for the Hung Thanh commune water delivery, Kim Phu farmers accessed water by piercing levees from the Hung Thanh commune.

> *Conflict between farmers has significantly reduced because on-farm irrigators help to manage water delivery, however, we still have some conflicts [Focus group discussion, Y La AC members, Ngoila]*

> *There was a remarkable reduction in the number of conflicts after IMT, however, in some shortage water cases, farmers at Kim Phu and Hung Thanh communes still have arguments and conflicts [Farmers, Ngoila, ID (49)]*

5.8.5 Roles of women

The roles women play have evolved in the Ngoila irrigation system. They play an essential role in WUA governance. Usually two, three or four WUA members are women. Respondents in this study thought that women were more effective than men in persuading and encouraging farmers to participate in irrigation systems management and to use water efficiently. Before the IMT, when the ISF was collected from farmers, women were given the task by IMC of working with farmers in order to increase the rate of ISF because they were considered patient and gentle. No longer needed in this role (as the ISF is no longer collected), women now play other important roles in distributing water between communes, collecting rubbish, and cutting grass in canals to ensure smooth water delivery.

> *Women are more patient than men in terms of encouraging farmers to participate in irrigation management. During the water delivery schedule, they present at the farm, inspect every farm and remind farmers to protect their farm borders to minimize water waste [Interview ID (2) former WUA member, Ngoila].*

> *We greatly appreciate the roles of women in our group, they not only take responsibility to deliver water, they also take part in dredging canals. They also help to solve problems such as conflicts, and outstanding water fees [Interview, ID (2), BOT member, Ngoila].*

However, farmers in all four communes also said that women did not participate in the role of on-farm irrigators because it is a very hard job and is usually conducted at night time.

> *We realise that our work is too hard for women because the Ngoila system usually supplys water in the night time, so we think it is more suitable for men than women [Group discussion, On-farm irrigators, Ngoila]*

Respondents reported that (n=37/50; 74%) women are considered to be the main decision-makers in agricultural production. A large proportion of women participate in AC meetings organised by villages.

> *In my village, women are the main labour force for agricultural production. They not only make the decisions in agricultural production but also are the main participants in agricultural meetings. The majority of men in my village go to work in other jobs [Farmers, Ngoila, ID (26)]*

> *I am the only person in my family to work on the farm. My two children are studying in Hanoi, my husband also lives and works in Hanoi and has found a job to support my children [Farmers, Ngoila, ID (47)].*

5.9 Governance arrangements for irrigation management

5.9.1 Rights, roles and responsibilities

Roles and responsibilities of WUA members have already been mentioned across many aspects of this chapter such as how WUA members and water users have been involved in water supply management, the O&M of irrigation systems.

Enthusiastic WUA members and hard working on-farm irrigators were seen in the Ngoila system. Group of farmers in each commune play an important role although they are low paid. The strong relationship between irrigation management level in term of technical and financial support was seen in Ngoila.

5.9.2 Vertical linkage/coordination/communication between tiers of government

Effective and strong vertical relationships between all irrigation managers was confirmed by six participants in both of BoT, IMB (WUA), focus groups and nearly 80% of farmers (n=40/50). The basis for this is the existence of flexible coordination between organisations that manage irrigation systems from the headwork to the end of the canal system.

Recently, the training programs have been conducted regularly, assistance has also been provided in terms of financial and technical support when ACs have needed help from BoT/IMB (WUA).

The relationship between the IMB (WUA), BoT and ACs was first developed through the delivery of financial and technical support. BoT provided the budget to pay for the operation of tertiary canals. By encouraging on-farm irrigators to stay with their jobs when their payment from the on-farm ISF was too low, extra wages or gifts were provided by the BoT at the end of the year as compensation. In terms of technical support the WUA is willing to send their technical staff to assist ACs when the offtakes or canals are broken or when natural disasters occur.

> *We usually support ACs by providing an amount of money to help ACs hiring farmers to dredge or clean canals when the need. This amount is nearly 1.800,000 VND for one village in one year. In addition, every year, we also encourage on-farm irrigators to participate in irrigation management by paying them extra money [Interview, ID (1) BOT member, Ngoila].*

> *We are usually encouraged by WUA members when we meet some difficulties in water distribution. In addition, at the end of each crop we are paid an extra amount of money from the WUA or they conduct some training program to help us improve our water management skills [Focus group discussion, on-farm irrigators, Ngoila].*

Every year if we meet any problems with major repairs of irrigation infrastructure, WUA will provide funding to do it [Interview, ID (2) AC member, Ngoila]

The manager of BoT explained that training programs for IMB (WUA) members, ACs and on-farm irrigators were important in the Ngoila system. The important components of the training programmes include: water measurement, losses, depth of water in the field, how much water is needed for a cropland unit, financial operations, accounting, auditing, maintenance, upkeep and repairs, office procedures, correspondence, impact of climate change in the source of water, innovative techniques applied in agricultural practices.

The programs not only help farmers and on-farm irrigators to enhance their technical and management skills in irrigation management, but also improve their knowledge of agricultural practices and reflected in them updating policies. In addition, members of BoT/IMB (WUA) stated that the roles of members of the WUA, AC, and on-farm irrigators have changed so it was very important to train new members to help them catch up with the new policies and to improve their skills in irrigation management.

All interviewees and focus group participants had a good appreciation of the roles of training programs in terms of improving their technical and management skills. They said that training programs were conducted frequently and had been implemented continuously since the point of transfer. Appendix 8 is one example of a training program organised by the BoT in 2013.

We think that skills of WUA members ensure water delivery and improve irrigation system efficiency. We try to conduct training programs. The local irrigation management board and on-farm irrigators need technical and management skills in order to operate irrigation system. [Interview, ID (1), BOT member, Ngoila].

I remember training programs are usually conducted once a year. The teachers are sometimes from Ministry of Agriculture and Rural Development (MARD) or some technical staff from BoT. During the training program we are introduced to the new policies and new techniques to apply in irrigation management. It is very useful for my job [Interview, ID (2) BOT member, Ngoila].

Some respondents were concerned there had been a reduction in the link between the IMB (WUA), ACs and farmers since the ISF waiver subsidy was implemented.

5.9.3 Horizontal links/coordination/communication between WUAs and between ACs

It was confirmed by two ACs interviewees that there is a good relationship between AC managers, and between the four ACs in terms of water supply co-operation.

> *Actually, sometimes we have some problems with the volume of water and we usually call WUA to request a longer water supply period or maximize the headwork offtakes. In some cases, we also call to the upstream AC such as Y La or Trung Mon commune and ask for help. They sometimes let our commune withdraw water by closing the water intake into their tertiary canals [Interview, ID (2), AC member, Ngoila].*

> *On-farm irrigators and ACs members had cooperated to manage irrigation systems, ACs also respond to our difficulties and sometimes they come and inspect all of the operation works to ensure smooth water delivery [Interview, ID (2), on-farm irrigator, Ngoila].*

5.10 Conclusion

This chapter, following the evaluation framework (Chapter 3) has presented the results of fieldwork for the Ngoila irrigation system. The results illustrate a number of benefits attributed to the IMT across the seven evaluation measures. There are also some insightful ways in which irrigation systems management might be improved in this system towards better agricultural productivity and social engagement.

Respondents in this study explained that Ngoila's Government subsidy covers O&M of headworks, main and secondary canal systems. However, revision of the highly bureaucratic accounting and payment process is warranted to speed up the payment of the subsidy to the IMB.

On the other hand, there are reported funding shortfalls to maintain tertiary canals attributed to the insufficient pricing of the on-farm ISF.

Better communication between the government and farmers may assist in an improved recovery of farmer debts. Misunderstanding about what the subsidy actually covers has led to an acute problem in Kim Phu commune where farmers are refusing to pay their on-farm ISF. The consequences of failing to remedy this misunderstanding will result in the ongoing degradation of on-farm irrigation infrastructure and the potential collapse of the important roles played by on-farm irrigators due to low salaries.

Significant improvements to water supply management were reported in Ngoila. The majority of irrigation systems have been concreted which minimises water loss and reduces time for water delivery. Farmers have been taught to save water. IMB (WUA) members and on-farm irrigators have taken their responsibilities seriously; they have developed supply schedules and implemented them by having a field presence, and by regularly checking and maintaining infrastructure. All of these things have improved supply.

There are some aspects that could be improved to further enhance Ngoila's water supply system. Farmers could be more strongly encouraged to be present on their farms when water arrives to avoid water loss and a more efficient delivery system. This is especially so given the outcome of the Land Law effects of narrowed farm borders. Attention should be brought to high level authorities (e.g IMB, BoT) in regard to the actions of AC favouring certain farmers over others and disregarding the supply schedule.

Ngoila has benefitted considerably from the conversion of its primary and secondary canals to concrete as part of the IMT process. Ngoila's financial assistance (described above) has resulted in well-repaired and maintained canals. Tertiary canal O&M requires some reconsideration. A persistent problem of waste management (agricultural, household and construction) will require attention in the future.

The original intent of the IMT to improve agricultural productivity has proven to be effective in Ngoila. The impact of IMT on both agricultural productivity and on household income and livelihoods has been positive in Ngoila. Across three measures: crop yield, crop frequency and crop diversity respondents reported improvement after IMT, as well as an expansion of irrigated agricultural land. Other sources revenue possible from the released from agricultural production were also explained.

There was a positive improvement of the social effects of IMT, groups of farmers play an important role to directly assist famers to operate and manage tertiary canals systems and deliver water to their farm. They were elected by farmers in agricultural meetings. Moreover, the meetings between farmers and leaders of villages and ACs, and irrigators were organized often. Moreover, the number of disputes between communes and between farmers has reduced after IMT. The role of women taking part in irrigation infrastructure from the initial IMT also was seen is positive impact on improving efficiency of irrigation systems.

There is a significant reduction in the number of conflict between four communes and disputes between farmers at the head and the tail of canals within communes due to the establishment of WUA who represented four communes to fairly distribute water to all. Their control of the water supply is based on a rotational plan which minimizes the effects of unordered water access between communes.

There is strong and flexible co-operation with both vertical (between the BOT/IMB WUA/ACs) and horizontal linkages between the four ACs in irrigation management. The vertical linkages are shown through the support from the IMB (WUA) and the BOT to the ACs and on-farm irrigators. Besides financial and technical support, they regularly provide training programs and help to improve management and technical skills of on-farm irrigators and farmers. Conversely, reports from farmers through on-farm irrigators and AC managers to the WUA/BOT are essential to help solve water management problems. In terms of horizontal linkages, the ACs co-operation by sharing the work load during water delivery is important.

Chapter 6 IRRIGATION MANAGEMENT TRANSFER IN GIA XUYEN SYSTEM

The Gia Xuyen Irrigation System is located in the Hai Duong Province in the Red River Delta Region of Vietnam. It was one of the earliest to go through IMT in the region and is representative of a typical irrigation pumping station in that region (See 4.9). IMT took place in Gia Xuyen in 2002.

This chapter is divided into two main parts. The first part, **Section 6.1** and **Section 6.2** present the roles of irrigated agricultural production of Gia Xuyen commune and Gia Loc district to the Hai Duong province, and outlines the geography and governance of the of Gia Xuyen's irrigation system. **Section 6.3** onwards presents the results of this study in regard to the evaluation of the impacts of IMT in Gia Xuyen. As such this chapter responds to several of the original objectives. The chapter will examine the current status and perceived efficiency of O&M of Gia Xuyen's irrigation system, it will present the perceptions of water users regarding the effectiveness of ongoing management and the effectiveness of irrigation systems and present farmers' perceptions in relation to the transfer of irrigation management responsibility in Gia Xuyen. The chapter concludes with an overview of the barriers to effective irrigation management in Gia Xuyen.

6.1 Geographical location Gia Xuyen Irrigation System

Gia Xuyen is only one part of a larger irrigation system. Gia Xuyen is one of 22 communes belonging to the Gia Loc district located in the South-West of Hai Duong province, as presented in the Figure 6-1. Water to the Gia Xuyen irrigation system is supplied by the Gia Loc subsidiary of the Hai Duong Irrigation Management Company. The Gia Loc subsidiary is one of 11 subsidiaries located in districts of the Hai Duong IMC.

The headwork and main canal lie outside the Gia Xuyen commune. The headwork that supplies the Gia Xuyen irrigation system is the Quan Phan pumping station (Figure 6-2). Water is pumped from the Thach Khoi Doan Thuong river and conveyed through two irrigation canals: the Dong Trang and Doan Thuong secondary canals to supply water to the field in Gia Xuyen commune. In the Gia Xuyen commune there are 446m of secondary canals, and nearly 6 km of tertiary canal systems. Water is pumped from the river to the system via the Quan Phan pumping station but an additional seven small pumping stations take water from other smaller rivers. Within the Gia Xuyen commune three villages which receive water from its irrigation system: Tranh Dau, Tang Ha, and Dong Bao.

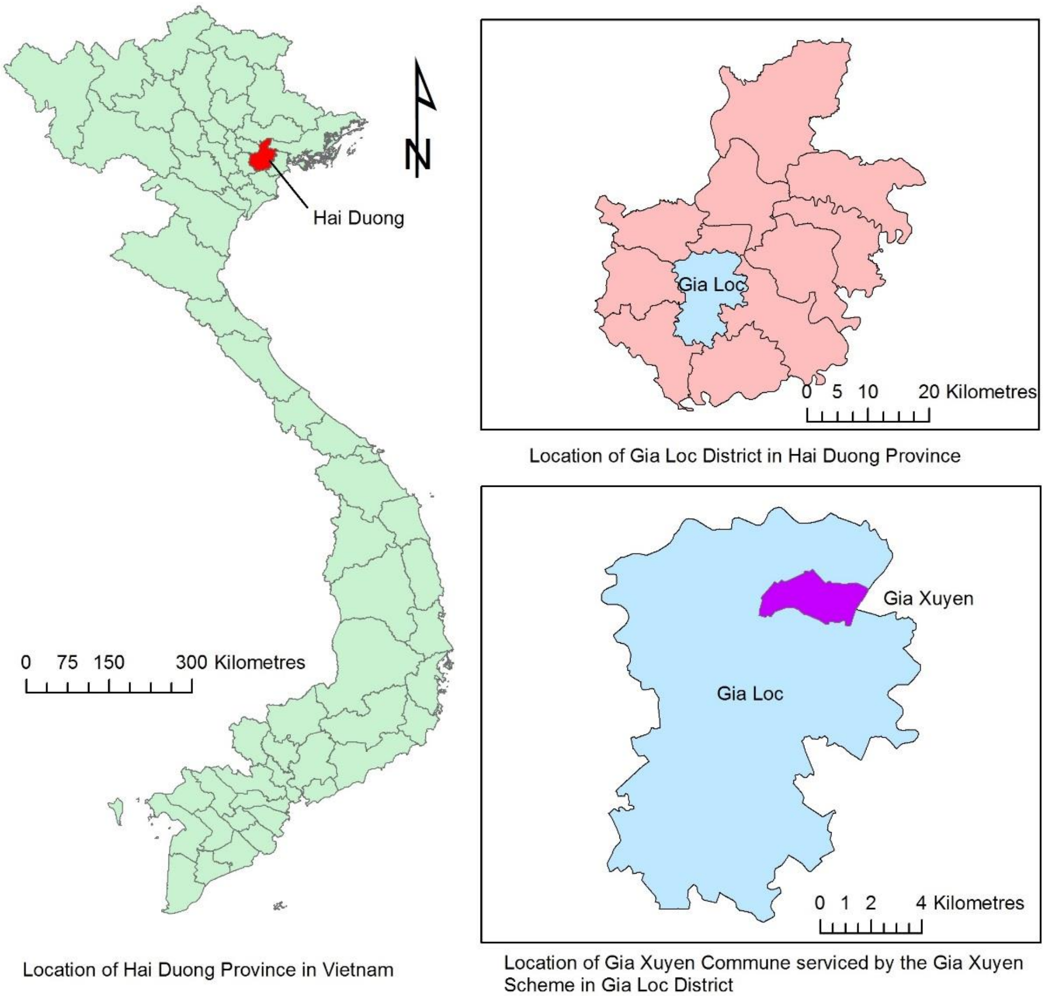

Figure 6-1: Location maps of Hai Duong Province, the Gia Xuyen irrigation system

Source: Created for this study

Figure 6-2: Quan Phan pumping station: Headwork of Gia Xuyen system

Source: Created for this study

When irrigation systems were transferred in Gia Xuyen, almost all the canal systems were concreted with the support from JICA.

Gia Xuyen's irrigation system irrigates three communes including Tranh Dau (head of the system), Tang Ha (middle of the system), and Dong Bao (tail of the system). Its irrigation capacity supplies 290 ha of agricultural land including 2,620 households, 209 ha of rice fields, 45 ha of aquaculture, water melons, and cabbages, and 16 ha of peach tree flowers. The detail of areas supplied is presented in Table 6-1.

Gia Xuyen has the advantage of being in a favourable location (100km from the Hanoi capital). It lies on the main road connecting large provinces such as Hai Phong and Quang Ninh. Furthermore, Gia Xuyen possesses highly fertile soil suitable for growing perishable vegetables and flowers (peach tree and other kinds of flowers such as roses, and daisies) (See figure 6-3) that are easily are exported to neighbouring provinces.

Table 6-1: Water supply by Gia Xuyen irrigation system

Irrigation system	Commune	Area (ha)	Number of households	Location
Gia Xuyen irrigation system	Tranh Dau	84	996	Head
	Tang Ha	67	620	Middle
	Dong Bao	136	1.004	Tail
Total		**290**	**2,620**	

Source: Focus group discussionwith WUA members 18 Dec 2013

Figure 6-3: Cabbages and peach tree, and rice crops in Gia Xuyen

Source: Fieldtrip observation 2013

Rice crops are grown from the beginning of January to the end of May. Water melons are cultivated in June and July. Peach flowers and cabbages are grown from August to the end of December.

In Gia Xuyen, vegetable and agricultural production in the spring season is three or four times more valuable than rice. Flowers and vegetables are an important source of income for farmers. It is estimated that farmers can earn from USD$10,000 to $12,000/ha/year from cultivating vegetables and peach trees (Thuan, 2014).

According to the Hai Duong Social and Economic Report from 2006 to 2010 (HaiDuong, 2010), agricultural production in the Gia Loc district, of which Gia Xuyen is part, plays an important role in Hai Duong province by consistently producing the highest agricultural output in Vietnam. Gia Loc performs significantly better than the other eleven districts in the Province.

6.2 Gia Xuyen Irrigation System Management

The IMT in Gia Xuyen IMT took place in 2002.

6.2.1 Background

There is very little documentation available about Gia Xuyen and its irrigation management prior to 2002. According to interviews with the Gai Loc IMC there were two reasons prompting IMT. Gia Xuyen was one of the highest agricultural producers in the province and both AC members and farmers in the commune have had a long history of participation in irrigation management.

Figure 6.4 provides an overview of irrigation management for Hai Duong Province, the Gia Loc District, (within which Gia Xuyen is situated), in Hai Duong Province. As Gia Xuyen is a part of a larger irrigation system authority for its management lies at the district level, with the Gia Loc IMC. The main entities engaged in the management of the Gia Xuyen irrigation system, along with their roles and responsibilities are described in full below.

6.2.2 Gia Loc subsidiary Irrigation Management Company (Gia Loc IMC)

Gia Loc IMC is a stated-owned entity with the main responsibility for irrigation management in the district. This IMC is based on commune boundaries. Gia Loc subsidiary IMC includes a directorate board—a director and a deputy director, appointed by the PPC based on the Provincial DARD’s recommendation. The IMC has five departments (Administration, Finance, Planning, Technical Management and Irrigation System Repair) and nearly 150 staff. Gia Loc IMC manages six pumping stations. There are from four to six staff in each department and around 20 irrigators undertaking O&M for one pumping station. The Gia Xuyen irrigation system is supplied by the Quan Phan pumping station. There are two permanent IMC staff responsible for managing and delivering water to the Gia Xuyen irrigation system as shown in figure 6-4.

Gia Loc is the subsidiary of the Hai Duong IMC which performs O&M for the whole irrigation systems in the district. The four main responsibilities of the Gia Loc subsidiary IMC are to:

- Manage the headwork, the main canals, the Quan Phan pumping station, and secondary canals;
- Develop an O&M plan, and to implement the plan and undertake major repairs in the Gia Loc district;
- Develop the water supply schedule between the Gia Loc subsidiary IMC and the many ACs;
- Accept and approve the water supply contracts with WUAs and ACs.

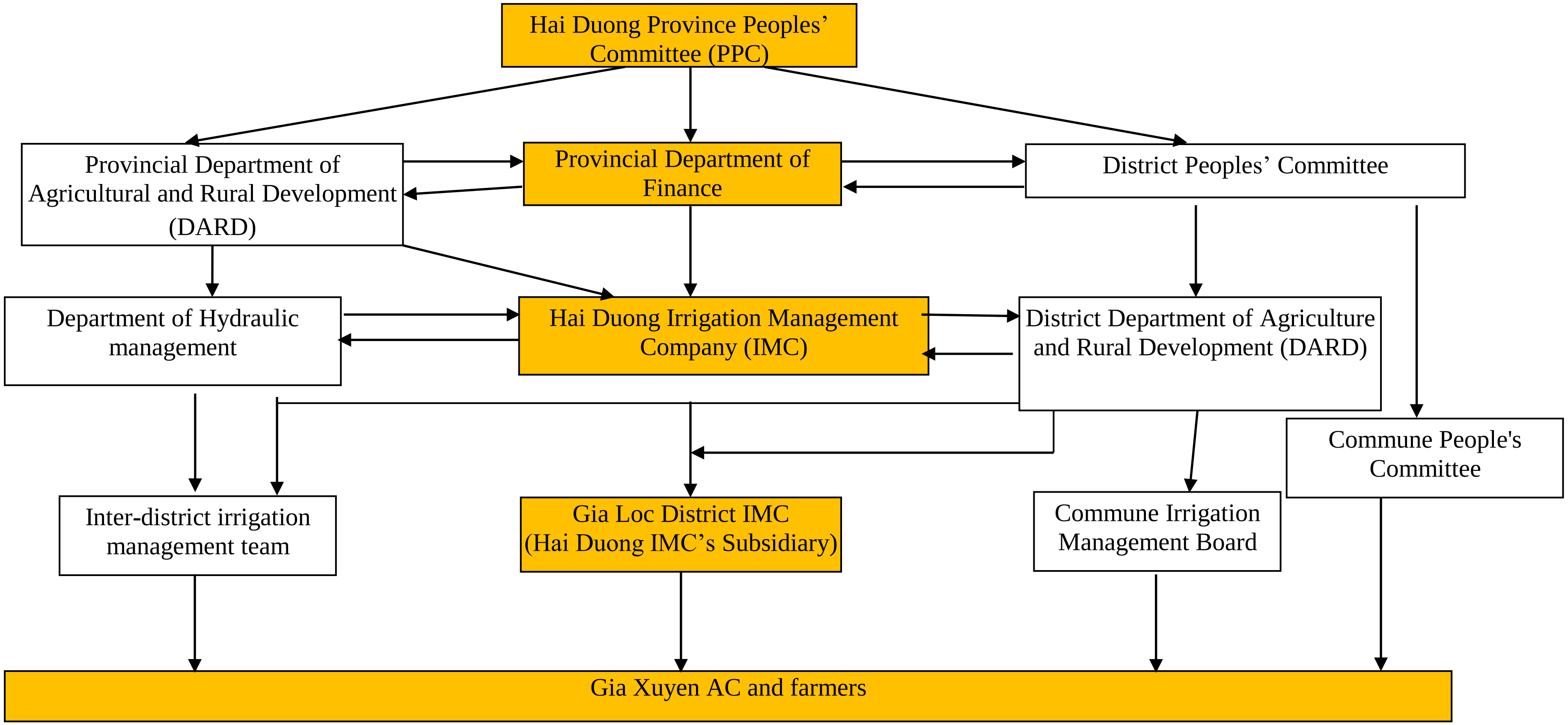

Figure 6-4: Governance of Irrigation System Management in Hai Duong Province

Coloured box refers to Gia Xuyen system

6.2.3 Gia Xuyen Agricultural Cooperative (AC) (WUA)

Gia Xuyen's local WUA is an AC responsible for managing the tertiary canal systems. The Gia Xuyen AC management board consists of a head, deputy head and heads of the services elected by farmers through the general assembly, and hold positions for two years. The deputy head ensures the functioning of the irrigation team located in each village. These villages are in turn in contact with the Gia Loc subsidiary IMC that signs water supply contracts each season. In the whole of the Gia Xuyen commune there are 6 to 12 irrigators who are responsible for the O&M of 8 pumping stations and the tertiary canal systems. The AC is based on commune boundaries as presented in the figure 6-5

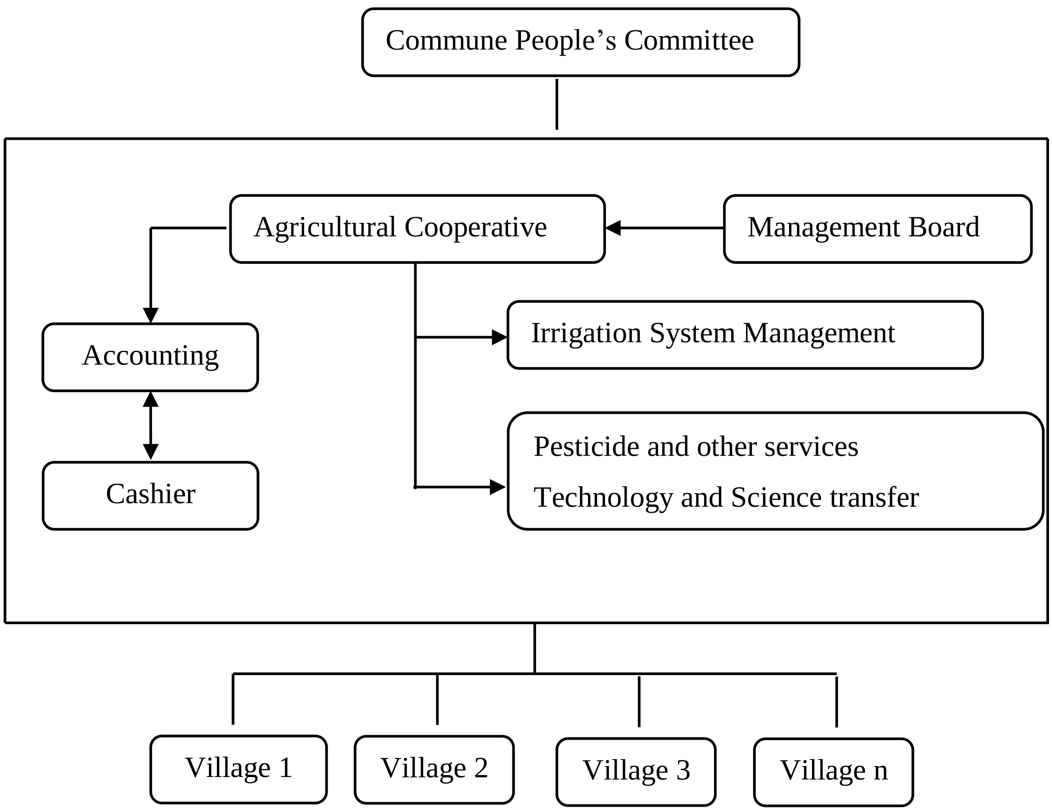

Figure 6-5: Gia Xuyen AC management

Source: Created for this study

Seven pumping stations are under management of the AC (WUA), while on-farm irrigators are responsible for managing the tertiary canal systems. The perspective of WUA members, on-farm irrigators and farmers were investigated in order to find the impact of the IMT and the main constrains to improvement.

6.2.4 On-farm irrigators

On-farm irrigators are farmers responsible for O&M of the on-farm irrigation systems (i.e. the tertiary canals). They are appointed by peers from every village in a commune. On-farm irrigators work in teams.

There are three villages in the Gia Xuyen system. Each village appoints or elects one or two farmers to join the team of on-farm irrigators in an AC. So in Gia Xuyen there are from 3 to six on-farm irrigators in each AC.

The main responsibilities of on-farm irrigators are to manage water allocation and distribution to different parts of the irrigation system (from the end of secondary to individual farms). The AC cropping calendar water allocation schedule is followed closely by irrigation teams. On-farm irrigators operate and maintain the tertiary canal systems which include cutting grass and removing silt and domestic and agricultural rubbish obstructing and blocking water flow in the canals.

6.2.5 Government subsidies

Prior to 2008, funds for the O&M of irrigation systems were generated through farmer contributions called ISFs. After 2008 the Vietnamese Government subsidised farmers through an ISF waiver; the subsidy is determined by the area of agricultural land under irrigation and type of irrigation system (i.e. gravity-fed or pumped). The Government funds are to assist with the O&M of headworks to end of secondary canals across Vietnam. The subsidy is delivered to province level finance departments. It is at the provincial level that decisions are made as to how the subsidy will be dispersed between provincial level and lower level irrigation management entities.

For the AC (WUA) to receive the government (MARD) subsidy at least three steps are followed:

Step 1: Giaxuyen AC (WUA) submits to the district Department of Finance a report that identifies the total areas that were irrigated in the previous financial year in order to receive a fee waiver. This Department examines the IMB report and decides if the information provided by the IMB is correct;

Step 2: The district Department of Finance forwards the report to the provincial Department of Finance which makes its assessment and subsequently forwards it onto the national Ministry of Finance;

Step 3: The national Ministry of Finance decides the amount it will provide in subsidies (and hence providing a fee waiver for farmers). MARD's subsidy is sent to the Provincial Department of Finance, which then sends the funds onto the Hai Duong IMC, which then sends funds to the Gia Loc subsidiary IMC, which then distributes funds to AC (WUA).

In Hai Duong the PPC supplied a decree in 2013: Decree No 25/2013/QD-UBNN titled: "The proportion sharing of Irrigation Service Fee in Hai Duong province". The decree dictates how the Government's (MARD's) subsidy will be shared between the district Gia Loc IMC and the commune, Gia Xuyen's AC (WUA). According to this decree, the distribution of funds between the IMC and the AC (WUA) were decided according to 'typical' irrigation systems.

Hai Duong's Decree 25 dictates that the Government subsidy will be split equally between the Gia Loc subsidiary IMC and the Gia Xuyen AC. These management entities receive 50% each of their share of the Government (MARD) subsidy. This subsidy is to cover O&M of the headwork the Quan Phan pumping station and secondary canals to the beginning of the tertiary canals including Gia Xuyen. Gia Xuyen's AC (WUA) has seven pumping stations that help deliver water to its on-farm canal systems.

6.2.6 ISF collection—on-farm irrigation fee collection

Farmers in Gia Xuyen pay an ISF to cover the costs of on-farm irrigators working on the tertiary canals. The cost of the on-farm ISF is independently decided by village leaders and farmers in each village. The amount to be paid is based on distance from canals and difficulty in accessing water supply. The ISF therefore varies between villages. Those closest to the beginning of the secondary canal pay least. The on-farm ISF is collected in two steps: (1) ACs give an updated list of farmers receiving a water supply, then (2) the AC ISF bills are distributed promptly to each of farmer. This bill itemises agricultural costs, including water. Table 6-2 shows that farmers in

Tang Ha and Dong Bao villages paid a similar amount whereas farmers in the Tranh Dau village paid only half that paid by the two other villages.

Table 6-2: On-farm ISF in Gia Xuyen commune, 2012

Irrigation system	Communes	Water service fee (VND/360m^2/crop)
Giaxuyen	Tranh Dau	25.000
	Tang Ha	50.000
	Dong Bao	60.000

Source: Farmers' questionnaire survey 2013

6.3 Results—Analysis of Irrigation Management Transfer in Gia Xuyen

The section describes the results from interviews with one IMC staff, two on-farm irrigators, a group of three WUA members from the Gia Xuyen system and 50 farmers from three villages who completed the questionnaire. Twenty-seven women and 23 men participated. The education levels, ranges of age and the positions of the households is presented in the table 6-3.

Table 6-3: Demographic information about participants

Age (In Years)	N	Education	N	Canal locations	N	Incomme	N
21-30	5	Primary	8	Upstream	19	Low	7
31-40	16	Secondary	27	Middle	12	Middle	24
41-50	14	High school	12	Downstream	19	High	19
51-60	9	Tertiary	3				
61+	4						
Total	**50**		**50**		**50**		**50**

There was an average of four family members and each family had nearly three people working on their farms.

Following the evaluation framework (see the methodology chapter) seven categories were used to evaluate IMT in Gia Xuyen. They include: financial arrangement, water supply management, maintenance of irrigation facilities, agricultural benefits, economic impacts on farmers, social effects, and governance aspects of IMT. They are discussed in turn in the following sections.

6.4 Financial Arrangements for irrigation system management

6.4.1 Allocation of government subsidies

Gia Xuyen's AC receives 50% of the ISF waiver subsidy from the Government based on the total agricultural areas under irrigation. This subsidy is the main source of funding for O&M of the secondary and tertiary canal systems. The remaining 50% of the subsidy is kept by the Gia Loc subsidiary IMC to undertake O&M of the headwork and the Quan Phan pumping station.

6.4.2 Financial management

Respondents in this study (IMC staff, all three WUA members in the group discussion and the on-farm irrigators) raised concerns about financial shortages for irrigation management in Giaxuyen resulting from an unfair share of the Government subsidy. Funding shortages negatively affected both AC (WUA) member's salaries and irrigation system performance.

IMC staff complained that the increase in the Government subsidy (as described in Chapter 4) has not keep pace with inflation and this is leading to insufficient resources for the company to fulfil its O&M duties for their irrigation systems. There has been a significant increase in the cost of construction materials and labour costs. Financial Policies last only 2-5 years and change, but prices increase over that time resulting in financial shortages and pressure on the IMC to perform its duties.

> *Even though our company has implemented and applied the current ISF waiver policy, funding amounts have increased to meet the inflation rate. The cost of construction materials and labour costs, have led to many difficulties for our company in recent years in terms of upgrading and concreting canal systems [Interview, ID (1), IMC staff, Gia Xuyen].*

6.4.2.1 Unfair financial allocation

This research has found that respondents perceived the PPC's decree is unfair in its distribution of the Government (MARD) subsidy between the subsidiary IMC and Gia Xuyen's AC. This problem was identified by three WUA members in the focus group discussion. They emphasised that they directly manage and operate seven pumping stations in Gia Xuyen commune; they also have to invest in their labour force, pay for electricity and materials needed for reparation work just as the IMC does (for one pumping station), but the AC receives only half of the Government subsidy. The perception is that the subsidiary IMC only supplies water, and yet in 2012 they received 1.146 10^3 VND/ ha while the AC (WUA) was subsidised only 670. 10^3 VND/ha. For this reason respondents thought that the PPC determined allocation of the Government budget is unfair. This allocation of funding does not match the different needs nor the effort expended.

> *We are operating and managing seven pumping stations while Gia Loc IMC only provide the water source. However, we received only 50% of the ISF waiver. It is unfair distribution as we are responsible for managing irrigation systems [Focus Group, WUA members, Gia Xuyen].*

When this matter of funding allocation was discussed with the IMC manager, he confirmed that his company closely follows the current provincial policy (Decree 25). In addition, he said that the distribution of funds between his company and Gia Xuyen AC (WUA) is fair because compared to other provinces the Gia Xuyen AC (WUA) gets a higher ratio of funds than other WUAs.

> *Due to Decree 67 from the National Government which is applied in many provinces, all the ISF exemption is subsidised for IMC and not for WUAs. Farmers have to pay for managing irrigation systems in their communes, Provincial Governments have tried to improve the commune- irrigation efficiency by issuing Decree 25. According to this regulation Gia Xuyen WUA is supported 50%. This decree has already showed support from the province [give name] for AC irrigation management [Interview, ID (1), IMC staff, Gia Xuyen].*

According to respondents the outcome of this unfair financial distribution between the IMC and the AC (WUA), there is a limited amount of money available to pay the salaries of WUA members and on-farm irrigators. Except for the leader of the AC, three other WUA members are paid less than the basic salary regulated by the Vietnamese Government (Decree66/2013/NĐ-CP dated 27/06/2013). Table 6-3 illustrates the income of WUA members.

Table 6-4: Monthly WUA member's salary

No	Position	Gia Xuyen (10^3VND/month)	Minimum salary (10^3VND/month)
1	Leader of WUA	1.450	1.150
2	Vice leader	1.000	
3	Technical staff	800	
4	Accountant	700	

Source: Focus Group discussion with Gia Xuyen WUA members in 2013

6.4.3 ISF collection—on-farm irrigation fee collection

6.4.3.1 On-farm irrigator's wages

Interviewees and focus group participants thought payment for the on-farm irrigators was too low. Most on-farm irrigators are enthusiastic, motivated, hard-working and patient and have tried to help farmers in their villages. They have continued to work for below-standard wages. Participants in this study explained that on-farm irrigators work at night and that this is a difficult job. They work at night because the Gia Loc IMC tries to reduce the cost of electricity consumption by pumping water at night.

> *Our salaries are paid entirely from the on-farm ISF, collected from farmers— 7.000 vnd/sao/crop. Gia Xuyen WUA also supports me 1.000 vnd/sao/crop, so in total I receive 500.000 vnd/month [Interview, ID (2), on-farm irrigator, Gia Xuyen]*

> *On-farm irrigators need to be enthusiastic, they have to work hard to meet the requirement of water supply from farmers with limited water supply time due to the minimised electricity consumption from Gia Loc IMC. In reality, they are paid less due to low on-farm ISF collected from farmers [Focus Group ID (1), WUA member, Gia Xuyen].*

The leader of Tang Ha village and eight farmers in the village also confirmed that their on-farm irrigators have worked very hard, and that they usually have to work under unfavourable conditions including hot and cold weather or at night. In one village, the difficulties faced by on-farm irrigators are well-understood. So, for each crop villages have been prepared to pay an extra 1.5 million to 2 million VND for each irrigator in addition to their salary paid from the ISF. However, one on-farm irrigator in the same village resigned in 2013 due to the low income.

> *On-farm irrigators have to work very hard with high responsibilities but they are not paid much money. Some of them do not want to work so we*

have to encourage them to work and so give extra money [Interview, ID (1), Leader of Tang Ha Village, Gia Xuyen].

On-farm irrigators are very patient and enthusiastic; they not only wait to deliver water to every farm but also solve conflicts and the problem of water thieves from headwork farmers. But they are paid less compared to their effort spent [Farmers, Gia Xuyen, ID (45)].

6.5 Water Supply Management

One of the objectives of this thesis was to investigate whether the IMT resulted in an improvement in the quality of irrigation supply service. Following the evaluation, framework water supply management performance is assessed following three indicators: (1) timeliness of water distribution, (2) adequacy of water supply and (3) equity of water supply. Figures 6-6 and 6-7 illustrate the farmers' satisfaction in regard to water supply management in the Giaxuyen system before and after IMT.

Figure 6-6 shows the perceptions of respondents in regard to their satisfaction with water management before the IMT. Nearly 43% of respondents were dissatisfied across all three measures (timeliness, adequacy, and equity). Figure 6-7 shows that almost 70% of respondents were either satisfied or very satisfied across the three measures after the IMT. Table 6-5 and 6-6 provide an overview of attributes of respondants rating satisafaction regarding water supply management.

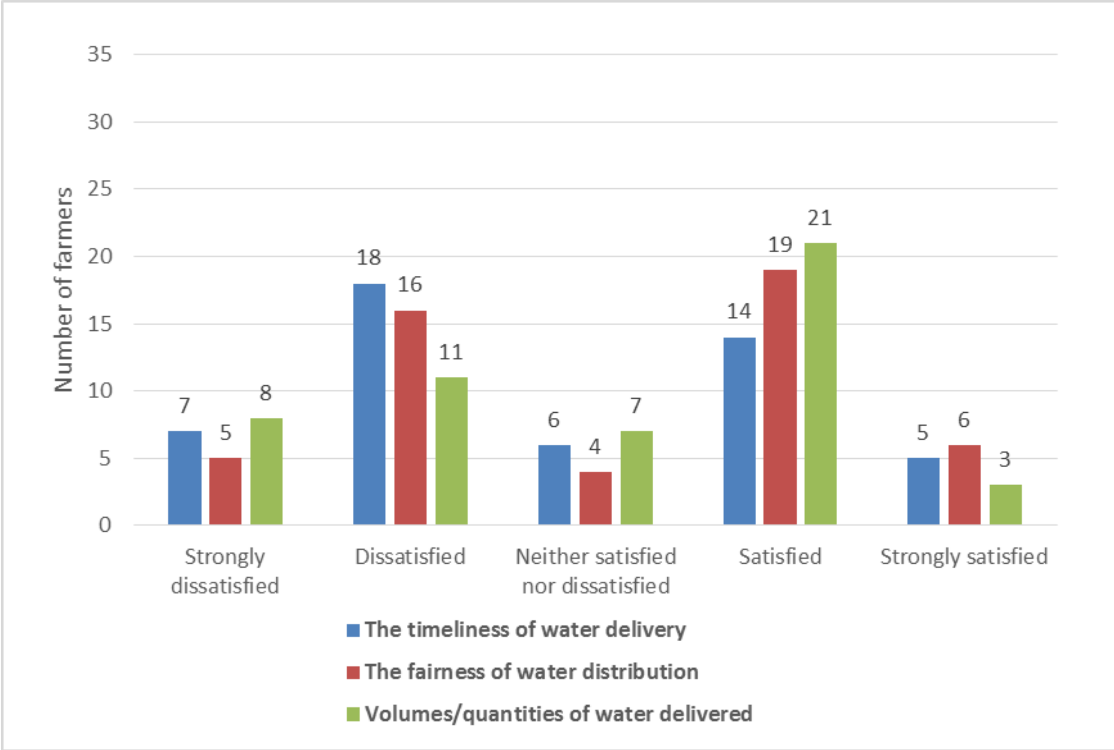

Figure 6-6: Farmer's perceptions about water supply management before IMT

Source: Farmers' questionnaire survey 2013

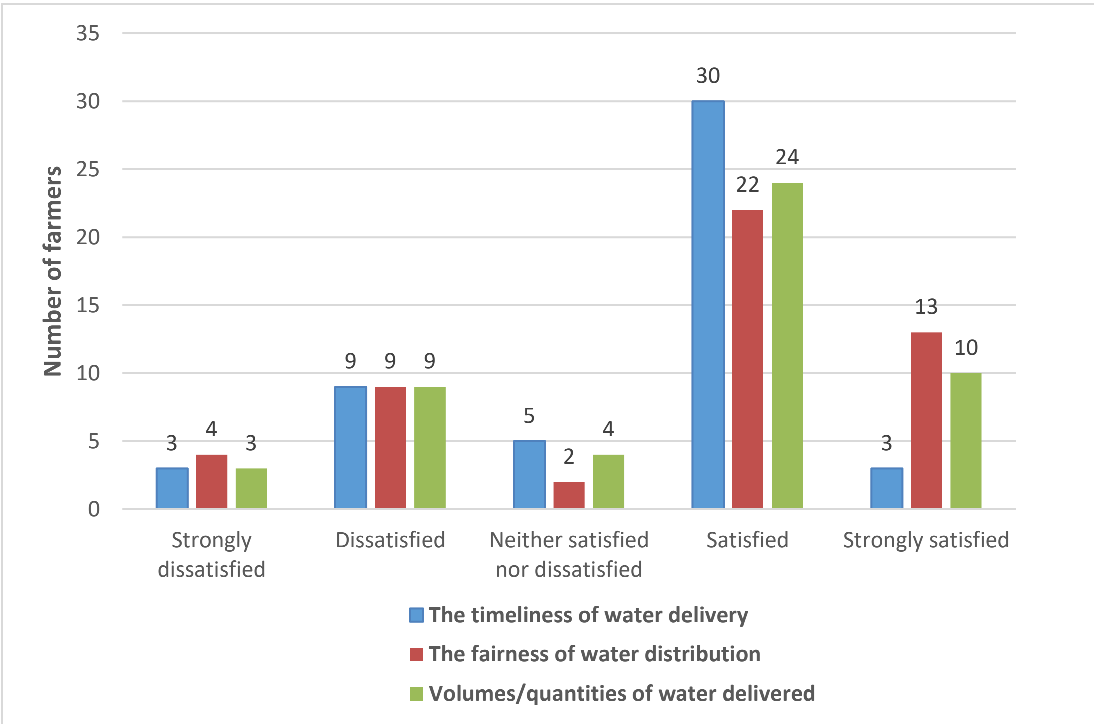

Figure 6-7: Farmer's perceptions about water supply management after IMT

Source: Farmers' questionnaire survey 2013

Table 6-5: Attributes of respondants rating satisafaction regarding water supply management before the IMT

Indicators	Farmer's satisfaction	Number of farmers	Gender		Canals Location		
			Women	Men	Head	Middle	Tail
The timeliness of water delivery	Strongly dissatisfied and disatisfied	25	10	15	4	8	13
	Nether dissatisfied nor satisfied	6	4	2	2	3	1
	Strongly satisfied and satisfied	19	7	12	14	1	4
The fairness of water distribution	Strongly dissatisfied and disatisfied	21	10	11	2	7	12
	Nether dissatisfied nor satisfied	4	1	3	1	1	2
	Strongly satisfied and satisfied	25	13	12	17	2	6
Volume of water deliver	Strongly dissatisfied and disatisfied	19	9	10	2	6	11
	Nether dissatisfied nor satisfied	7	5	2	2	3	2
	Strongly satisfied and satisfied	24	12	12	16	2	6

Table 6-6: Attributes of respondants rating satisafaction regarding water supply management after the IMT

Indicators	Farmer's satisfaction	Number of farmers	Gender		Canals Location			Household Income		
			Women	Men	Head	Middle	Tail	Low	Medium	High
The timeliness of water delivery	Strongly dissatisfied and disatisfied	12	6	6	0	1	11	1	7	4
	Nether dissatisfied nor satisfied	5	2	3	2	1	1	1	4	
	Strongly satisfied and satisfied	33	15	18	17	11	5	5	14	14
The fairness of water distribution	Strongly dissatisfied and disatisfied	13	5	8	0	2	11	2	7	4
	Nether dissatisfied nor satisfied	2	2		2				2	
	Strongly satisfied and satisfied	35	16	19	17	12	6	6	14	15
Volume of water deliver	Strongly dissatisfied and disatisfied	12	5	7	2	1	9	1	5	6
	Nether dissatisfied nor satisfied	4	3	1	1	2	1		2	2
	Strongly satisfied and satisfied	34	17	17	14	10	10	7	17	10

Overall, in terms of water supply management, education, gender, and household income did not affect respondents' satisfaction. Table 6.6 shows the most important variable influencing satisfaction was the location of the respondent's farm along the canal. The majority of dissatisfied farmers were situated at the tail of the canals, with the exception of two farmers situated at the head. The following sections present more detail information about farmer's perceptions about water supply management.

6.5.1 Timeliness of water distribution

Just over two-thirds of farmers were satisfied with the timeliness of water supply since the transfer. Of all the measures (timeliness, quantity and fairness) the biggest improvement perceived by farmers in this study as a result of the transfer was timeliness. Thirty-three respondents indicated that they were satisfied or strongly satisfied with the timeliness of water supply compared to nineteen farmers who were not.

The reasons of this change in satisfaction were investigated. There were three main reasons identified: (1) support from projects, (2) improvement of farmer's knowledge, and (3) enhanced responsibilities of on-farm irrigators and WUA members.

Respondents indicated that when irrigation systems were transferred to farmers, with the support from JICA, the secondary canals were concreted and seven earthen water offtakes were replaced by concrete ones. The majority of canal sections were upgraded using bricks or concrete. As a result, there has been a considerable reduction of water seepage and waste. Prior to this, water was delivered through earthen canals, with high permeability, and many broken canals were only temporarily filled so farmers in Tang Ha village (at the tail of canals) had to wait for three days for their supply. Now it takes only one or two days for water to reach the village. Previously canals were deeper. It was hard to get water by gravity from the deep canals. Farmers had to use rope buckets to deliver water from canals to their farm (Figure 6-8). This effort delayed water supply to their farms.

Figure 6-8: Water delivery from canal to farm by rope bucket

Source: Adapted from website (Nong Thon Ngay Nay, 2012)

> *After transfer is better than before. You can imagine that almost all the systems are earthen, with many offtakes from headwork to my place and high permeability. It took so long to deliver water to our village, especially in droughts. A lot of water was lost during delivery time so it was really hard to get water reliably for cultivating [Farmer, Gia Xuyen, ID (50)].*

Seventy-two percent of farmers explained that before the transfer, on-farm canals were often blocked either by grass or from dumped agricultural waste (unsold agricultural production) (n=24/33). Just under half of respondents said that water ran freely from their farms due to unprotected farm borders (n=15/33).

Prior to the IMT these problems would have been solved by individual farmers, who, if they wanted to access water would have to clean the canals by themselves. After the IMT, on-farm irrigators work closely with farmers and regularly inspect the canals, especially during the water-supply schedule to ensure timeliness of delivery to individual farms. In addition, farmers also indicated that before the IMT in every water-supply period, farmers were usually informed of the water-supply schedule through a local radio announcement. Now on-farm irrigators sometimes visit individual households to remind them to be present at their farms and to protect their farming borders.

> *The advantage of IMT is the convenience of taking water. Water delivery is quicker than before. Although we were informed the time the water supply would arrive to our farm it usually came late [Farmer, Gia Xuyen, ID (21)].*

6.5.2 Equity of water supply

Nearly two-thirds (n=35/50) of the farmers perceived there to have been an improvement in the fairness of water supply. Larger volumes of water and enhancement of WUA members and on-farm irrigator's responsibilities are two main reasons for the improvement.

Prior to the IMT farmers' uttered this: "Manh ai nguoi ay lay"; [this sentence was repeated seven times in the farmers' questionnaires]. It means anyone could withdraw water at any time during the water delivery period, even when it was not their turn. Farmer's rights to access water are now ensured by WUA members and on-farm irrigators. Irrigators are frequently present in the canals during water delivery, and encourage farmers to follow the water delivery timetable. In addition, on-farm irrigators also remind farmers to protect their farm borders to save water for downstream farmers. Over half of respondents (n=12/21; 57%) said that water shortages happened prior to the IMT. Upstream farmers usually over-withdrew water leading to difficulties for downstream farmers to access water. The experience has been more water available in the canals due to the improvement of canal infrastructure and improved timeliness of supply (resulting from effective co-operation between the Gia Loc subsidiary IMC and the Gia Xuyen AC (WUA). This has created more opportunities for the two downstream villages include Tang Ha and Dong Bao to access water.

Improvement of fairness of water supply was confirmed by WUA members and on-farm irrigators. Gia Xuyen AC (WUA) members were responsible to make contact with Gia Loc subsidiary IMC to make detailed schedules for water supply. In addition, respondents explained that "flexible" water delivery was developed, depending on the season. For example, for the summer crop, downstream farmers furthest from the pumping station took the first turn to withdraw water. In the spring season downstream farmers received their water later.

Besides the improvement of water supply, we created the flexible water schedule in keeping with crop cycles and depending on water availability, but usually upstream farmers were supplied first and then farmers at the tail of canals [Focus group, WUA members, Gia Xuyen]

We are located at the head of canals so we usually assess water first and then farmers in the tail of canals. Compared to before the IMT, on-farm irrigators work with more responsibility to ensure water is delivered to every farm [Farmers, Gia Xuyen, ID (1)].

6.5.3 Adequacy of water supply

A large number of farmers after the transfer were satisfied or strongly satisfied with the volume water supplied. Prior to the IMT, less than half of the farmers (n=21/50; 42%) agreed that their farms were supplied a sufficient amount of water compared to more than two third of farmers (n=34/50; 68%) after the IMT.

Beside the improvement of physical conditions as mentioned above, high-level responsibilities designated to AC (WUA) members and on-farm irrigators is an additional reason that has led to better quantities of water. These WUA members have worked with very high level responsibility to increase the frequency of farm inspection, and the dredging of canals. In addition, they usually adjust the water schedule in order to meet water requirements. In addition, they explained that beside water pumping by Quan Phan pumping station, Gia Xuyen village also were supplied by 7 pumping stations.

In many circumstances, we still deliver water following the schedule to every village, and then see which village has an insufficient amount of water, then we decide to supply water when all other villages have adequate water. We have to change the water supply [Focus group, WUA members, Gia Xuyen].

When water is insufficient for our village, we call on-farm irrigators and leaders of the village. They usually discuss with WUAs and adjust the water calendar. It may cause a delay but we are supplied adequate water [Farmer, Gia Xuyen ID (48)].

However, Figures 6-6 and 6-7 illustrate that there are still many farmers dissatisfied with water supply management, especially in regard to timeliness (n=12/50; 24%) and the quantity of water distributed (n=13/50). Eight farmers in Tang Ha raised concerns about water supply management. They said that compared to the initial years after the IMT there are now problems with water supply (from 2010 to present 2013). The main reasons are incorrect canal design and lack of awareness of farmers at the headwork of canals to save water.

Farmers said that they were not encouraged to participate in the canal design. Donor funding from JICA provided for concreting the systems. Farmers were not encouraged to give ideas to project managers. This lack of consultation with farmers contributed to problems with canal design and has resulted in difficulties for Tang Ha commune to access water.

> *I work as an on-farm irrigator. I found that the design of the canal has a problem from the beginning of IMT process. It is really hard to take water to our village [at the tail of the canal]. This problem happens in nearly 1000 m of the canal, the height difference is about 20 cm and in another section 600 m long, the height difference is 40 cm between upstream and downstream [Interview, ID (1) on-farm irrigators, Gia Xuyen]*

> *Beside the wrong design of canal systems when the IMT was implemented, , there is a gradual degradation of, and sedimentation in, the canals. As a result, water takes a very long time to get to our village. While water is in very high volumes at the head it is rarely here [Farmer, Gia Xuyen, ID (28)].*

A reduction of farmers' awareness is another problem leading to difficulties in adequacy of water supply. Problems occur when head farmers do not follow the water-supply schedule and take their turn as they should. There is a number of water thefts from upstream. Some farmers break holes (Figure 6-9) in the offtakes in order to get water whenever they want or they can develop the offtake control and then they can manage offtakes by themselves. In one place, at the head of canal water had illegal access but at the end of the canal water drains directly down to the river. As a result, farmers at the downstream canal (other villages) usually face difficulties with water volume for cultivation.

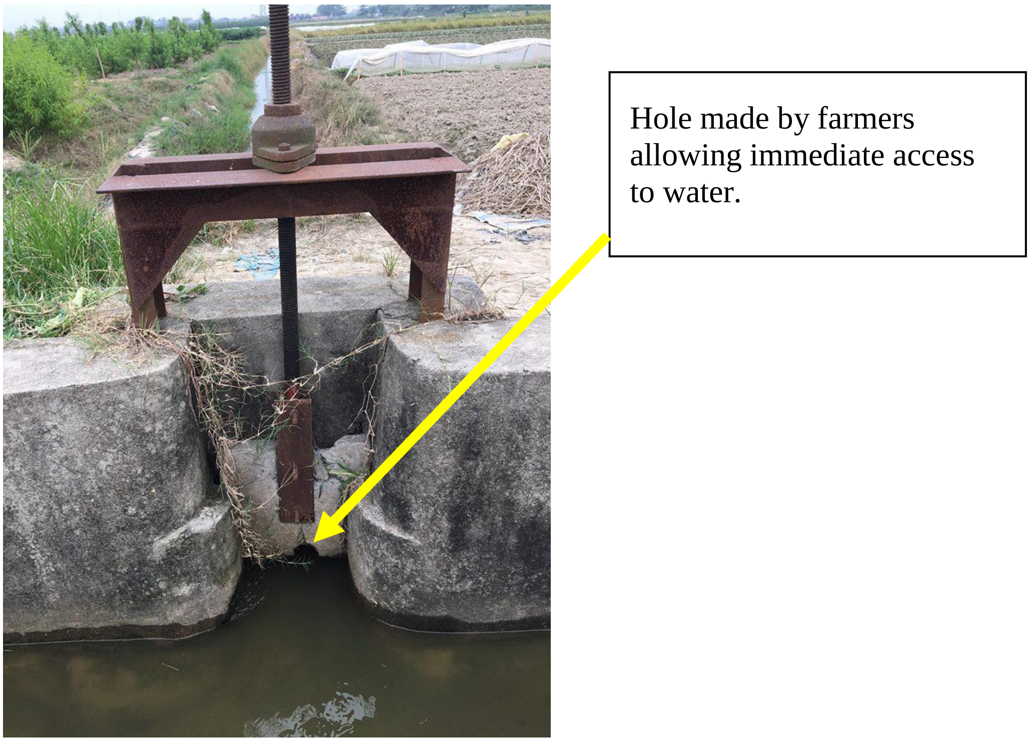

Figure 6-9: Modified offtake of one of the secondary canals

Source: Fieldtrip observation 2013

In order to minimise the impact of water theft to the downstream farmers, downstream irrigators have to use earthen or grass to temporarily fill in the broken holes to minimise water loss. According to farmers, on-farm irrigators assist with supply and work very hard. They may have to be present in the canals 24 hours a day. They are also patient and explain to farmers what is needed in order to ensure delivery of water to all farms. Sometimes on-farm irrigators are unable to solve the water theft because the farm land is across very large areas.

Figure 6-10: Group of ACs in Tang Ha village

Source: Fieldtrip observation 2013

As a result, it now usually takes from 2 to 3 hours to deliver water from headwork to the downstream village compared to about 40 minutes in the beginning of IMT implementation.

> *It was really hard to deliver water because of a lack of awareness from farmers in the headwork. They take water without following the water-supply schedule. They may be busy so did not access water when it was their turn. When it was our turn they opened their offtakes and withdrew water. Two of us are responsible for six offtakes so we could not stay in one place to protect only one gate or offtake. Sometimes it makes me very frustrated [Focus group, WUA members, Gia Xuyen].*
>
> *We are supplied water in the supply period of four to five days a month. If compared to before (before 2010) we only needed 12 hours from morning to the afternoon, but now we need 24 hours or 36 hours to irrigate our villages [Farmer, Gia Xuyen, ID (25)].*

Sometimes we could not solve the problem of headwork water thieves. We have to allow them to access enough water even if it is not their turn. Then water will be delivered to the tail of canals, [interview, ID (2) On-farm irrigators, Gia Xuyen]

6.6 Operation and Management of Irrigation Facilities

Overall, the quality of irrigation infrastructure improved in Gia Xuyen in the immediate years after the transfer according to the majority of farmer respondents discussing the O&M of irrigation systems in Gia Xuyen.

6.6.1 Operation and Management of the headwork and secondary canal system

The improvement of O&M was confirmed by three WUA members during the focus group. They stated that Gia Xuyen irrigation systems were frequently maintained and quickly repaired when a canal was broken, and rubbish was collected. Better canal maintenance also was confirmed by 20 farmers (n=20/50; 40%) in Gia Xuyen. Figure 6-11 shows the concreted secondary canal in Gia Xuyen.

Figure 6-11: The secondary canal system

Source: Fieldtrip observation 2013

> *It was a significant improvement when irrigation systems were transferred to our community. Canal systems were rebuilt and offtakes concreted, so water is well protected and it reduces the volume of water loss [Focus Group, ID (3), WUA members, Gia Xuyen].*

It is much better when IMT happened in Gia Xuyen in terms of canal maintenance. Before, water wastage happened in many places because farmers broke canals and offtakes to take water from the main canals for their farm. Later, one part of the offtake was rebuilt with support from JICA. Farmers' knowledge also improved and they have more sense of irrigation protection and water saving [Focus group, WUA members, Gia Xuyen].

6.6.2 Operation and Management of tertiary canal systems

According to WUA member’s perspectives, the O&M of on-farm irrigation systems in Gia Xuyen improved after the transfer. Operational activities are completed twice a year. In some years, on-farm irrigators may be needed three times per year to ensure that on-farm canals work with high efficiency.

However, nine farmers (n=9/12; 75%) in Tang Ha and eleven (n=11/19; 57%) farmers in Dong Bao villages were dissatisfied with the capacity of their irrigation systems. They thought the maintenance of the canal systems under Gia Xuyen AC (WUA) was good immediately after the transfer. However, more recently problems have emerged. Operation activities are being ignored by AC (WUA) staff. Irrigation systems are rarely maintained or dredged by the AC (WUA). A large quantity of waste is disposed into the canal systems.

Farmers reported that the work done by AC staff is ineffective in terms of the quality and frequency of service. Some canals sections were broken and temporarily filled with soil (as shown in Figure 6-12) because some headwork farmers ignore the supply schedule and break canals to withdraw water when the delivery belonged to the downstream farmers. Farmers said that broken canals were not fixed for long periods of time.

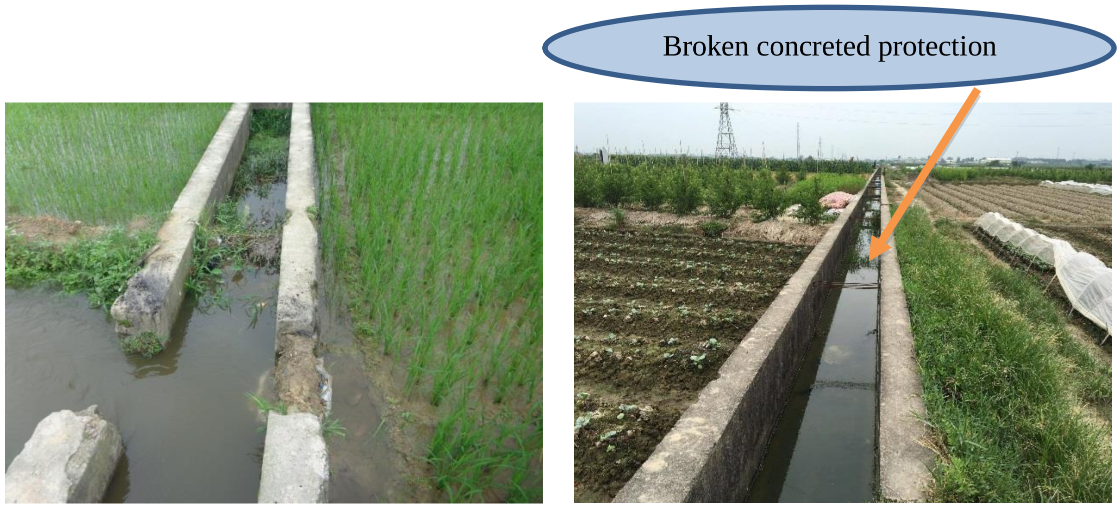

Figure 6-12: Canal broken (left picture) and canal protection lost (right picture)

Source: Fieldtrip observation 2013

> *On-farm irrigators in my village get paid to maintain canals but it is ineffective and not carefully done. Grass and other rubbish are not all collected, some broken sections of on-farm canals were not reconstructed yet [Farmer, Gia Xuyen, ID (31)].*

> *There is twice yearly maintenance and dredging of canals by on-farm irrigators however, this is not enough because we grow from three to four crops in one year. I think we need more care about irrigation maintenance in my village [Farmer, Gia Xuyen, ID (37)].*

When asked, "*What changes do you think should be made to improve the way the irrigation system is currently being delivered*?*"*, 22 farmers (n=22/50; 44%) said that farmers needed more help from the subsidiary IMC and the AC (WUA) especially for drainage canals. Flood control in Gia Xuyen is a problem; the lack of drainage canals and the poor quality of the irrigation systems leads to flooding. Respondents said that it takes a long time and a lot of effort and money to grow vegetables, but all production may be lost because of flooding after only one heavy rain event.

> *We meet difficulties with flooding in the rainy seasons. We need more attention from the irrigation manager in terms of improving flood control. We need more flood canal management and more pumping stations to deal with floods. If not our agricultural production will be affected [Farmer, Gia Xuyen, ID (27)].*

> *Drainage systems are extremely ineffective. In some crops, it is nearly time to cultivate, but is raining for several days - the drainage systems are inefficient in delivering water which destroys all of the production [Farmer, Gia Xuyen, ID (30)].*

6.6.3 Waste management

Waste disposal into canal systems is a serious problem in Gia Xuyen both for main and on-farm irrigation systems. All interview and focus group participants, and 28 questionnaire respondents (n=28/50; 56%) mentioned this as being a problem. Waste from agricultural operations, household waste and solid waste from road construction are the main sources of waste in Gia Xuyen's canals.

6.6.3.1 Agricultural Waste

In Gia Xuyen, the spring crop is the harvest that brings the most benefits for farmers. They grow flowers, vegetables such as cabbages, cauliflowers, and water melons. This high level of production however can become a severe problem if the price of those commodities drop and farmers cannot sell their products. Unsold harvest is disposed of into canals and pollutes them. One of the by-products of rice harvesting is straw. One part of this waste becomes food for livestock or alternatively is burned. However, other parts are thrown to the rice field, which then falls into canal systems. Figure 6-13 was taken during the field trip in Gia Xuyen in January 2014. Water melons and straw have been discarded into the canal.

Figure 6-13: Watermelon and straw blocking canals in Gia Xuyen system

Source: Fieldtrip observation 2013

Gia Xuyen produces more than three crops during intensive spring production. As a result, dealing with the volume of waste thrown into the canals is challenging. Respondents explained that there is only one on-farm irrigator in the village. It is very difficult to manage the volume of waste without additional assistance from other organisations.

> *Actually, although, farmers were reminded in the agricultural meeting about the rubbish problem, I have to say some farmers are unaware of their activities. After harvesting their farm, they throw all of remaining produce into the canal. It is very hard for us to collect all the rubbish [Interview ID (1), on-farm irrigators, Gia Xuyen].*

6.6.3.2 Household waste

According to the Hai Duong Social and Economic news (Minh, 2014), 8 Sep 2014, in Gia Xuyen, every day, nearly 2.7 tons of domestic rubbish needs collecting. Before the IMT there was two AC staff responsible for collecting village waste. However, farmers paid a very low fee to these waste collectors. The payment was insufficient to maintain the waste collectors' interest. As a consequence now only two out of nine villages have a waste collection system. Rubbish collection teams in seven other villages have discontinued collecting waste. In addition, some or all villages directly discharge sewage into the irrigation canals. Solid waste is blocking water flow and water in the canal systems is polluted.

6.6.3.3 Housing and road construction waste

Solid waste from road construction dumped into the canals is also a severe problem in Gia Loc district, and Gia Xuyen. Gia Loc subsidiary IMC staff thought that dealing with the waste was the leading problem facing their company. This problem has persisted for a long time. As yet the IMC has not found a permanent solution. All of the solutions that have been applied in Gia Loc IMC have been temporary. It was expected that effective cooperation between the IMC and construction companies would have been set up to resolve the problem. Rewards, penalties, and sanctions are lacking, and the root cause of the problem is out of the control of the IMC. The following response indicates an interviewee's perspective as to how to assist communes reduce the environmental impact of waste.

> *It was very difficult to deal with the rubbish problem in this area, it seems out of our control now. I think Hai Duong Province needs to develop long-term solutions instead of temporary ones. Although we have spent our staff and money to collect waste ensuring water delivery and to protect our environment, it needs help from communes and the whole society [Interview ID (1), IMC staff, Gia Xuyen).*

Several respondents (seven farmers in Tang Ha village (including the head of commune), said that other industries are also discharging waste water into the canal system. They said that sometimes very dark water from unknown sources is draining into the canal systems, especially at night. Respondents said that it is difficult for them to find out exactly the source of the waste water. This kind of water pollution has serious impacts on the quality and productivity of agricultural systems.

6.6.4 Quality of irrigation systems maintenance

Figure 6-14 shows farmers' perceptions of the improvement to irrigation performance after the IMT. Overall, the majority of farmers (84%; n=42/50) perceived that quality of irrigation systems maintenance have improved after IMT. Of these, just under half thought the improvement was either significantly better or better.

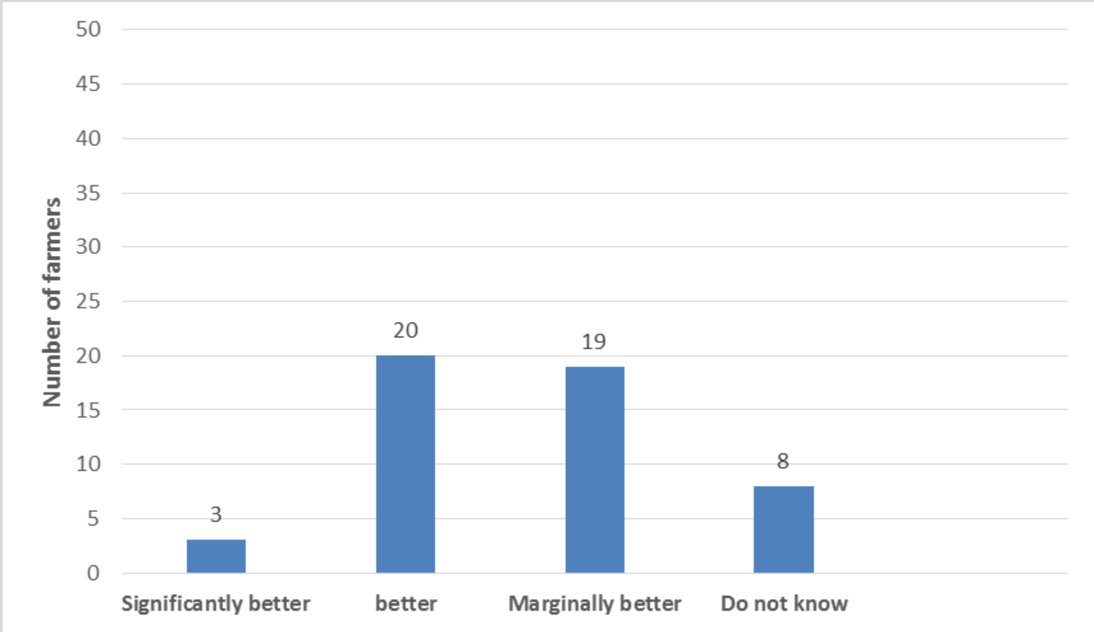

Figure 6-14: Respondent perceptions about the impact of IMT on increasing agricultural productivity in Gia Xuyen system

Source: Farmers' questionnaire survey 2013

Farmers stressed that since 2012 until now, maintenance activities have been ignored. Degradation of irrigation systems has followed. For example, small pumping stations have rusted. This problem has severely affected water supply.

6.7 Agricultural benefit

When asked if agricultural productivity had improved as a consequence of IMT and hence WUA management of irrigation systems, almost the majority of farmers in Gia Xuyen (n=44/50) thought it had.

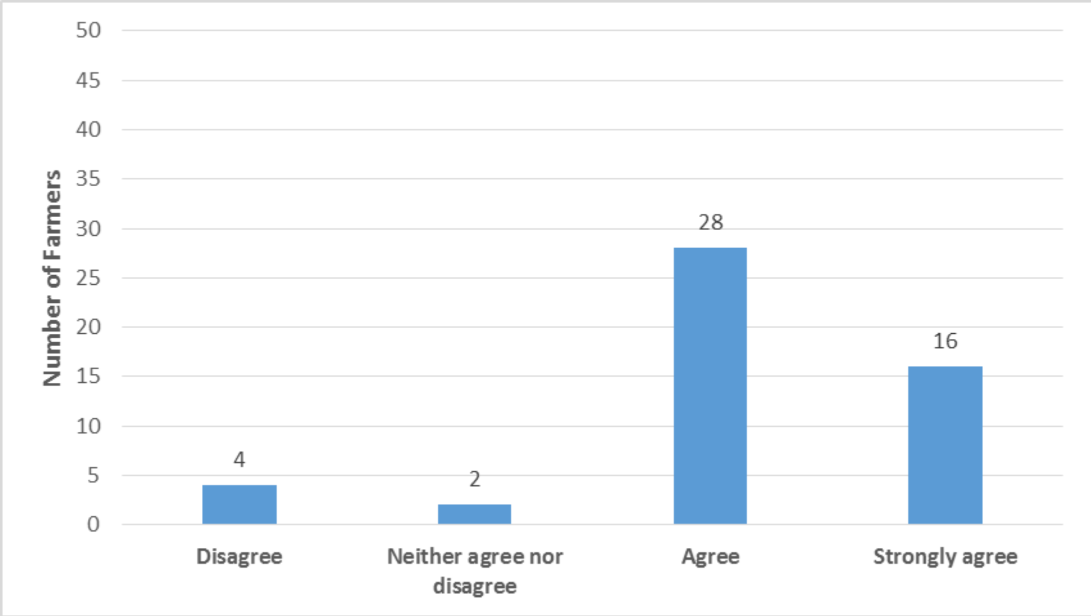

Figure 6-15: Respondent perceptions about the impact of IMT on increasing agricultural productivity in Gia Xuyen system

Source: Farmers' questionnaire survey 2013

6.7.1 Change in crop yield

Crop yield increase and crop diversity are the two main reasons given by farmers to explain why agricultural production has risen. In terms of increasing of crop yield, over half of respondents (n=26/50) claimed that after the IMT, there was a significant increase in crop yield which resulted in higher agricultural production. While respondents confirmed that agricultural productivity is affected by many other aspects such as technology and weather, they think their productivity has improved due to better water supply.

Thirty farmers (n=30/50) confirmed there has been a rise in cropping frequency due to the improvement of water supply. Before the IMT farmers focused only on summer and spring crops. Sometimes there was a non-farming period between the two crops. However, now farmers can grow three to four crops in one year including a winter-spring rice crop, or a combination of spring rice, water melon, winter vegetables, and spring rice, soybean, special onion, and spring rice, summer rice, winter vegetable. Six farmers in Tang Ha village said farmers could cultivate five crops a year in their villages instead of two. New kinds of crops only need a short time to cultivate which also increases agricultural yield.

After transfer, due to the adequate water supply, beside the rice field, my family increases from one to two corn crops per year, agricultural output has increased [Farmer, Gia Xuyen, ID (14)]

Productivity has significantly increased, not only in my family but also for farmers in my village. You can imagine that if crops are supplied with an adequate quantity of water, it creates the chance to change the kinds of crops—those with high productivity. In addition, we grow many crops during a year. As a result, total agricultural production has increased [Farmer, Gia Xuyen, ID (48)].

Tranh Dau is one of the villages famous in the whole province with extremely high crop production. They grow cabbage and peach trees. Farmers can earn more than 100 million VND per ha [Focus group, WUA members, Gia Xuyen].

6.7.2 Increased crop diversity

Eighteen farmers mentioned an increase of agricultural production resulting from crop diversity. Before the IMT many agricultural products were imported to Gia Xuyen. Seven farmers said that rice was considered to be the main product in Tang Ha village before the IMT. Now they grow high value crops such as vegetables, flowers, beans and peach trees. These farmers said they reduced rice planting. Farmers produced rice only to feed their family. In addition, diverse kinds of vegetables such as cabbages, beans, potatoes and sweet potatoes, and roses were grown in each crop. Tang Ha is specialist for growing cabbages, Tranh Dau grows peach tree with very high agricultural production. Farmers indicated that these kinds of products were two to three times higher in value than rice.

The result of more water available to our farm has created the chance for our commune to change the variety of crops. My family has moved from traditional rice to the higher productivity rice such as 'SYN6". It generates more than 300 kg/"sao" compared to nearly 200 kg/"sao" before [the IMT] [Farmer, Gia Xuyen, ID (49)]

Many kinds of high production crops have been grown in my village as it is convenient for us because water was supplied to individual farms. Before the IMT, we only focussed on two main rice crops but now we grow three saos of rice, two saos for watermelon in spring crop, in the summer crop we all grow pear, melon, and cabbages in the winter crop [Farmer, Gia Xuyen, ID (31)].

6.8 Economic impact on Farmers

Overall, almost all respondents (n=43/50) agreed or strongly agreed that the IMT has increased their household income (Figure 6-16). According to the farmers' questionnaires, on average household incomes are now three times higher in Gia

Xuyen. The main reasons farmers gave for this increase was that agricultural productivity had improved.

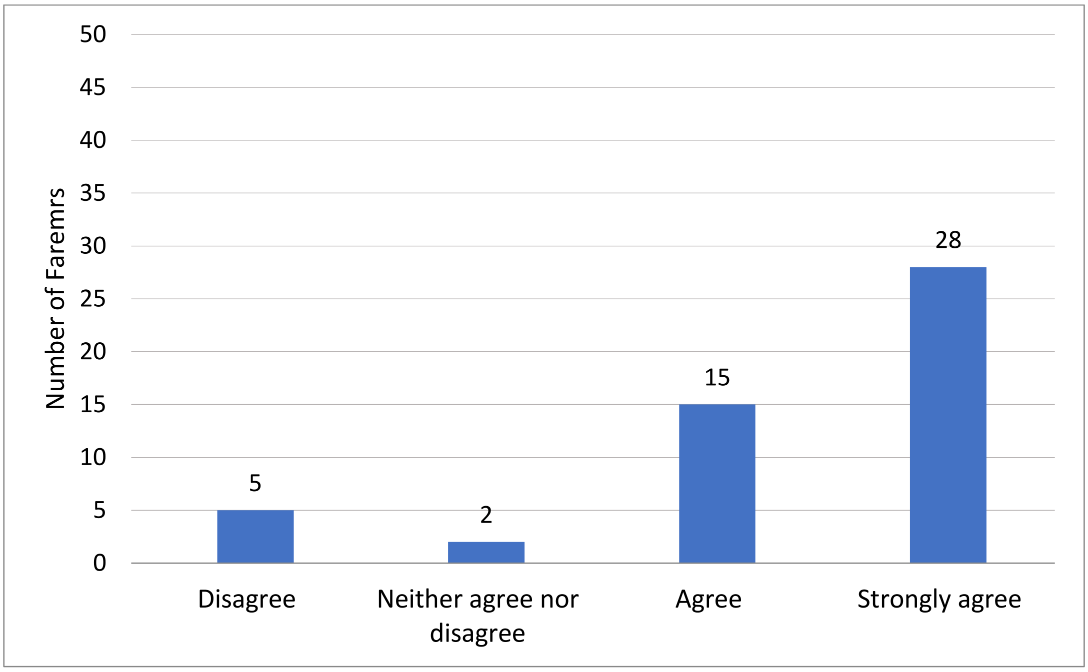

Figure 6-16: Respondent perceptions about the impact of IMT on increasing household income

Source: Farmers' questionnaire survey 2013

6.8.1 Increased income from agricultural production

According to this study the living standards of farmers has improved since the IMT. Two villages focussed on growing vegetables only and because these attract high prices at market, the average income per ha is now over 100 million VND. According to the farmers' questionnaire, the lowest increase in household income was from 5 million to 100 million VND. The highest increase was from 20 to 120 million VND after IMT.

> *My household income has significantly increased after the transfer. Actually, the income is affected by many factors. But sufficient water supply has had a huge impact on our crop productivity. My family income has increased from 20 million VND to 120 million VND after IMT (Farmer, Gia Xuyen, ID (31)]*

> *Before the IMT, farmers in our village only focussed on two main rice production crops. Farmers had a precarious life before. There was a shortage of food sometimes. After the transfer, water is more sufficient. Agricultural output has increased due to the diversity of crops. My family's income has significantly increased. Other families' income has also risen [Farmer, Gia Xuyen, ID (5)].*

6.8.2 Increased income from diversification to other industries/sources

Seven farmers (n=7/50) mentioned other sources of income. They explained that agricultural production is the main occupation which attracted almost all of the labour force in Gia Xuyen. Agricultural production is the main sources of income. They also explained that households that did not directly participate in agricultural production may work in the related fields such as agricultural trading or labour exchange.

> *In my village, the main income source of income is from agricultural production. It accounts for 90%. Sometimes in harvesting time, I have to hire someone to work for me [Farmer, Gia Xuyen, ID (45)]*

> *We depend mainly on agricultural production, my family has four members and all of us work in agriculture. We grow many kinds of products and have three main crops, so we are so busy. My income is all from selling our products [Farmer, Gia Xuyen, ID (19)].*

6.9 Social effects of IMT

Numerous social benefits have been reported on the basis of the IMT. Farmers' participation in decision making; more productive meetings and leadership building; reduction of conflicts between farmers; and sharing roles between men and women are discussed below.

6.9.1 Farmer participation in irrigation management

When farmers participate in irrigation infrastructure management and decision-making the 'ownership' of irrigation systems improved. IMC staff, focus group participants, one on-farm irrigator and twenty farmers in Gia Xuyen, emphasised that the participation of farmers was happening in irrigation management a long time before the IMT. They were certain that after the IMT has implemented farmers had a much greater sense of ownership, and have taken on more responsibilities in the O&M of the tertiary canal systems. Respondents also said that farmers directly manage the tertiary canal systems and, for those systems that have not been concreted yet, every year, village leaders discuss with farmers to make decisions about dredging frequency. As a result, farmers provide their labour and money to implement O&M activities.

However, compared to other questions, when asked *"Do water users participate in the design, and implementation of the irrigation system when irrigation systems were* *transferred?"* a low response rate was received from farmers. Almost all farmers (n=48/50) said they were not encouraged to participate in irrigation design. One leader of the village said that when a project was implemented in his village, farmers were not encouraged to participate in building the canal systems; and, even when farmers noticed some problems during the construction project, they were not allowed to speak up. Top-down management still happens. IMC staff and construction project managers believe farmers have limited understanding about complicated technical issues. Farmers in this study said they remain silent because they projects are subsidised by the Government, and they simply receive it. There have been no reason for farmers to comment, they were not asked to give their opinion.

> *I have to say that we did not participate in building canals. We were informed that the canals were to be restructured and were subsidized so we do not need to participate. Even if we could see something wrong with the design for example, as downstream was higher than upstream they did not listen (Farmer, Gia Xuyen ID no.35).*

All responses across all three villages confirmed that farmers only participated in irrigation management by paying a fixed-rate on-farm ISF as well as some extra money (approximately 10.000 vnd/sao/crop). This on-farm ISF was used to supplement on-farm irrigators' salary. In addition, it was also was used to hire more farmers to fulfill O&M activities.

> *Actually, farmers in our district have a long history of participation in irrigation management. However, after the IMT with the support from JICA, farmers were more understanding about PIM and they paid more attention to irrigation management [Focus Group, WUA members, Gia Xuyen].*

6.9.2 Leadership capability

The managers of ACs are elected by the congress participants who representatives for farmers from every village. They are allowed to take the position no longer than 5 years.

At the village level, leaders of each village and on-farm irrigators are elected by farmers from the village meetings.

> *There are three on-farm irrigators in our group representing three villages. We are elected once a year from farmers, and the members may change depending on farmer's and on-farm irrigator's satisfaction [Interview, ID (1), on-farm irrigator, Gia Xuyen].*

6.9.3 WUA meeting frequency and productivity productive meetings

According to the response from AC (WUA) managers and on-farm irrigators, this study found that at the commune level, the Congress of cooperative members of AC is organised once a year according to the Agricultural Cooperative Law in 1996.

In addition, at the commune level, almost all farmers (n=41/50) confirmed that agricultural meetings were usually organised once a year in each village. The annual working plan and water distribution and irrigation preparation plans are presented during the meeting.

> *The one to two meetings with us are usually organised during crop. The intensive meetings are also organised in an urgent situation such as water shortage or a broken canal intake [Interview, ID (1), on-farm irrigator, Gia Xuyen].*

In terms of frequency of internal meetings between on-farm irrigators and WUA members, WUAs members and on-farm irrigators said meetings were usually organised two to three times a crop. In some urgent cases meetings were organised to solve urgent problems in terms of water distribution.

However, according to the farmers' questionnaire, there is a low rate of household participation in meetings and poor support from individuals speaking up during meetings. Less than half of respondents (n=20/50 households) said that their family had a member who participates in village meetings. Only nine respondents said that they had spoken or given ideas during a meeting. When asked why they did not speak up in meetings, three respondents explained that they did not want to talk.

6.9.4 Conflict resolution

The farmers' questionnaire suggests that there has been a significant reduction in disputes both in terms of the number and intensity of conflicts. As can be seen from Figure 6-17, the large proportion of farmers (n=31/50; 62%) indicated there was a reduction in the number of conflicts between farmers after the IMT.

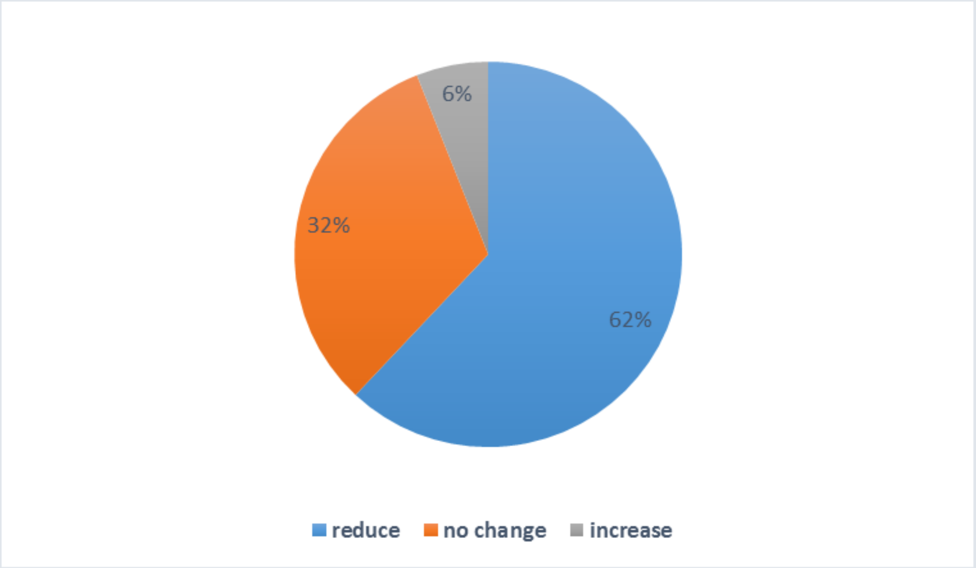

Figure 6-17: Respondent perceptions about the impact of IMT on reducing conflicts between farmers by percentage in Gia Xuyen

Source: Farmers' questionnaire survey 2013

Reasons given by farmers and on-farm irrigators to explain the significant reduction in disputes between farmers after IMT include the plan of water supply and water delivery was discussed more carefully between irrigation management officials from the IMC, WUA and on-farm irrigators. Water supply schedules were established and closely monitored between them. It ensured that upstream farmers and downstream farmers had the same rights to access water.

> *We usually discuss with the IMC and AC members before every water delivery period. When water volume is low in the rice season, water is delivered to the furthest to closest canal systems. However, when we have high water volume, especially in spring season, farmers in the head of canals have chance to withdraw first, then farmers in the tail canals [Interview, ID (1), on-farm irrigator, Gia Xuyen].*

However, there was a large number of farmers (n=16/50; 32%) who said there were still conflicts and some who thought there had been an increase in disputes after the IMT These respondents said that water shortages still happened and this led to disputes between farmers at the head and tail of canals.

6.9.5 Roles of women

The roles of women in the IMT transfer are reflected in the results from the interviews with IMT members, three WUA members and on-farm irrigators. This study found that all of the officials in the AC (WUA) and on-farm irrigators are men and they are involved in almost all management activities such as water distribution, O&M planning. Therefore men hold the power of decision-making in irrigation management at the Gia Xuyen community.

In contrast, respondents in the farmers' questionnaire when asked "Who makes the decisions on agricultural production" said that women were actively involved in agricultural production activities. The majority (n=31/50; 62%) responded that women's roles in agricultural production included deciding the types of crops and providing labour in agricultural production.

Three focus group participants and the on-farm irrigator confirmed that that it is hard for women to take part in on-farm irrigator roles. These roles require hard labour from early morning until late at night. As a result, in three villages all on-farm irrigators are men. Women usually dredge canal systems and collect rubbish when required by the WUA.

> *It is really hard for women to work as irrigators or take part in irrigation management because these jobs have to work in the night. [Interview, ID (2), on-farm irrigator, Gia Xuyen].*

6.10 Governance arrangements for irrigation management

6.10.1 Rights, roles and responsibilities

After the transfer the IMC member and WUA members in the focus group discussion reported improvements of roles and responsibilities of both irrigation systems managers and farmers in Gia Xuyen. Gia Loc IMC staff interviewee suggested that leaders of the IMC usually remind their staff that there are no reasons for lack of irrigation systems effectiveness or poor water supply management, especially when their O&M costs are subsidized by the Vietnamese government from the ISF waiver.

6.10.2 Vertical linkage/coordination/communication between tiers of government

The cooperation between the IMC and Gia Xuyen commune has been evident from the time the IMT was implemented in 2003 in the Gia Xuyen commune. The Gia Loc IMC interviewee when asked the question "Why was Gia Xuyen chosen to become one of the initial communes to implement IMT?" responded that one of the reasons was existing high degree of cooperation between farmers and the IMC in Gia Xuyen before IMT. Due to farming practices there was a long history of farmers' participation in O&M of irrigation systems in Gia Xuyen. Even before the IMT, Gia Xuyen AC members had significant responsibilities. Leaders of the Gia Xuyen AC paid attention to irrigation systems management and they were willing to support IMT in their communes.

Respondents reported a strong link between the Gia Loc subsidiary and Gia Xuyen AC (WUA) in irrigation management. The water supply schedule was regularly discussed between Gia Xuyen AC (WUA) members and Gia Loc subsidiary staff. Coordination was also described during circumstances of water shortage, when the and Gia Xuyen AC (WUA) members held discussions to extend water supply time, to meet the agricultural water supply requirements of farmers.

However, in the farmers' questionnaire, when asked the question, "*What changes do you think should be made to improve the way the irrigation system is currently being delivered"*? 22 farmers (n=22/50; 44%) suggested that farmers needed more attention from Gia Loc subsidiary IMC and Gia Xuyen AC (WUA).

> *We need more attention from irrigation managers in terms of improvement of flood control. We need more flooding canals management and more pumping stations to deal with flood. If not our agricultural production will be affected [Farmer, Gia Xuyen, ID (27)].*

Half of the respondents (n=25/50; 50%) agreed that cooperation between on-farm irrigators, WUAs and the Gia Loc subsidiary was good in solving temporary problems such as adjustment of the water supply schedule. However, in terms of technical support and maintenance of canals, many sections that were degraded and broken have not yet been fixed. The evidence water users have given is that the problems of canal design, and broken offtakes were raised a long time ago but damage has not yet been repaired.

> *We sometimes send complaints to the leader of WUAs. Verbally some constrains have been solved but some others still need solutions from upper level of management [Interview, leader of Tang Ha village, Gia Xuyen].*

> *We need more attention from WUA and IMC ensuring sustainable of water supply and the quality of water supply [Farmer, Gia Xuyen, ID (26)].*

6.10.3 Horizontal links/coordination/communication between WUAs and between communes

Both the Gia Xuyen AC (WUA) and Gia Loc subsidiary IMC stated that there is a lack of cooperation between irrigation management entities and other organisations especially construction companies. This problem negatively affected the operation of irrigation systems. As discussed in Section 6.6.1 in terms of rubbish management in Gia Xuyen. The lack of cooperation between IMCs and road construction companies was seen as a consequence of the lack of application of sanctions and absence of incentives in this area. As a result, in some cases, just as Gia Loc IMC had finished their mandates of collecting rubbish and restructuring irrigation systems, road construction companies had disposed rocks and other materials directly into canals. Households release waste water and dump solid waste into irrigation systems. However, sanctions or incentives were not applied. Gia Loc subsidiary IMC does not have the right to punish to prevent unlawful activities. As a result, rubbish management has become increasingly worse.

> *In my opinion, collecting rubbish, preventing water theft or vandalism is a temporary solution, it does not help to solve the grassroots of the problems. Compare with other organisations they have their rights to fine people if they destroy infrastructure. For example, the transportation organisation will charge money if individually or other organisations having vandalism actions. But Gia Xuyen WUAs or even our IMC do not have any right to do it. So these problems happen year to year and we could not stop it ([Interview, ID (1), IMC staff, Gia Xuyen]*

> *I think that the transportation department need to care about solid garbage which was dumped in to the canals;we did inform them many times but the problems still happen and they need to take it more seriously [Group discussion, WUA members, Gia Xuyen].*

6.10.4 Roles of donor projects

The representative of Gia Loc IMC and WUA members expressed an appreciation for the role of the JICA project in Gia Xuyen. They discussed how JICA supported the physical building and upgrading of irrigation systems. The JICA project in 2003 invested in the upgrade of 15 water supply gates and concreted the majority of the secondary and tertiary canal systems supplying water for 150 ha.

Besides the technical support from the JICA project, Gia Xuyen AC (WUA) was strengthened with the purpose of increasing the participation of farmers involved in irrigation management. The establishment of the Gia Xuyen AC (WUA) was made possible by strengthening the Gia Xuyen ACs. During agricultural meetings AC (WUA) members were elected by farmers. In addition, through participation in training programs, subsidiary IMC staff, WUA members, and farmers have improved their management and technical skills.

> *The Gia Xuyen system was subsidised by the JICA project. Before the IMT, the JICA project gave financial support to reconstruct irrigation systems but they also paid strong attention to educating people who directly manage irrigation systems. There is not only my company staff but also irrigators in Gia Xuyen who could participate in training programs. We did not organise any technical and management programs [Focus group, WUA members, Gia Xuyen]*

The problem of dependence on the donor project was found in Gia Xuyen. From 2003 there have been no training programs in Gia Xuyen. Furthermore, from the irrigation manager's perspective, donor projects are considered the only tool to improve the effectiveness of irrigation systems management. The representative of the Gia Loc subsidiary IMC said that they are expecting to have other donor projects or other sources of funding from the Vietnamese government in the near future in order to help upgrade irrigation infrastructures and support training programs for their staff.

> *We did not conduct technical and training programs. It could be said that the participation of farmers in irrigation systems has existed for a long time but I confirm that the farmers' participation was much higher after implementation of JICA project. I expect to have another project to help us dealing with upgradation of irrigation systems to minimise irrigation degradation [Interview, ID (1), IMC staff, Gia Xuyen].*

> *I started working as an on-farm irrigator in 2009. I did not participate in any training program. I work based mostly on my experience and follow the water supply schedule from WUA [Interview, ID (1), on-farm irrigator, Gia Xuyen].*

6.11 Conclusion

This chapter, following the evaluation framework (Chapter 3) has presented the results of fieldwork for the Gia Xuyen irrigation system. The results illustrate a number of benefits attributed to the IMT across the seven evaluation measures. There are also some insightful ways in which irrigation systems management might be improved in this system towards better agricultural productivity and social engagement.

This study has identified a financial shortfall in both the headworks managed by the Gia Loc subsidiary IMC and the Gia Xuyen irrigation system. Respondents from Gia Xuyen AC (WUA) explained that there is inequity in the distribution of funds between the Gia Loc subsidiary IMC and WUA. Respondents said that sharing of the subsidy was unfair because it has led to a shortfall of funding for O&M in Gia Xuyen.

After the IMT an improvement in water supply management was confirmed by the majority of farmers in Gia Xuyen. However, farmers also said that there were water shortages in Gia Xuyen. Respondents thought this was due to mismanagement and unlawful activity by some farmers. They thought WUA members and on-farm irrigators should pay more attention to fixing broken canal intakes as well as preventing water theft.

Although Gia Xuyen WUA members explained they regularly repaired and upgraded irrigation systems as needed, farmers are still concerned about the conditions of canal infrastructure. The IMT took place over ten years ago and the donor-funded canals are aging. Farmers said that O&M of canal systems was well organised immediately after the transfer, but over time O&M has declined. Broken offtakes and damaged channel coatings have not been repaired.

Gia Xuyen faces serious problems of managing waste disposal both in the main and tertiary canal systems. As a result of debris placed in canals, water is blocked and water supply is delayed. Waste water discharged from local manufacturing into irrigation canals is a problem reported only in Gia Xuyen.

Overall, respondents suggested that post the IMT they have experienced both agricultural and economic achievements in Gia Xuyen. Participants indicated that when the IMT was implemented in Gia Xuyen, crop frequency increased as did revenue.

The IMT has also had social impacts in Gia Xuyen, Here farmers participated in irrigation systems management before the transfer, but they usually did so by providing labour or money for dredging and upgrading canals. After the transfer, farmers had more opportunity to participate in managing canal infrastructure. Farmers elected WUAs members and on farm-irrigators who represented them.

Farmers had the right to re-elect if members worked ineffectively during their previous term. However, farmers were not encouraged to participate in the initial phases of the JICA project. Few households participated in agricultural meetings, and the role of women was not seen as significant in irrigation systems management. Women are underrepresented in WUA membership. Although the number and intensity of conflicts has been reduced, arguments still occur sometimes.

There has been a long history of co-operation in Gia Xuyen between the IMC and farmers, well before the IMT. Although IMC officials and WUA staff have been effective in the O&M of irrigation systems, farmers in this study indicated that they need more support from upper level irrigation systems management staff to solve current problems such as degraded infrastructure and associated problems of water supply. The problem of rubbish disposal and waste water drainage into the canals are yet to be controlled and will require better horizontal integration.

Chapter 7 IRRIGATION MANAGEMENT TRANSFER IN N6 SYSTEM

The N6 system is located in the Nghe An Province in the North Central Coast region of Vietnam (see Figure 4.9). The model of IMT in the N6 system is considered one of the earliest models of IMT in Vietnam and was the first pilot inter-commune scale irrigation management system. IMT took place in N6 in 1996. It has since become the model for other projects in terms of improving the participation of farmers in irrigation management.

This chapter is divided into two main parts. The first part, **Section 7.1** and **Section 7.2** present the roles of irrigated agricultural production of the Yen Thanh district, and Nghe An province, and outlines the geography and governance of the of N6's irrigation system. The second part of this chapter presents the results of this study in regard to the evaluation of the impacts of IMT in N6. As such this chapter responds to several of the original objectives. The chapter will examine the current status and perceived efficiency of O&M of N6's irrigation system and it will present the perceptions of water users regarding the effectiveness of ongoing management and the effectiveness of irrigation systems and presents farmers' perceptions in relation to the transfer of irrigation management responsibility in N6. The chapter concludes with an overview of the barriers to effective irrigation management in N6.

7.1 Geographical Location of the N6 Irrigation Systems

N6 is only one part of a larger irrigation system. N6 is a secondary canal scheme located in the Yen Thanh district, Nghe An province. Figure 7-1 displays the location of N6 system. The headwork and main canal of the larger system is operated and managed by the North Nghe An IMC. The N6 system is located 9km downstream from the headworks that takes water from the Lam River and stores it in the Bara Do Luong dam. The headwork of the N6 system is manually operated. A gravity off-take feeds 6km of canals. Figure 7-2 shows the main and secondary canals that supply water for the N6 system.

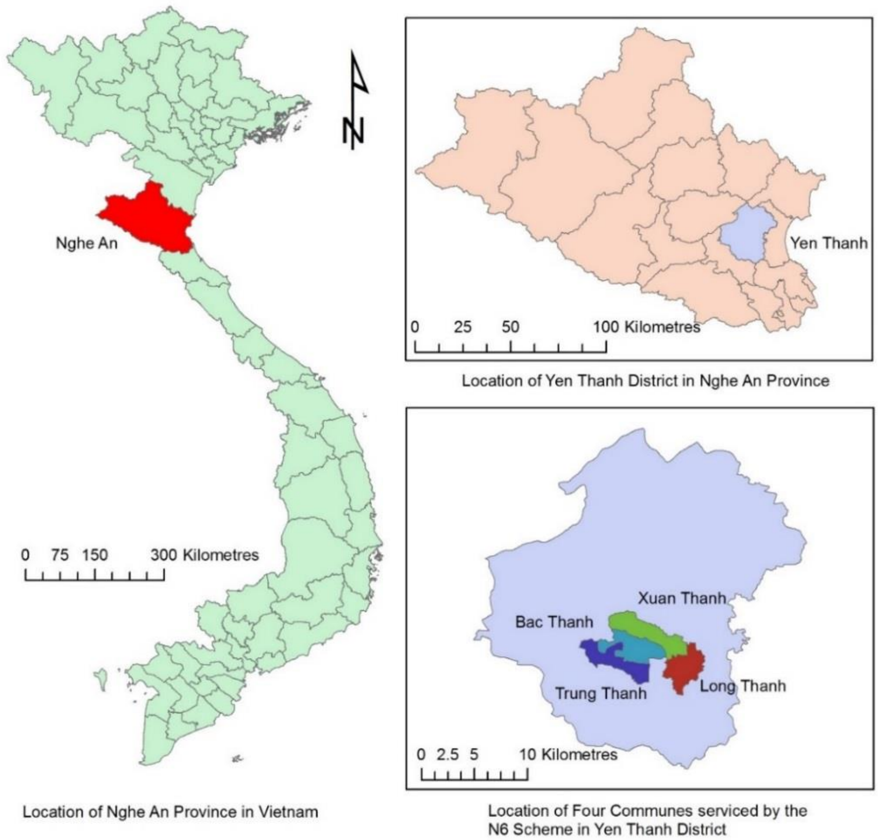

Figure 7-1: Location maps of the N6 irrigation system and four Communes irrigated by N6 System

Source: Create for this study

Figure 7-2: The main canal and the headwork of the N6 secondary system

Source: Fieldtrip observation 2013

Less than one-third of the N6 secondary canals are constructed of concrete (27.2%); the remainder are earthen canals. Figure 7-3 shows the earthen secondary canals and Figure 7-4 shows a concrete section in the N6 irrigation system.

Figure 7-3: Earthen canal

Source: Adapted from Tuyen (2013, p.74)

Figure 7-4: Concrete canal

Source: Adapted from Tuyen (2013, p.75)

Along N6's secondary canal, there are 26 water offtakes delivering water to tertiary canals.

N6 is an inter-commune irrigation system based on hydrological boundaries. It irrigates four communes: Bac Thanh, Trung Thanh, Xuan Thanh and Long Thanh, and 2,312 households. Table 7-1 illustrates the detail of irrigated areas, and the number of households from the headwork to the end of the tertiary canals.

Table 7-1: Water supply by the N6 irrigation system

Irrigation system	Commune	Area (ha)	Number of households	Location
N6 irrigation system	Bac Thanh	72.46	544	Head
	Trung Thanh	16.08	544	Head
	Xuan Thanh	32.56	771	Middle
	Long Thanh	106.30	544	Tail
Total		**281,4**	**2,312**	

Source: Focus group discussion with WUA members

N6's irrigation capacity is 281.4 ha of agricultural land including 2,312 households in four communes. It supplies water for the production of two seasons of rice crops and mixed vegetables. Rice and mixed vegetables are cultivated from June to September and the second rice crop (the spring crop) is cultivated between January and May.

7.2 The N6 Irrigation System Management

The N6 WUA was established in 1996 following the policy of IMT in the Nghe An province.

7.2.1 Background

Prior to 1996, N6 was managed by the North Nghe An Irrigation Management Company (IMC). The Yen Thanh subsidiary IMT (one of the four subsidiaries of the North Nghe An IMC) was responsible for O&M of the N6 secondary canal system. Tertiary canal systems were managed by four Agricultural Cooperates (ACs). Each AC was responsible for diverting water from the N6 secondary canal to the tertiary canals in their commune to irrigate individual farms.

IMT in N6 system was partial. The ownership of the secondary canals remained with the Government. Since 1996 the N6 O&M of the irrigation system has been carried out by the WUO (WUA). The North Nghe An IMC handed over management of the N6 secondary canals to N6 WUO (WUA)—a group of farmers. The formation of the N6 WUO (WUA) was supported by donor funding from the Asian Development Bank (ADB) as one component of a larger construction project that included an upgrade to the headworks and retention dam and the upgrading of the majority of main irrigation canals.

The ADB project ran from 1996 to 2000. During the infrastructure construction period, local farmers provided labour and building materials (such as bricks, sand, and gravel) to upgrade the main N6 secondary canal system. ADB projects, in addition to providing technical support to improve the efficiency of irrigation systems, also encouraged the participation of farmers in irrigation management. ADB project staff worked closely with the IMC, and the ACs to guide the establishment of the N6 WUA. Training programs were run to help newly elected WUO (WUA) members to improve their technical skills and to raise their awareness about managing irrigation systems. Following the guidelines for WUO (WUA) establishment, these training programs were conducted regularly and WUO (WUA) congresses were organised every two years. WUO (WUA) congresses evaluated the role of the WUO (WUA) in the previous term. In addition, water users also had the opportunity to participate in irrigation management by electing their WUO (WUA) members and agreeing to support their actions towards improving N6's irrigation management system.

The following section illustrates the hierarchical structure and roles of N6 irrigation management entities including the North Nghe An IMC, Yen Thanh subsidiary IMC, WUO (WUA) and ACs.

7.2.2 The North Nghe An Irrigation Management Company (IMC)

The North Nghe An IMC is a special stated-owned agency which as a "public utility", is not expected to make benefit financially from its activities but has to balance its budget. Currently, there are 281 staff working in the North Nghe An IMC, of which 66 people have either undergraduate or postgraduate qualifications, and 185 staff are vocationally trained. The North Nghe An IMC manages the headwork, Do Luong dam, which provides the bulk water to the main canal. Water is delivered to the beginning of the N6 secondary canals by gravity offtake. The North Nghe An IMC manages the DoLuong dam, 17 reservoirs, and the entire irrigation and drainage systems in four districts of the North of Nghe An Province. The management of the North Nghean IMC is presented in Figure 7-5.

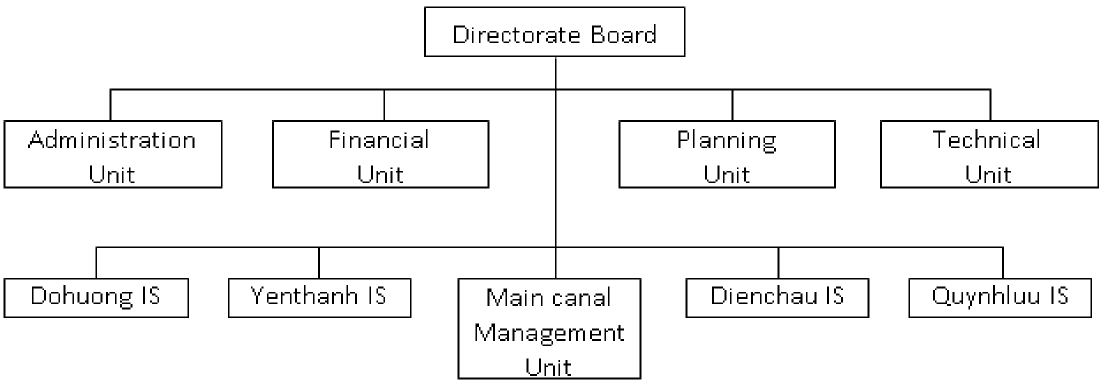

Figure 7-5: The North Nghe An Irrigation Management Company

Source: created for this study

The North Nghe An IMC includes a Directorate Board and four functional departments: financial, administration, planning and technical. The Directorate Board consists of a director and a deputy director who are appointed by the PPC. There are five management units in the IMC. The Main Canal management Unit is responsible for O&M of the main canal. The four other departments are responsible for managing irrigation infrastructure located in individual districts including Do Luong, Yen Thanh, Dien Chau, and Quynh Luu.

The four districts the North of Nghe An Province have four IMC subsidiaries Yen Thanh IMC provides O&M for the district including N6 one of many irrigation systems in the district. Yen Thanh irrigation subsidiary is directly responsible to deliver water from the headwork to the intake of the N6 secondary canal.

7.2.3 The N6 Water User Organisation (WUO) (WUA)

There are four members of the N6 WUO (WUA) which including a chairman, vice chairman, accountant, and technician. The four WUO (WUA) roles are cycled via an election process every two to four years in the party congress. The chair and vice chair are concurrently the head or deputy head of the four Agricultural Cooperatives (ACs) serviced by the system.

The chairman oversees all aspects of management while the vice chairman is responsible for supervision of technical duties. The accountant is responsible for preparing budgets, collecting income, keeping accounts; and the technical staff member takes responsibility for monitoring all O&M activities including water allocation, and checking the irrigation system to ensure adequate and reliable water delivery. The irrigation management model is presented in Figure 7-6.

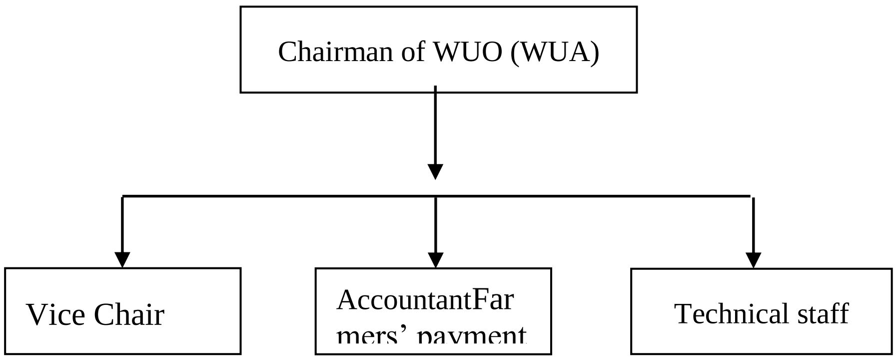

Figure 7-6: N6 Water User Association Management structure

Source: Created for this study

At the local level, irrigation teams in the four ACs are engaged in ensuring the supply of water through the canal system from the secondary canals to the tertiary and on-farm canals.

The N6 WUO (WUA) signs contracts with the four communes for supply of irrigation services and delivers water to the beginning of the tertiary canal systems.

7.2.4 On-farm irrigators

On-farm irrigators are farmers responsible for O&M of the on-farm irrigation systems (i.e. the tertiary canals). They are appointed by peers from every village in a commune. On-farm irrigators work in teams.

There are four ACs in the N6 system. Each village appoints or elects one farmer to join the team of on-farm irrigators in an AC. So in N6 there are from 3 to 4 on-farm irrigators in each AC.

The main responsibilities of on-farm irrigators are to manage water allocation and distribution to different parts of the irrigation system (from the end of secondary to individual farms). The AC cropping calendar water allocation schedule is followed closely by irrigation teams. On-farm irrigators operate and maintain the tertiary canal systems which include cutting grass and removing silt and domestic and agricultural rubbish obstructing and blocking water flow in the canals.

7.2.5 Government subsidies

Prior to 2008 funds for the O&M of irrigation systems were generated through farmer contributions called ISFs. After 2008 the Vietnamese Government subsidised farmers through an ISF waiver; the subsidy is determined by the area of agricultural land under irrigation and type of irrigation system (i.e. gravity-fed or pumped). The Government funds are to assist with the O&M of headworks to end of secondary canals across Vietnam. The subsidy is delivered to province level finance departments. It is at the provincial level that decisions are made as to how the subsidy will be dispersed between provincial level and lower level irrigation management entities.

In N6 for the provincial IMC subsidiary to receive the government (MARD) subsidy at least three steps are followed.

Step 1: N6 WUO (WUA) submits to the subsidiary IMC a report that identifies the total areas that were irrigated in the previous financial year in order to receive a fee waiver. The subsidiary IMC examines the WUO report and decides if the information provided is correct.

Step 2: The subsidiary IMC forwards the report to district Department of Finance which makes its assessment and forwards it onto the provincial Department of Finance which makes its assessment, and subsequently forwards it onto the national Ministry of Finance.

Step 3: The national Ministry of Finance decides the amount it will provide in subsidies (and hence providing a fee waiver for farmers). MARD's subsidy is sent to the Province Department of Finance, which then sends the funds onto the North Nghe An IMC, which then sends funds to the Yen Thanh subsidiary IMC, which then distributes funds to WUO (WUA).

When government subsidies covering the ISF commenced in 2008 through Decree 115 there was a significant increase to North Nghe An IMC's budget. This is because the fees charged for O&M of the headworks to tertiary canals almost doubled (as explained in Chapter 4). Table 7-2 indicates the total amount of funding subsidy provided by MARD for the Nghe An province from 2009 to 2012. Table 7-3 shows the change in fees from 2006 to 2010 in the N6 system.

Table 7-2: MARD funding subsidy for the Nghe An province

Year	ISF funding (10^3 VND)
2009	72, 030.000
2010	193,824.000
2011	181,000.000
2012	181,000.000

Source: Adapted from (Luc, 20120

Table 7-3: Irrigation Service Fee paid by farmers (2006/07) and Government subsidy in N6 by commune

Year	Trung Thanh 10^3(VND)	Bac Thanh 10^3 (VND)	Xuan Thanh 10^3 (VND)	Bac long 10^3 (VND)
2006	12,455	64,644	28,209	82,717
2007	12,455	64,644	28,209	109,430
2008	Vietnamese Government subsidies commence			
2010	26,622	128,399	57,696	211,693

Source: Focus group discussion with Yen Thanh subsidiary IMC staff

7.2.6 ISF collection—on-farm irrigation fee collection

Farmers in N6 pay an ISF to cover the costs of on-farm irrigators working on the tertiary canals. The on-farm ISF is calculated for each of the four communes in N6 on a seasonal basis and is decided by a majority agreement of farmers during a commune's AC meeting. Fees are adjusted contingent upon the outcome of the previous season's agricultural productivity and the effectiveness of how well on-farm irrigators performed their duties. The on-farm ISF is collected in two steps: (1) ACs give an updated list of farmers receiving a water supply then (2) the AC ISF bills are distributed promptly to each of farmer. This bill itemises agricultural costs, including water. Table 7-4 shows the on-farm ISF in four communes under N6 WUO management in 2012. The amount of the on-farm ISF is different between communes.

Table 7-4: On-farm ISF across four locations in 2012

Irrigation system	Commune	ISF (VND/sao/crop)
N6	Trungthanh	20.000
	BacThanh	30.000
	XuanThanh	30.000
	Bac Long	35.000

Source: Farmer's questionnaire survey; 1 sao = 360m²

7.3 Results—Analysis of Irrigation Management Transfer in N6

The section describes the results from interviews with two AC leaders, two IMC staff in the North Nghe An IMC, and two on-farm irrigators, two focus group discussions with the four members of the N6 WUO, and four IMC staff in the Yen Thanh subsidiary of the North Nghe An IMC, and 50 farmers who completed the questionnaire (28 men and 22 women).

Table 7-5: Demographic information about participants

Age (In Years)	N	Education	N	Canal locations	N	Income	N
21-30	8	Primary	11	Upstream	20	Low	12
31-40	15	Secondary	21	Middle	13	Middle	36
41-50	16	High school	13	Downstream	17	High	4
51-60	8	Tertiary	4				
61+	3						
Total	**50**		**50**		**50**		**50**

The age of respondents in N6 ranged from 21 to 62 years old. Family size ranged from 1 to 6 people. An average of 2 family members were working on farms.

Following the evaluation framework (see methodology chapter) seven categories were used to evaluate IMT in N6. They include: financial arrangement, water supply management, maintenance of irrigation facilities, agricultural benefits, economic impact on farmers, social effects, and governance aspects of IMT. They are discussed in turn in the following sections.

7.4 Financial Arrangements for irrigation system management

7.4.1 Allocation of government subsidies

N6 WUO received 10% of the Government's ISF waiver subsidy based on the total area of agricultural land under irrigation based on the provincial decisions. The on-farm ISF is the main source of funding for O&M of N6's secondary canal and tertiary canals. Ninety percent of the Government's ISF waiver subsidy is kept by the Yen Thanh subsidiary IMC for O&M of headworks.

7.4.2 Financial management

According to the 2012 Nghe An province report (Luc, 2012) the problem of canal degradation is not because of a funding shortage. It stresses that the ISF has been significantly increased since it was subsidized by the Vietnamese government. Findings in this study conflict with the provincial report. According to participants, lack of sufficient funding is one of the biggest problems to resolve in the N6 system.

7.4.2.1 WUA member's salaries

Three out of five IMC staff in both interviews and group discussions said that before the IMT, there was a serious shortage of funding for the WUO (WUA) for O&M of the N6 secondary system both in terms of payment for WUO member's salaries and for maintenance of their irrigation systems.

All five WUO members in the focus group discussion said that they have been paid less than they should have been compared to their efforts. WUOs members were paid less than the basic salary regulated by the Vietnamese Government. The Labour Law implemented in 2013 stipulated that the minimum salary of people working in government sectors should receive is 1,150.000 VND/month (Decree66/2013/NĐ-CP dated 27/06/2013). These respondents were paid around 70% of the stipulated minimum salary. Table 7-5 shows that WUA member payments in 2012 fell below the recommended salary for government sectors.

Table 7-6: Monthly WUO member's salary, 2012

No	Position	N6 (10^3VND/month)	Basic wage (10^3VND/month)
1	Chairman of WUA	800	1.150
2	Vice of chairman	700	
3	Technical staff	700	
4	Accountant	500	

Source: WUA members Interview, Fieldtrip investigation 2013-2014

WUA members stressed in the focus group discussion that in times of difficulty (e.g. when there is a high demand for canal repair, for example during drought) there is little or no budget left over after maintenance to pay WUAs member's wages.

> *The biggest problem is the financial problem. The subsidy from the North Nghe An IMC is insufficient for our O&M. Also, most of us have to work for the Agricultural Cooperative and the WUO at the same time. In some cases when operating costs are excessive for example spending on rubbish collection, or there has been a long period of drought, the budget runs out and we just work as volunteers [Focus group, WUA members, N6].*

This problem was also identified by the rector of the North Nghe An IMC and all members in discussions with the subsidiary IMC. They understand the problem of the WUO (WUA), and they admitted that instead of keeping all four members of the WUO, now only one or two WUO members are burdened with all O&M duties. Instead of paying salaries for all four WUO members, these members, who are also working and paid by an AC, use salary savings to hire farmers to do O&M of the N6 secondary canal. Hired farmers are paid for their work after the successful completion of a single crop.

> *I know their salary is too low and it is insufficient for the WUO. They get paid around 500 VND, so the members of WUO are usually rotated between the four leaders of the ACs They consider their roles in the WUA to be supplementary [to their AC jobs] [Interview, ID (1), IMC staff, N6].*

> *In order to reduce the financial burden, instead of four to five members like before, the N6 WUA now keeps only two members, and in some urgent cases they hire farmers to implement dredging and cleaning canals [Focus group, IMC staff, N6].*

7.4.2.2 On-farm irrigators wages

When asked about the difficulties faced in managing the tertiary canals, members of the WUO (WUA), subsidiary Yen Thanh IMC staff and two on-farm irrigators in Bac Long commune thought that the wages on-farm irrigators received from farmers were low compared to the effort they spend. Respondents thought that the limited funding for O&M of the tertiary canals systems was not a problem of the IMT. Funding was too low both before IMT too. The reason given is that farmers collectively agree to pay low on-farm costs.

> *I can say no one wanted to take this job because they are paid too little. It is around 500 VND per crop [Interview, ID (2), IMC staff, N6]*

> *It was hard for us to persuade farmers to take this job. They said they have to work hard, and sometimes farmers blame the problem of water shortages on them. So some of them work only one year and then they ask to resign [Interview, ID (2), AC member, N6]*

And on-farm irrigators stated that:

> *I only receive 30,000 VND and 40,000 VND per day for my job. It is hard to stay with this job. I consider this job like an additional job. My main job is working on the 6 "saos" of my family's farm. I am working like a volunteer to deliver water for farmers in my area. [Interview, ID (1), on-farm irrigator, N6]*

7.4.2.3 Irrigation service fee

The results show that 86% (n=43/50) of farmers thought the on-farm ISF is acceptable. They said the fee price was appropriate for their income.

7.5 Water Supply Management

One of the objectives of this thesis was to investigate whether the IMT resulted in an improvement in the quality of irrigation supply service. Following the evaluation framework water supply management performance is assessed following three indicators: (1) timeliness of water distribution, (2) Adequacy of water supply and (3) Equity of water supply. Figures 7-7 and 7-8 illustrate the farmers' satisfaction in regard to water supply management in the N6 irrigation system before and after IMT. Table 7.7 and 7.8 provide an overview of attributes of respondants rating satisafaction regarding water supply management.

Figure 7-8 shows perceptions of respondents in regard to their satisfaction with water management before the IMT. Eighteen percent of respondents were dissatisfied across all three measures (timeliness, adequacy, and equity). It also shows that almost 90% of respondents were either very satisfied or satisfied across the three measures after the IMT.

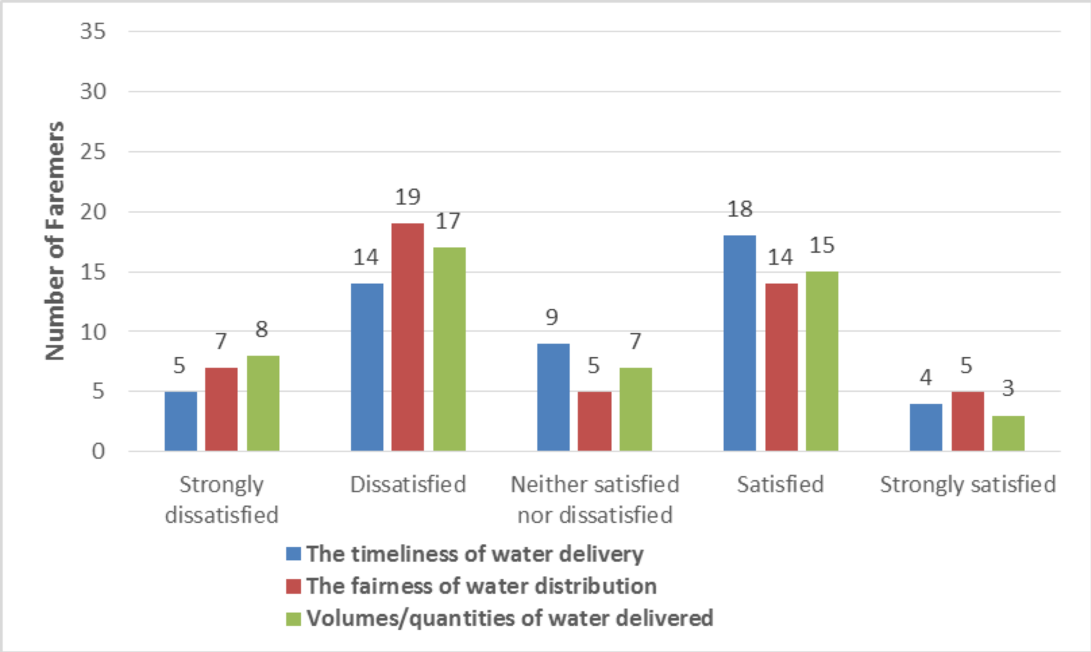

Figure 7-7: Respondent perceptions about the impact of IMT regarding water supply management before IMT

Source: Farmers' questionnaire survey 2013

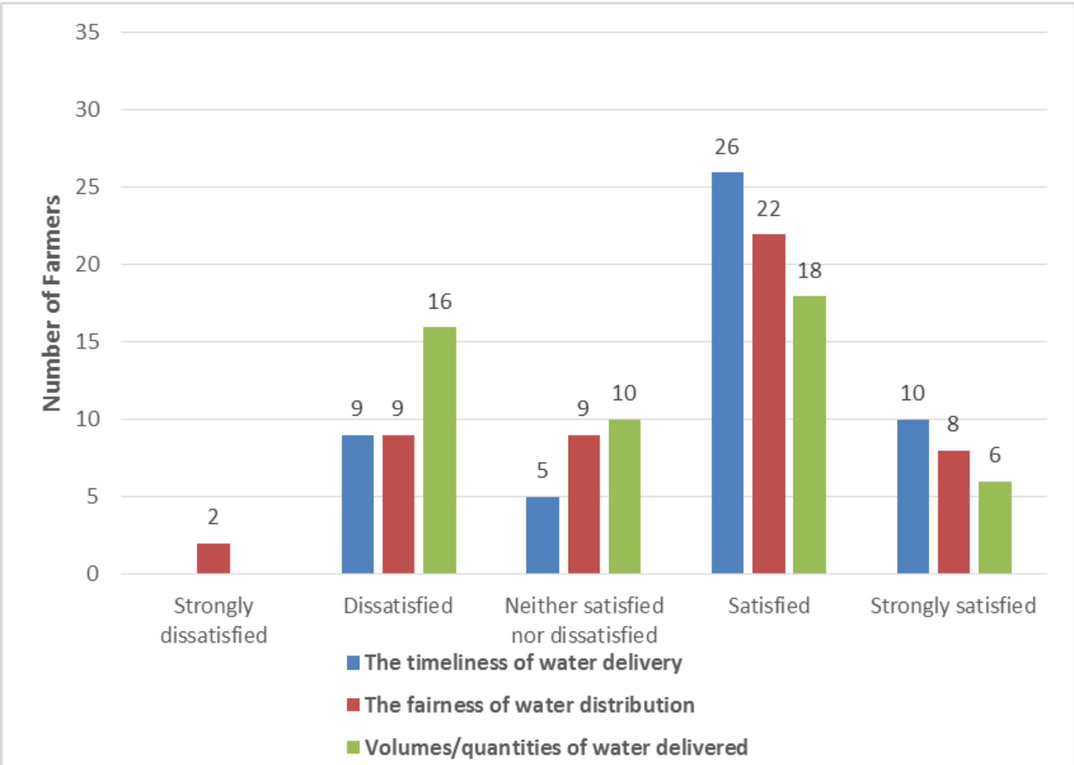

Figure 7-8: Respondent perceptions about the impact of IMT regarding water supply management after IMT

Source: Farmers' questionnaire survey 2013

Table 7-7: Attributes of respondants rating satisafaction regarding water supply management

Indicators	Farmer's satisfaction	Number of farmers	Gender		Canals Location		
			Women	Men	Head	Middle	Tail
The timeliness of water delivery	Strongly dissatisfied and disatisfied	19	5	14	4	6	9
	Neither satisfied nor dissatified	9	3	6	2	5	2
	Strongly satisfied and satisfied	22	12	10	12	4	6
The fairness of water distribution	Strongly dissatisfied and disatisfied	26	12	14	6	9	11
	Neither satisfied nor dissatified	5	2	3	2	2	1
	Strongly satisfied and satisfied	19	7	12	12	2	5
Volume of water deliver	Strongly dissatisfied and disatisfied	25	13	12	5	8	12
	Neither satisfied nor dissatified	7	4	3	3	3	1
	Strongly satisfied and satisfied	18	5	13	11	2	5

Table 7-8: The description of the respondants about water supply management before IMT

Indicators	Farmer's satisfaction	Number of farmers	Gender		Canals Location			Household Income		
			Women	Men	Head	Middle	Tail	Low	Medium	High
The timeliness of water delivery	Strongly dissatisfied and disatisfied	9	2	7	0	3	6	4	5	0
	Neither satisfied nor dissatified	5	2	3	2	2	1	1	1	3
	Strongly satisfied and satisfied	36	18	18	18	7	11	7	26	3
The fairness of water distribution	Strongly dissatisfied and disatisfied	13	4	7	0	2	9	3	7	1
	Neither satisfied nor dissatified	9	3	6	4	3	2	2	5	2
	Strongly satisfied and satisfied	30	15	15	16	9	5	5	21	4
Volume of water deliver	Strongly dissatisfied and disatisfied	16	5	11	2	4	10	6	9	1
	Neither satisfied nor dissatified	10	3	7	2	3	5	0	6	4
	Strongly satisfied and satisfied	24	13	11	15	6	3	3	17	4

Overall, after the IMT farmers reported greater satisfaction with water management. Education, gender, and household income did not affect respondents' satisfaction. Table 7-8 shows the most important variable influencing satisfaction was the location of the respondent's farm along the canal. After the IMT, almost all dissatisfied water users in regards to water supply management are located at the tail of canals. Detailed information reagrding farmer's perceptions about water supply management is presented in the following sections.

7.5.1 Timeliness of water distribution

As can be seen in the difference in Figures 7-7 and 7-8, there was a slight increase in the number of farmers satisfied with water timeliness since the transfer of the N6 system. After the IMT, over 70% (n=36/50) of respondents were satisfied or strongly satisfied with the timeliness of water supply compared to 44% (n=22/50) before. In addition, the number of farmers dissatisfied with the water timeliness of water delivery fell from 19 to 9 farmers.

The reasons given by those who gave positive responses is due to concreting of the headwork from Doluong dam and 300m of 6000 m of the secondary canals from the N6 in take 1996.

The leader of WUO is responsible for all water-related issues for the secondary canals. During the water supply period, the WUO members go to the field and check the volume and arrival of the water supply. The members have cooperated with on-farm irrigators to manage water delivery and sure it arrives on time. During AC meetings farmers are reminded about the water calendar and the water supply schedule as well as by loud speaker on the days water is delivered. Farmers are encouraged to be present on their farm on water delivery day to ensure their water farming borders are well-managed to avoid water loss. WUO members and on-farm irrigators work closely together during the water supply period.

The water supply calendar has been developed for both main and spring crop seasons and is updated after each crop. Water supply schedules are based on an agricultural production plan and the water supply requirements for each ACs. The N6 WUO and the Yen Thanh subsidiary IMC decide the water schedule for individual ACs.

The improvement in the timeliness of the water supply was confirmed by two WUO members in the focus group discussion. They said that WUO members usually made contact with on-farm irrigators and the managers of the four ACs to discuss specific water supply matters that helped ACs to actively implement the agricultural production plan. In addition, they also illustrated that since the N6 WUO was established, the time to fix problems during water delivery has shortened. For example, water leaks and broken canals are repaired promptly. Respondents indicated that during water delivery before the IMT, farmers in four communes had to report any problems to the Yen Thanh subsidiary IMC and wait for their responses. After IMT, the N6 WUO has the right to deal with problems to ensure smooth supply of water.

> *There has been an improvement in the equity of water distribution and more transparent water allocation after the N6 scheme was transferred. We are more active and quickly respond to farmer's complaints. We directly solve problems of O&M. Before the IMT, farmers needed to ask the North Nghe An IMC instead. It took long time to deal with problems [Focus group, WUA members, N6].*

7.5.2 Equity of water supply

In N6, farmers' perceptions about the fairness of water supply were more positive than the other factors of timeliness and adequacy of water supply after the IMT. Before the IMT 46% of all farmers (n=23/50) said they were dissatisfied or strongly dissatisfied with the fairness of water distribution. After the IMT the number of those farmers is significantly reduced to less than one third of respondents (n=11). After the IMT 60% (n=30/50) of farmer's opinions indicated that they were either satisfied or strongly satisfied with the fairness of water supply after the transfer.

The reasons for this improvement are discussed below. In principle, the main role performed by WUO members in terms of water delivery is to ensure water supply through the secondary canal to the beginning of the tertiary canal system. A "downstream priority" has been developed by the WUO, meaning that farmers furthest from the opening of the N6 secondary canal have first access to water. Bac long commune located at the end of the canal accesses water first, then Xuan Thanh, Bac Thanh, and lastly Trung Thanh which is closest to the opening of the secondary canal. This practice was introduced to ensure every farm along the canal has an equal chance to withdraw water. Prior to the establishment of the WUO, individual irrigators from the four ACs spontaneously and individually opened the gate of the N6 canal to take water for their farm when it suited them.

7.5.3 Adequacy of water supply

The majority of farmers in N6 reported there was not much change in the volume of water supply after the IMT. 50% of all farmers (n=25/50) farmers were dissatisfied or strongly dissatisfied with the volume water they received before IMT, still 36% (n=16/50) of respondents said they were not satisfied after the IMT.

Almost all of respondents who gave positive comments were farmers located at the head of the N6 secondary canal (Trungthanh and Bacthanh communes). These two communes are very close to the opening gate, so they easily access water and receive an adequate volume of water.

> *Actually, I can say that it has been very easy to get water both before and after the transfer because we are located in the head of canals. Even if my farm gets insufficient water I can deliver it by myself, even when the water schedule belongs to downstream farmers [Farmer, N6, ID (6)].*

> *In the past, it was difficult for us to access water. I remember my husband usually had to be outside the farm for the whole night in order to wait for water to be delivered to our farm. In some cases, he could not get water because upstream farmers withdrew all the water. Recently, although the amount of water is not always sufficient, the water supply is better. Every farm can have water more or less [Farmer, N6, ID (36)].*

In all of three aspects, there is still a number of farmers still were unsatisfied with the water management. They explained that water supply management in both main and spring crop seasons had worsened. They stressed that almost of spring farming is now abandoned. Farmers claimed they did not know the water supply schedule and were not informed when water was to be delivered to their farm. In some seasons agricultural production was very low because of severe water shortage. As a result, in some villages there has been a reported reduction in planting the spring square. In N6 there has been a move from irrigated agriculture to other sectors because agricultural productivity is insufficient for their livelihood.

> *There is not much difference between before and now. You can see the canal. There is no water in canals even though we need water for cultivating our farms. There was a significant reduction of rice production last year because of lack of water for production. This led to an increase in pests. We have nearly two "saos" we could not cultivate. My husband was an on-farm irrigator in my village, however he had to withdraw his role because*

> *farmers re-elected this season. They hope a different person will do the job better—to deliver sufficient water for our village. [Farmer, N6, ID (46)].*
>
> *It was very difficult to access water for not only for my family, but many households lost their crop. The reason is because when the rice field needs water at the peak time in order to give the highest productivity there was no water supply at that time. There was a loss of most of agricultural productivity this summer season because of water shortages [Farmer, N6, ID (43)].*
>
> *It is too short supply time for my village. So, sometimes we are unable to access water. Floods and droughts happen many times during a year. It is very difficult to get enough water as you can see here. There is not much water in the canal. My family needs water at critical times because we need it to grow rice. Sadly, there was a significant reduction of rice production last year because of a lack of water for production. [Farmer, N6, ID (45)]*

During the focus group discussion with N6 WUO staff, all four participants confirmed water supply shortages to be a real problem. They explained the N6 system shares water with several other downstream intakes and that water deliver is controlled by the Yen Thanh subsidiary IMC, and that sometimes supplying water is out of their control. The Director of the North Nghe An IMC also raised concerns about the shortage of water delivered from the headwork. They explained there had been a reduction of water supply from the Lam River which led to a reduction of water supply not only in the N6 scheme but also for all irrigation systems in the province.

Furthermore, they indicated that in some circumstances a large volume of water is evaporated during periods of hot weather. This has contributed to severe water shortages in this area. All farmers from Long Thanh commune in 2012 experienced very serious water shortage problems. Some farms lost almost all of their crops because when farms should have been receiving their largest volume of allocated water they did not receive any. N6 WUO members also illustrated currently, they have tried to minimise the effect of drought.

Even under severe conditions, water is still supplied to farms through the effort of WUO members.

> *We sometime receive farmer's complaints about water shortages, especially from the Long Thanh commune. For some crops, we do not get sufficient water from the headwork, so it is difficult for us to bring adequate water quantity to farmers [Focus group, WUA members, N6]*

> *We also need farmers to understand that water sources are limited. Sometimes the temperature is over 40 degrees. Water is evaporated and we have to extend the water supply for farmers, but the amount available is not always adequate [Focus group, IMC staff, N6].*

7.6 Operation and Management of Irrigation Facilities

Overall, the quality of irrigation infrastructure has not improved much since the N6 irrigation system was transferred. Limited government budgets, a low ISF, and lack of farmers' participation in irrigation management have led to very poor irrigation maintenance.

7.6.1 Operation and Management of the N6 secondary canal

Now the N6 WUO members implement only the most basic of duties and short-term maintenance activities, such as removal of silt and weeds, rubbish collection, and minor repairs. As a result, some respondents think that the major responsibilities for O&M should be returned to the North Nghe An subsidiary IMC. The Vice-rector of the North Nghe An IMC stressed that the inefficiency of the WUO has been well understood for a long-time. However, because his company closely follows the PPC policy he is unable to change the situation. The PPC policy dictates the financial model and roles and responsibilities of WUAs. Under extreme circumstances the North Nghe An IMC can help the WUO by sending technical support or by directly dredging canals.

> *The N6 secondary canals have been degraded since it was transferred to N6 WUO. Due to financial difficulties, they could not implement major repairs. As a result, in order to ensure political stability it is vital to ensure water supply for farmers so they can cultivate on their farm. So my company sometimes sends technical support or implements operational activities [Focus group, IMC staff, N6]*

During the field trip observations were made of the degraded canals from the beginning of headwork (as presented in Figures 7-9, 7-10 and 7-11).The majority of canal sections are made of earth. In some channel sections, the offtakes are managed manually by filling the canal with soil to control water supply from the N6 secondary to the tertiary canal systems. This temporary method results in water being distributed to where it may not be needed or wanted as the blocking system is inefficient and some water will be lost to upstream canals. This also works to delay the arrival time of water for downstream canals.

Figure 7-9: N6 secondary headwork degradation

Source: Fieldtrip observation 2013

Figure 7-10: Irrigator closing the offtake by filling canal with soil, 2013

Source: Tuyen (2013, p.74)

Figure 7-11: Earthen secondary canals

Source: Fieldtrip observation 2013

The majority of farmers (more than 80% of respondents n=42/50) complained about the poor quality of maintenance works. Main complaints were about the degradation of irrigation systems and the problem of rubbish disposed into canal systems.

Farmers indicated that due to a lack of maintenance, moss and grass have grown in canal systems and blocked them. The earthen channel banks are eroded and not repaired. These things lead to poor performance of the canal systems.

> *It was too long after transfer, the N6 secondary canal was not upgraded, and too much sediment and grass cover the systems. If these problems are not fixed it seriously impacts water supply [Famer, N6, ID (13]*
>
> *There is serious degradation of irrigation systems both in N6 secondary and its tertiary canals. It takes too long to deliver water to our farm because we are at the tail of the canals [Farmer, N6, ID (38)].*

The poor quality of irrigation system maintenance was confirmed by all four WUO members in the focus group discussion, five IMC staff in both the focus group and interviews, and two AC staff. Two reasons given as to why there are such serious problems are first due to financial shortages in N6 WUA, and second because farmers lack awareness and dispose large volumes of rubbish into the canals.

7.6.2 Operation and Management of tertiary canal systems maintenance

To ensure canal capacity to deliver water to farms, tertiary canal systems are dredged and cleaned by on-farm irrigators before every crop. When farmers were asked the question “What is the greatest challenge of current irrigation management for your community”, the majority of farmers (88%; n=44/50) said that on-farm earth canals are badly degraded. Only 30% of tertiary canals are concreted in Bac Thanh and 35% in Xuan Thanh. Every two to five years AC leaders said they launched ‘campaigns’ (policies/plans) to rally farmers to clean and concrete the existing canal systems, or to build new on-farm channels. Two AC leaders explained that farmers were encouraged to give money, materials, and labour to upgrade the tertiary systems. These activities sometimes involved participation of volunteers from the women’s union, youth groups and farmers. Some households contribute labour, others pay money.

> *There are 9 villages, each village has two on-farm irrigators responsible for daily dredging and cleaning of canals during the water supply period. About every two to five years, depending on the demand for maintenance of the tertiary canals, we launch a campaign to encourage farmers to upgrade one or two canal sections. However, it cannot be implemented frequently because many farmers are poor, so they cannot not afford to give money [Interview, ID (1), AC member, N6].*

> *When canal sections are too degraded we have to call for farmers’ contribution. Each family pays an equal amount of money. Then we hire farmers in our village to implement the maintenance or preparation [Interview, ID (2), AC member, N6].*

7.6.3 Waste management

Waste management is another serious obstacle preventing the efficiency of the N6 irrigation systems. This problem was identified by 30 farmers and four WUA members and two out of five IMC staff. Waste disposal is not only preventing downstream farmers to access water but also negatively affecting long-term performance of canal systems. Three main kinds of rubbish are dumped into canals: waste from agricultural operations, from households and from village road construction.

7.6.3.1 Agricultural Waste

Rice is the main agricultural product in N6. Farmers also grow sweet potatoes, potatoes, corn or vegetables in the spring crop. Rice harvesting leaves a lot of straw waste. Part of this waste is used to feed livestock or it is burned. However, the remainder is thrown to the rice fields and then drained to the canal systems or directly disposed into canals. Pesticide containers including plastic bags and bottles also are also discarded or washed into canals another and affect water flow in N6. Waste disposed into a rice field is shown in Figure 7-12.

7.6.3.2 Household waste

Lack of a waste collection service or system is a major problem leading to pollution in the communes. Many communes had established waste collecting systems in the past, however the lack of a long-term strategy and low staff payment has resulted in ineffective practices; waste collection groups have disappeared. As a result, a huge quantity of waste is disposed directly into the environment. It is thrown on the road and in rice fields. Some is thrown directly into the canal systems and blocks water flow.

Figure 7-12: Waste from rice field in N6

Source: Fieldtrip observation 2013

7.6.3.3 Housing and road construction waste

Solid waste from road construction dumped into the canals is another problem in N6. Recently, there has been significant development in agriculture. Many roads have been concreted with Government funding, replacing earthen roads. Farmers have also invested their money into extending their house square. At times expanding house size includes building over and covering canals (Figures 7-13 and 7-14). As a result, during construction, gravel or sandstone is dumped into channel systems and block water flow.

Figure 7-13: Rock and sandstone dumped into canals in N6

Source: Field trip observation 2013

Figure 7-14: Famers close canal in front of their houses in N6

Source: Field trip observation 2013

Every year N6 WUO spends a large amount of money and labour collecting waste from canals. This problem has existed for a long time and they have not yet found solution. In some seasons almost the entire 10% subsidy that N6 WUO received from the Government was used to maintain canal systems. Two out of three IMC members also realized the difficulties the WUO faces and they reported that in some crops the Yen Thanh subsidiary IMC sent their staff to assist WUO to dredge N6 canals and collect waste before the water delivery period.

One part of N6 canals goes along the road. This canal is open so rock and soil from roads are easily disposed into the canal. It costs both money and labour to collect it every year. We did spend a lot of effort to dredge the canal system and minimise the negative impact on the environment. In some seasons almost the entire budget is spent on hiring people to collect rubbish to ensure farmers downstream can access water [Focus group, WUA members, N6]

The problem of rubbish disposed into canals is serious, especially when the canal runs along the road. We know it is very difficult for N6 WUO. Their funding is limited but there is huge amount of rubbish that needs to be collected every crop. So in this area, it seems out of our control now. [Interview, ID (2), IMC staff, N6].

7.6.4 Quality of irrigation systems maintenance

When asked *"Do farmer think quality of maintenance of N6 systems has changed since the transfer"* information was gathered from 50 farmers. Figure 7-15 displays the result of IMT on irrigation maintenance. Ninety-six percent of farmers thought there had been improvement to irrigation management but the bulk of respondents (86%; n=43/50) thought the change was marginal.

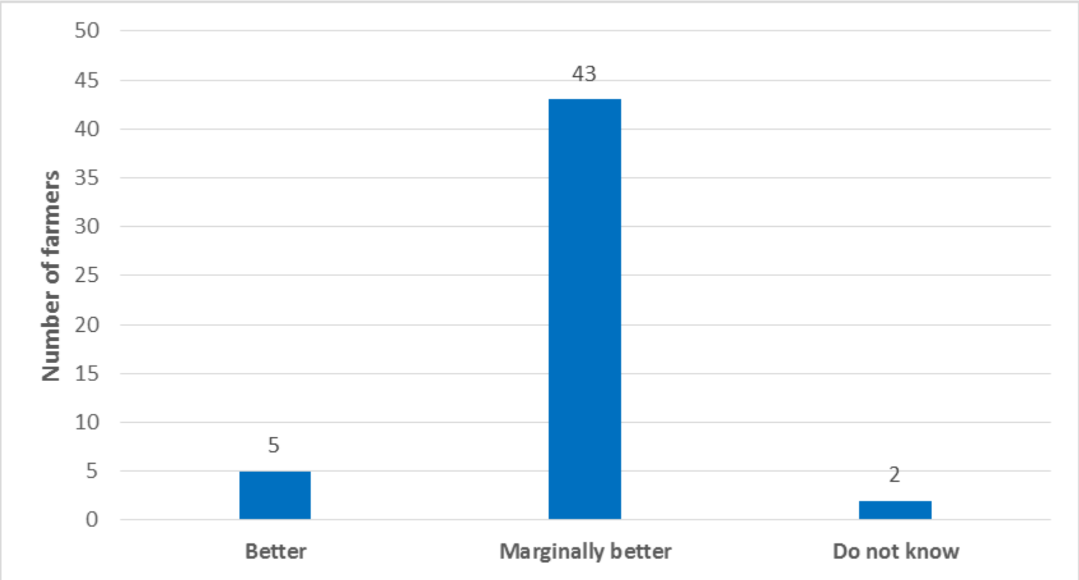

Figure 7-15: Farmer's respondent perception about the change of irrigation maintenance

Source: Farmers' questionnaire survey 2013

Farmers stressed that in the initial five years after the IMT the canal systems were well maintained by the N6 WUO it managed the N6 secondary canal. However, approximately five years after transfer (since 2000), maintenance activities have been ignored and this is negatively affecting water supply management in this system.

7.7 Agricultural Benefit

When asked if agricultural productivity had improved as a consequence of IMT and hence WUA management of irrigation systems, half the respondents (n=25/50) thought it had (Figure 7-16.). In contrast, one third of respondents (n=15/50) thought that agricultural productivity had not changed under the management of WUOs.

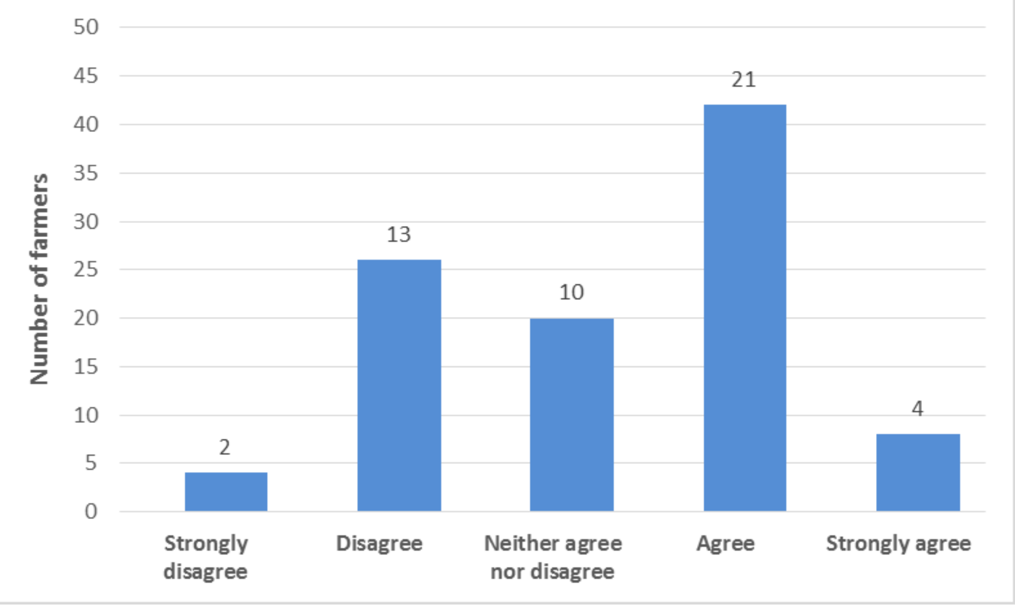

Figure 7-16: Respondent perceptions about the impact of IMT on increasing agricultural productivity

Source: Farmer's questionnaire survey 2013

Of the respondents who thought agricultural productivity had increased after the transfer two main reasons were given: improvement in water supply and the increase in area of land under irrigation.

7.7.1 Change in crop yield

Farmers who agreed that the IMT has brought positive impacts to agricultural production thought that individual farms were supplied a reliable amount of water. There was now guaranteed delivery of water, even during the dry season, in quantities needed by farmers. Respondents commented that the role of the IMT in securing reliable delivery of water has assisted healthy rice growth with high productivity. In addition, an adequate water supply to farms has reportedly reduced the intensity of some diseases. When irrigated crops are supplied with sufficient water it creates adverse living conditions for pests and minimises the spread of these pests and diseases. For example, there are two sensitive stages during harvest when rodents can seriously damage agricultural fields: when there are young seedlings, and just before harvest.

> *Increased regular supply of water has reduced insects and mites, weeds, plant diseases, snails, slugs, rodents that consume enormous quantities of seed and grain in rice production. My household productivity has increased from 230kg/sao to 320kg/sao in main crop [Farmer, N6, ID (4)]*

> *My family's livestock depends on rice production. Water supply is now adequate and suitable for rice cultivation, so rice productivity has significantly increased compared to the past. As a result, my family income is not only sufficient for living but also we have money to spend on my child's education [Farmer, N6, ID (29)]*

> *My family's two "saos" (1sao= 360m^2) were usually destroyed by blast disease due to lack of water supply. It is necessary to deliver water to rice fields at specific times for rice development, but due to the lack of water supply this area was not supplied, so we lost almost all our of produce. This area is now supplied regularly so we can cultivate on this farm. We get nearly 400kg per two crops [Farmer, N6, ID (41)].*

7.7.2 Increased crop diversity

Increased crop diversity was identified by 40% (n=20/50) of respondents as an important change since the IMT. Farmers said that instead of growing rice, tomatoes, beans and potatoes are grown as well as other agricultural products with high economic value such as flowers. Some have extended to the husbandry of pigs, fish, buffaloes, and ducks to increase their agricultural production.

> *I can say if water is not sufficient rice production will be badly affected. On-farm irrigators are working with more responsibilities than before to supply water for us. In some cases their family members also help to deliver water when our village needs it. My family income has increased because we have extend 1 "sao" to grow flowers to sell in the Tet vacation. [Farmer, N6, ID (43)]*

> *The North Nghe An IMC only focused on supplying water for two main rice crops before IMT. However, when WUA manages N6 systems, besides the main crop they also supply water for the spring crop to help us cultivate vegetables or potatoes. My family has adequate water in our ponds to grow fish. Agricultural output has risen significantly. [Farmer, N6, ID (38)].*

7.7.3 Expansion of irrigated areas

Of the 25 farmers who said they had expanded their irrigated area, one third of them (8/25) agreed that the IMT has assisted farmers to increase areas under irrigation. They explained that there are two kinds of agricultural expansion. First, due to improvements in the quality of the irrigation service, water is delivered to areas that could not be cultivated before. Second, more crops were cultivated - now across two seasons instead of one. A variety of spring crops were grown including vegetables such as tomatoes or potatoes. Eight households in Xuan Thanh commune, located in the middle of canals, expressed their happiness stressing that has been water supplied for two main crops.

> *Currently, irrigators are helping us to deliver water to individual farms. We did not meet any problems with water. I also extended the vegetable square to sell them in the local market (Farmer, N6, ID (15)]*

> *It is much better in terms of water delivery. We get water to our location not only for my family but also for my community; we increased the spring crop, growing flowers and vegetables that were only rice square before. This kind of production brings much higher profit than rice [Farmer, N6, ID (40)].*

Three out of five IMC staff showed their positive belief about the impact of the IMT. They stated that almost all agricultural areas are used to cultivate only two main rice crops. Before the IMT because of water shortages there were two to three months where farmers could not grow any crops. Food shortages occurred as a result and farmers experienced a really hard life. However, after the implementation of the transfer program, farmers were trained to improve their knowledge and encouraged to grow crops in abandoned fields and to grow some kinds of vegetables that required less water.

7.8 Economic Impact on Farmers

Economic performance is examined to better understand how irrigation systems transfer has affected farmer’s livelihoods and their communities. A change in household income has been an important outcome of the IMT in N6.

When asked if household income had increased as a result of WUO management of their irrigation systems, overall farmers’ responses in N6 were in agreeance. Just under half of participants (n=23/50) agreed they received a higher income when N6 irrigation systems management was transferred to the WUO. One third of farmers in N6 did not think the IMT had brought a significant increase to their household income (n=16/50) as presented in Figure 7-17.

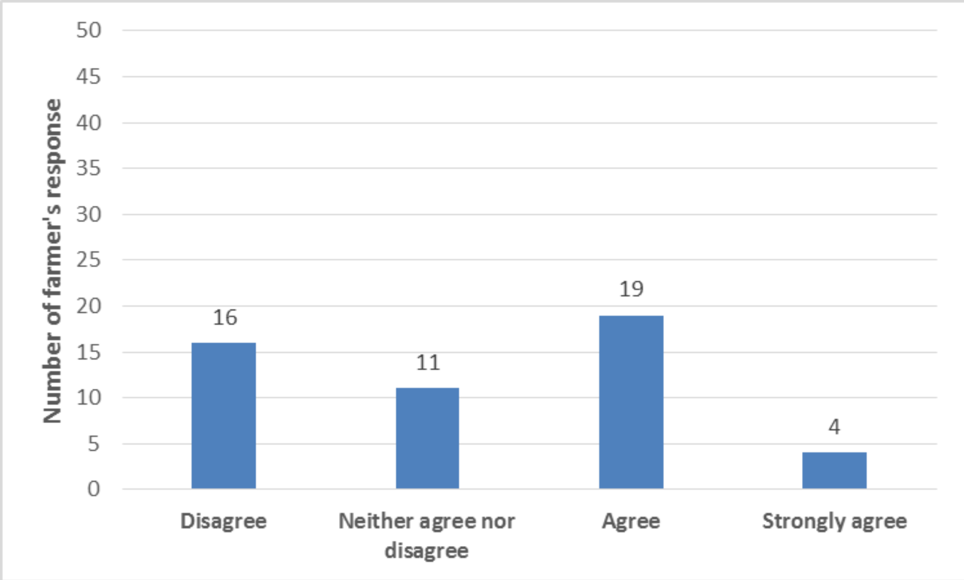

Figure 7-17: Respondent perceptions about the impact of IMT on increasing household income

Source: Farmers' questionnaire survey 2013

7.8.1 Increased income from agricultural production

When farmers were asked why their household income had increased after the IMT, 23 farmers said that the rise in agricultural productivity is the most significant factor to increase household income.

Some farmers explained that they no longer had to spend so much time working on their farms. Other sources of income were possible due to a reduction of labour in farming practices.

> *My family income has slightly increased from 27 million VND to 40 million VND after IMT (Farmer, N6, ID (43)]*

> *There is a significant increase in my household income, the main change is moving "two saos" from rice production to grow vegetables and I can cultivate three crops per year. It brings large amounts of money for my family [Farmer, N6, ID (13)].*

7.8.2 Increased income from diversification to other industries/sources

Twenty nine participants including 21 farmers, and four IMC staff and all four WUA members agreed that time pressure doing farm labour had been reduced after the IMT. Some of the farming work force was now able to be released from agricultural production activities. The reason given for this release is that WUO members and on-farm irrigators now help villages to deliver water to individual farms instead of every household having to help retrieve water as they did before the IMT.

This release of family members from farming duties means they have been able to take up other forms of employment. They have opened small businesses or moved to other places or cities to work on construction sites or in clothing factories. Goods produced in small businesses include grocery shops and tofu production. Household members return to full-time farm work during harvest when a larger labour force is needed.

> *Agricultural production now does not require as much labour as before, so I am now the main person responsible for farming. My wife has opened a small grocery shop to sell some necessary items for this commune; because my house is located centrally [Farmer, N6, ID (21)]*

> *Working on the rice field now is much easier than before. Some of the labour force is released from agriculture. Water supply is managed by WUO. I am informed by the AC or on-farm irrigators the date that my field plot is supplied with water and I just go to my farm on that day to ensure that the water supply is adequate for my farm, and that my farm borders are protected to avoid water loss from my farm to others. My wife started making tofu to sell in the market from 2007(Farmer, N6, ID (35]*

> *Not only me but also some other people in my village go to work for private construction companies in my area. I have just come back to help my wife. Now it is the harvesting season. Due to the supply of water, we also grow fish and harvest twice a year instead of once, as it was before [Farmers, N6, ID (41)].*

7.9 Social Performance

Numerous social benefits have been reported on the basis of the IMT. Farmers' participation in decision making; more productive meetings and leadership building; reduction of conflicts between farmers; and sharing roles between men and women are discussed below.

7.9.1 Farmer participation in irrigation management

Farmers have been encouraged to participate in irrigation management in the N6 system for a long time, before the IMT and after it.

Two-thirds of farmers (n=32/50) agreed that technical staff supported the farmers' ideas when the tertiary canals were upgraded or maintained but farmers were not encouraged to participate in the construction of the N6 secondary canal systems.

IMC members suggested when the donor ADB project was implemented in Nghe An, project support provided for concreting the headworks. Farmers participated by giving money and materials to help upgrade the N6 secondary canals and some sections of tertiary canal systems.

> *ADB supported with money to build and concrete the headwork and the N6 intake whilst farmers offered support through their labour and money to upgrade their on-farm canal systems [Interview, ID (2), IMC staff, N6]*

Two AC leaders agreed that in their commune farmers are encouraged to participate by offering their labour and money to help concrete degraded systems as part of the three to five year ‘campaigns’. Discussions between ACs and farmers during the annual AC meetings decide how much money, and how much labour is needed. Decisions are made when there is majority agreement among participants.

7.9.2 Leadership capability

The managers of ACs are elected by the congress participants who representatives for farmers from every village. They are allowed to take the position no longer than 5 years.

At the village level, leaders of each village and on-farm irrigators are elected by farmers from the village meetings.

When the N6 WUO (WUA) was established the members were elected by farmers and they represent four communes to O&M the N6 secondary canal. However, in recent years, due to the financial difficulties, the members of WUO (WUA) were not elected by farmers; they were appointed by the North Nghe An IMC.

7.9.3 WUA meeting frequency and productivity productive meetings

At the commune level, the interview with two AC managers, interview with IMC staff, the Congress of cooperative members of AC is organised once a year according to the Agricultural Cooperative Law in 1996.

At the village level, majority of farmers (n=46/50) said that village meetings are typically organized around each crop cycle, of which there are two meetings per year. Meetings are organized by village leaders and AC representatives.

However, congress parties between the N6 WUA and farmers have not been organised for a long time. Due to the initial regulation when the N6 WUO was established, the congress party (General Assembly) needed to organise one meeting every four years. A number of farmers represent every village and participate in the gathering. Members from the four ACs and district governance (e.g. financial or rural development departments) also are invited by the WUO. During the congress, through the WUO annual report farmers are informed about the achievements from the previous year and existing problems for irrigation management. Farmers elect new WUO members, including the chairman. In the meeting the annual budget, a financial plan, capital purchases, and O&M plans are also approved by water users (farmers). Farmers have an opportunity to present their point of view on how to improve irrigation management.

However, all four WUAs members, two ACs and four IMC staff confirmed that congress parties have not been organised since 2008. Instead, there are internal meetings between WUO members and on-farm irrigators to arrange water delivery in the N6.

> *Before 2005, the N6 meeting was organised once a year and participants from four communes have the right to elect their WUO leader and members. However, there has not been a meeting for some time and N6 WUO only organises internal meetings between them to establish the irrigation plan [Interview, ID (1), AC member, N6]*

> *We have not had a congress party since 2005. We only organised meetings twice a year between us and on-farm irrigators at the beginning and after every crop. Beside water management, labour for WUO is also decided during these meetings. [Focus group, WUA members, N6].*

7.9.3.1 Lack of facilities for WUAs

Field observations led to the conclusion that irrigation management facilities are lacking in N6. The WUO does not have its own office. The focus group discussion was arranged in a building that had the appearance of an abandoned house. The researcher was told it belonged to the Bac Long AC, yet they need to request the use of it from the N6 WUO to organise their meetings.

7.9.4 Conflict resolution

The farmers' questionnaire suggests that there has been a significant reduction in disputes both in number and intensity of conflicts. As can be seen from Figure 7-18, more than three quarters of farmers (n=33/50; 66%) indicated there was a reduction in the number of conflicts between farmers after the IMT in N6.

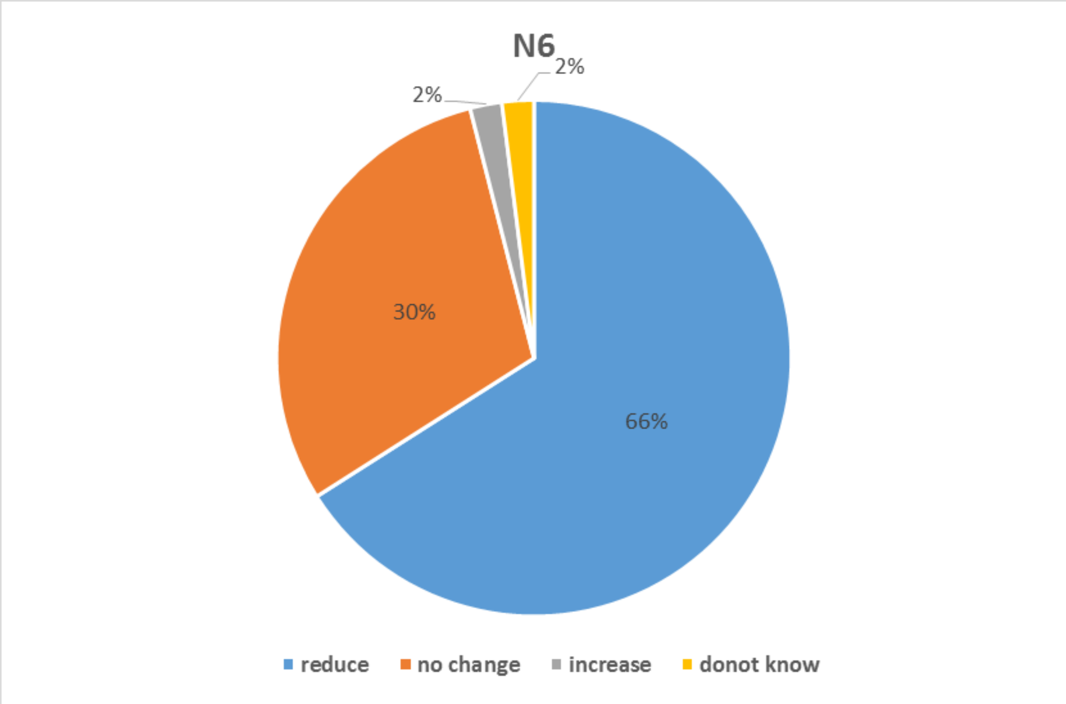

Figure 7-18: Respondent's perceptions about the impact of WUA on reducing conflicts between farmers by percentage in N6

Source: Farmers' questionnaire survey 2013

The most significant outcome of the IMT in N6 is a reported reduction of conflict between upstream and downstream farmers. This achievement was indicated by all six IMC members in both the focus group discussion and interviews, with two AC staff and five WUO members. They explained that prior to the establishment of the WUO, conflict over water allocation was common. It was extremely difficult for the downstream farmers to access water because of excessive and unlawful use by upstream farmers who used more than their allocated 'share'. Conflicts occurred due to inequitable water distribution and supply.

> *In the past, it was very difficult for downstream farmers to access water. Upstream farmers withdrew water from canals at any time they needed it and prevented downstream farmers from accessing water by blocking water flow, especially in the rush of cultivation time. As a result, some serious conflicts happened between them. However, the situation changed since WUOs took over responsibility for the allocation of water. Every village can access water in an orderly fashion due to the "downstream priority". It has helped to reduce a huge number of disputes between farmers at the head and tail of the canal systems [Interview, ID (2), AC member, N6]*

> *The number of conflicts between farmers and between communes has reduced dramatically because the WUO establishes the water delivery schedule so each commune has a fixed timetable for their farm's cultivation. They usually appoint one person to go to the farm and check whether or not there is enough water for each location, then they will deliver water for other areas [Interview, ID (2), IMC member, N6]*

> *We have a very detailed schedule for water delivery. For example, Long Thanh commune can have water in the morning and Bac Long will take their turn in the afternoon. We are also present in the field at that time to ensure that farmers in one commune do not withdraw water when water delivery timetable belongs to another commune. As a result, conflicts have nearly been solved 100% [Focus group, WUA member, N6].*

There has been a reduction in both number and intensity of disputes. Farmers said that on-farm irrigators play an essential role in not only taking responsibility for the delivery of water but also taking action to minimise conflicts between upstream and downstream farmers. If on-farm irrigators did not present when water was delivered, anyone could participate in water delivery, and would create a huge number of problems in terms of both water volume and number of disputes.

> *Farmers at the head canal usually blocked water flow by using bricks or wood when it was not their turn to take water. As a result, arguments and fights happened quite often. There has been a significant reduction due to the management of WUO [Farmer, N6, ID (38)]*

> *Now that the water supply is managed by the N6 WUO the water delivery calendar for every commune is created and during the time of water supply N6 members come and investigate and check the water volume to ensure every commune has adequate water. Farmers are not allowed to get water by themselves, so there are less disputes [Farmer, N6, ID (17)].*

7.9.5 Roles of women

Respondents in the farmers' questionnaire when asked "Who makes the decisions on agricultural production" said that women were actively involved in agricultural production activities. Over haft of respondents (n=29/50; 58%) said that women play an important role in deciding agricultural practices include seeds, pesticides, and water consumption.

Women's roles in the structures of WUO were noticeably limited in the N6 region. Of the five members, only one WUO member is woman. This person works as the accountant and does not have any responsibilities in O&M. As explained in previous sections, due to the financial difficulties facing the N6 WUO, there has been a reduction in the number of WUO members so all O&M responsibilities belong to the chairman and vice chairman.

7.10 Governance arrangements for irrigation management

The roles of WUA members, the linkages between WUAs themselves and relationship between WUAs and other irrigation management entities will be discussed in this section.

7.10.1 Rights, roles and responsibilities

The reduction of roles and responsibilities of WUO members was seen a serious problem in the N6 system. This not only negatively affects irrigation efficiency but also the sustainability of the WUO model. Lack of finance and institutional support from government is considered the main reason for the weakness of the WUO.

In addition, law requires the technical member of the WUO to have completed vocational training and members are re-elected by farmers every two to five years. Yet there is no incentive for farmers to improve their educational status to meet the technical and managerial skill requirement of being a WUO member in N6. This is because there is a lack of security in positions and payment is insufficient.

Theoretically, to ensure equality between communes WUO members are elected, representing each of the four ACs. WUO members are usually AC leaders who work both in the AC and for the WUO. The N6 irrigation system supplies four communes (Bac Thanh, Xuan Thanh, Trung Thanh, and Bac Long) and each commune has one representative member in the WUO to help farmers in individual villages to raise their voice about water management and to help ensure equity in water distribution.

However, results from this study have identified that, due to financial hardship, instead of five members only two members are working for the N6 WUO. WUO member roles are considered to be voluntary, and, in addition to the AC responsibilities. The North Nghe An IMC has to encourage AC leaders to take the WUO member roles instead of them being voted in by farmers. Some WUO members would like to withdraw from their role but the IMC has tried to encourage them to stay and help the IMC to manage N6 irrigation system. IMC staff suggested that there is inequity because WUO members who represent the head of canals have "upstream advantages" and easily access water and have fewer responsibilities than members who are located in the tail canals.

> *The biggest problem is financial issues. Our staff did not even receive salaries because all subsidies go to hiring people to dredge canals and collect rubbish from canals [Focus group, WUA members, N6]*

> *I know it is difficult for them to operate and manage the N6 system. They are only responsible for ensuring the minor repair of canal systems. If they want to do major maintenance work they need to submit a financial estimate document to our IMC and from that we can support for them to implement the operation activity. Currently, N6 WUO keeps only two members instead of 5 initial members in order to reduce the payment, and they hire labour to collect rubbish or implement dredging canals every year [Interview, ID (2), IMC staff, N6].*

7.10.2 Vertical linkage/coordination/communication between tiers of government

It was confirmed by three IMC staff that in extreme circumstances they will assist the WUO to implement major repairs or provide technical support. However, according to the focus group discussion with the WUO and from interviews with the two AC there is a lack of co-operation and support between irrigation management organisations.

Respondents suggested that governance arrangements for irrigation management are not strong or clear enough. The WUO has no authority to deal with actions that negatively affect irrigation performance. As a result, activities such as waste disposal into canals, canal vandalism, and water theft have occurred for a long time but it has been very difficult to eliminate these problems. One IMC staff member raised his concerns about the collapse of the WUA model. He said that in the initial stage the formation of the WUO had received much government assistance including registration, accounting systems, and development of an internal structure. However, over time, the ongoing support dwindled, there was a lack of Government guidelines, and no long-term strategies to sustain the operation of the WUO.

> *I can say that the N6 system was established but is totally lacking institutional guidance to keep it going. If nothing is changed, I think the system will break and the WUO will no longer exist [Interview, ID (2), IMC staff, N6]*

> *We did advise our difficulties with higher irrigation systems management but we still have not received any assistance in order to change our situation [Focus group, WUA members, N6].*

Furthermore, N6 WUO members claimed they did not receive any co-operation from the district transportation department to help control waste. It is difficult to solve these problems because they require the integration of many organisations.

> *I think that the transportation department should take care of garbage dumped into the canals. We did inform them many times but the problems still happen and tend to be more serious [Focus group, WUA members, N6].*
> *We have limited support for WUO operation due to limitations of farmer and our capacity. We know the WUO has problems but we main focus on tertiary canal management [Interview, ID (2), AC members, N6].*

According to the interview with the MARD manager, MARD evaluates the roles of training programs for WUA members and on-farm irrigators. Training programs play an important role in improving both technical and management skills for WUA members and on-farm irrigators which result in increasing effectiveness of irrigation systems management and operation.

MARD requires donor project (ADB or WB) managers to conduct training programs when they launch new water management or technical projects. MARD also establishes a framework for organisations to follow when they conduct training programs.

> *The responsibilities to support WUA members and on-farm irrigators and irrigation system management is an important duty not only for MARD but also for IMCs as well. MARD has already issued many policies to encourage both provinces and donor projects such as ADB, and the WB to conduct training programs for new irrigation management projects. MARD has also established a training framework in order to help lower tiers of irrigation managers educate irrigators and WUA members. The expectation is that participation in these training programs will improve the knowledge of water management of WUAs members and on-farm irrigators. They will also understand necessary techniques to improve the O&M of their irrigation systems [Interview, MARD manager, ID (1)].*

However, participants indicated that training programs were only conducted regularly during the project phase of canal construction. N6 was evaluated as one of the successful pilots in terms of irrigation systems transferred from government to farmers. It was considered to have benefitted both farmers and the government (IMCs). When the project finished training programs ceased from 2008. The IMC agreed that newly appointed WUO members needed to be educated in terms of O&M practices. They said that the central Government should be responsible for conducting training programs for IMC staff and WUA members as well.

According to IMC staff, one of the reasons given as to why there is no longer a training program is that N6 did not have complex technical requirements when it was transferred to WUAs. Leaders therefore did not think it necessary to conduct training programs. Some respondents from North Nghen An IMC thought the central government should conduct training programs for the WUO members.

> *When the N6 irrigation system was transferred to the WUO I think this O&M activity was not a major requirement in terms of technical and management skills so we did not conduct training programs. Actually, in my opinion, the number of WUO members should be reduced from 5 to 2 or 3 [Interview, ID (1), IMC staff, N6]*

> *We also think training programs are important to help WUAs improve their skills and WUA members change over time so new members need to improve their understanding about irrigation management. However, province and national government should conduct these programs because we lack the capacity to conduct them [Interview, ID (2), IMC staff, N6].*

7.10.3 Horizontal links/coordination/communication between WUAs and between communes

It was stressed by all four WUO members that there was lack of co-operation between former and current WUO members in terms of sharing technical support and experience. They had not received any instructions or other documents since they took over these responsibilities from former WUO staff. Their irrigation management skills were based on their experience of their roles in AC management.

> *Actually, we are working based on our experience in different roles. Former WUO members did not share any documents or experiences, especially the technical skills for managing N6 secondary canals. When WUO members retire, new members like us simply have to step in and get on with it without a hand-over or training [Group discussion, WUA members, N6].*

7.10.4 Roles of donor projects

Three IMC staff emphasized that until 2005 when the ADB project was implemented in this location, both irrigation infrastructure upgrades and WUO members' wages were paid through donor project funding. At the same time WUO members and on-farm irrigators were given important responsibilities. When the project finished, the WUO became an independent organisation. All O&M activities funding had to be covered by the 10% ISF waiver from the North Nghe An IMC. Now degradation of the irrigation system is getting worse and the diminished WUO puts pressure back onto the IMC. One of the IMC staff stated that it is better to deliver the 10% ISF waiver to the four ACs and to let each commune manage their own canal sections; they may not need the WUO.

In the focus group discussion with four members of IMC staff they all agreed that the performance of the N6 model had worsened and might collapse if they do not receive assistance from the government.

7.11 Conclusion

This chapter, following the evaluation framework (Chapter 3) has presented the results of fieldwork for the N6 irrigation system. The results illustrate that despite the comprehensive range of benefits afforded by the establishment of the WUO this study has identified a number of unresolved challenges persistent since the IMT.

Respondents in N6 thought that there is serious financial shortfall for the WUO to implement O&M of its canal systems. They thought salaries too low for WUO members and on-farm irrigators compared to the effort they spend on management of irrigation systems. The shortage of funding has a direct impact on the frequency and quality of maintenance activities.

Farmers perceived water supply management to have slightly improved after the transfer. The development of the water supply calendar managed by WUO members has brought surety for timeliness of water distribution. Farmers have an equal chance to access water and in greater volume. However, a large number of farmers explained that water does not arrive as quickly as did immediately after the transfer. This is explained by poor canal construction. The majority of canals are earthen. There has been an increase in the degradation of canals over time. Although farmers are encouraged to participate in irrigation management, the number of concreted canals is low. Farmers don’t have the resources to upgrade canals from earth to concrete.

There is insufficient management of waste (agricultural, household and construction). This has increased the need to maintain the N6 canal systems and disrupted supply.

Half of respondents in N6 thought that their agricultural production has increased after IMT. Improvements in water supply management have allowed farmers to expand their irrigated area, which in turn has helped increase crop yield and to diversify crops beyond rice production. The perception of respondents is that household income has slightly increased after the transfer.

A significant reduction of conflict between communes and farmers was seen as a positive advantage the IMT has brought to the N6 system. Farmers felt they had been encouraged to participate from point of transfer, and they have continued to play an important role in maintaining tertiary canals. However, lack of meetings between WUA members and farmers is reported. In recent years, there have been no meetings. In addition, women are absent in both governance of the WUA and in influencing agricultural meetings.

Horizontal and vertical organisational linkages are weak in the N6 system. There has been a serious reduction in roles and responsibilities of WUA members due to the financial shortages and limited institutional support from government. The IMC has taken over roles that theoretically belong to the WUA (such as upgrades or major repairs of the N6 secondary canal). Training programs that once were organised regularly by the IMC or the Government have fallen away. Instead of being voted in by water users, WUA members are now appointed by the IMC

Chapter 8 DISCUSSION CHAPTER

This research set out to identify best practice management, and to identify aspects of existing irrigation systems that should be changed to improve irrigation management. In doing so, this research has assessed and compared the impact of the IMT on irrigation system management in three small-medium irrigation systems for three case studies. The previous chapters presented the analysis, one for each of the three case studies each of them representing a significant region.

- Tuyen Quang province in mountainous region (Ngoila irrigation system);
- Hai Duong in Red River Basin (Gia Xuyen irrigation system);
- Nghe An in Northern Central region (N6 irrigation system).

The research set out to identify solutions to improve irrigation management under the devolved structure including economic efficiency, O&M of irrigation systems, and enhanced or meaningful involvement of local people. The evaluation framework developed for this study has been applied to assess the success of the IMT for irrigation management from a number of aspects (financial, physical/practical, governmental, and social).

This chapter brings together the detail from the three case studies, drawing comparisons that identify existing barriers and potential solutions to improve performance across a number of measures. Applying the evaluation framework to the responses gathered from interviews, focus groups and questionnaire data has allowed for an understanding of the impacts of the IMT and ongoing management challenges. The similarities and differences between natural conditions and governance models of the three case studies are compared in this chapter. Both physical and governance differences have elicited different outcomes for the three case studies. **Section 8.1** compares the geographical, physical conditions to show natural advantage between systems. **Section 8.2** analyses the governance style (inter-commune vs single commune systems and quasi-state vs farmer led). **Section 8.3** discusses the findings of the evaluation framework across the three case studies to illustrate shared barriers and potential solutions, unique to specific governance structures, in a bid to achieve higher irrigation system performance.

8.1 Physical characteristics and climatic influences

Irrigation performance is directly affected by natural conditions such as climate, topography and soil condition. This section discusses both similarities and differences in natural conditions for the three case studies and how these affect the irrigation systems management.

As mentioned in Section 3.1, the three case study locations are situated in the Northeast Mountainous Region, the Red River Delta, and the North Central Coast of Vietnam. Each of these exhibits unique natural features in terms of rainfall and topography. Physical attributes of the locations in which the case studies are situated leads to some natural advantages and disadvantages of irrigation system efficiencies.

8.1.1 Climate

Rainfall is the key determinant of water availability for irrigation. Figure 8-1 shows the average monthly rainfall for each of the three case studies. Ngoila and Gia Xuyen receive most of their rainfall from May to August and here is slight variation whilst for N6, most rainfall comes between September and October with significant variation leading to more difficult water supply management in the N6 system.

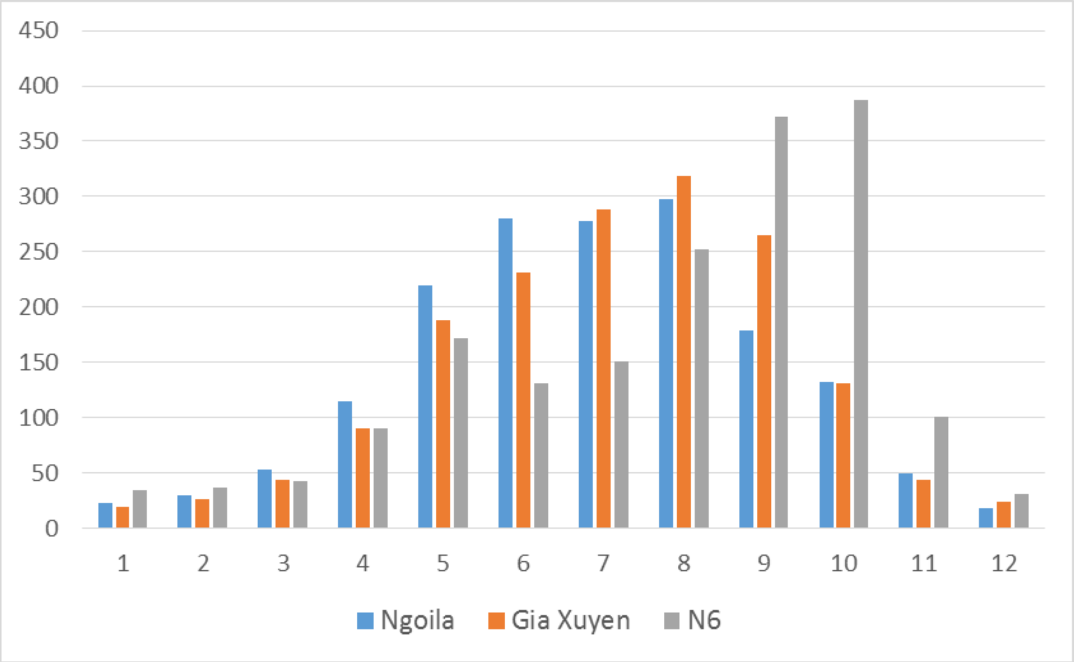

Figure 8-1: Average monthly rainfall across three locations (mm), 2015

Source: (HVAC, 2016)

8.1.2 Topography

There is variation in topography between the three case study locations. For Ngoila, situated in the Northeast Mountainous Region, as the region name implies, the topography is steeply sloped. Here, water easily runs from farm to farm, or to rivers or springs. For Gia Xuyen in the Red River Delta region, again, as the region name implies, it is low-lying and flat. As a delta, the soils are fluvial and highly fertile. Flat topography is advantageous for equitable water distribution. N6 in the North Central Coast region is hilly, and therefore has sloping topography. Canal systems here are gravity fed. Water here too, runs from farm to farm, or to rivers.

8.1.3 Types of Irrigation System

As mentioned in Chapter 3, there are many different types of irrigation system in the whole country of Vietnam. Three irrigation systems have been chosen to represent typical schems in each region. The reservoir headwork is common in the North East Mountainous Region where canals are gravity-fed. Pumping stations are typical headworks in the Red River Delta; and gravity-fed canals are common in the North Central Coast Region.

It should be noted that in the three case studies the quality of infrastructure varies considerably. In Ngoila and Gia Xuyen the majority of canals have been concreted with donor funding support. In N6 however, only a small proportion of canals are concreted. The construction of the surface of canals directly affects water supply. Concrete is better than earthen canals because less water is lost from the system.

8.2 Different Governance Structure Irrigation Systems Management

The different governance structures for irrigation systems management in the three case studies play an important role in determining the efficient function of the systems. There is a variety of governance structures for irrigation management across the country from fully privatised to government owned. The three case studies introduced various organisations involved in the O&M of irrigation management including quasi-state, and farmer organizations. Each of the case studies has a slight variation on a two tier system (see Table 8-1), e.g. one tier for the headworks+secondary canals and one tier for tertiary (Ngoila—quasi-state, gravity-fed); or, one tier for the headworks and one tier for secondary+tertiary canals (Gia Xuyen—state-led, pump); or, one tier for secondary canals and one tier for tertiary canals (N6—farmer led, gravity-fed).

One other key governance difference between the case studies is the way the irrigation systems are defined. Hydraulic boundaries define Ngoila and N6 irrigation systems. They irrigate across communes. Gia Xuyen on the other hand irrigates only one commune defined by an administrative boundary. These different are summarised in Table 8-1 and Figure 8-2.

Table 8-1: Comparison of management entities and roles

Model	Entity	Type of Entity	Role
Ngoila	IMB (WUA)	Quasi-state organization	Manages the headworks and inter-commune secondary canals
	AC	Farmer organization	Manages commune-based secondary and tertiary canals
Gia Xuyen	IMC	State company	Manages headwork
	AC (WUA)	Farmer organization	Manages commune-based secondary and tertiary canals
N6	IMC	State company	Manages headworks
	WUO (WUA)	Farmer organizations	Manages whole inter-commune secondary canals
	AC	Farmer organization	Manages commune-based tertiary canals

Note: IMB = Irrigation Management Board, AC = Agricultural Cooperative,
IMC = Irrigation Management Company, WUA = Water User Association

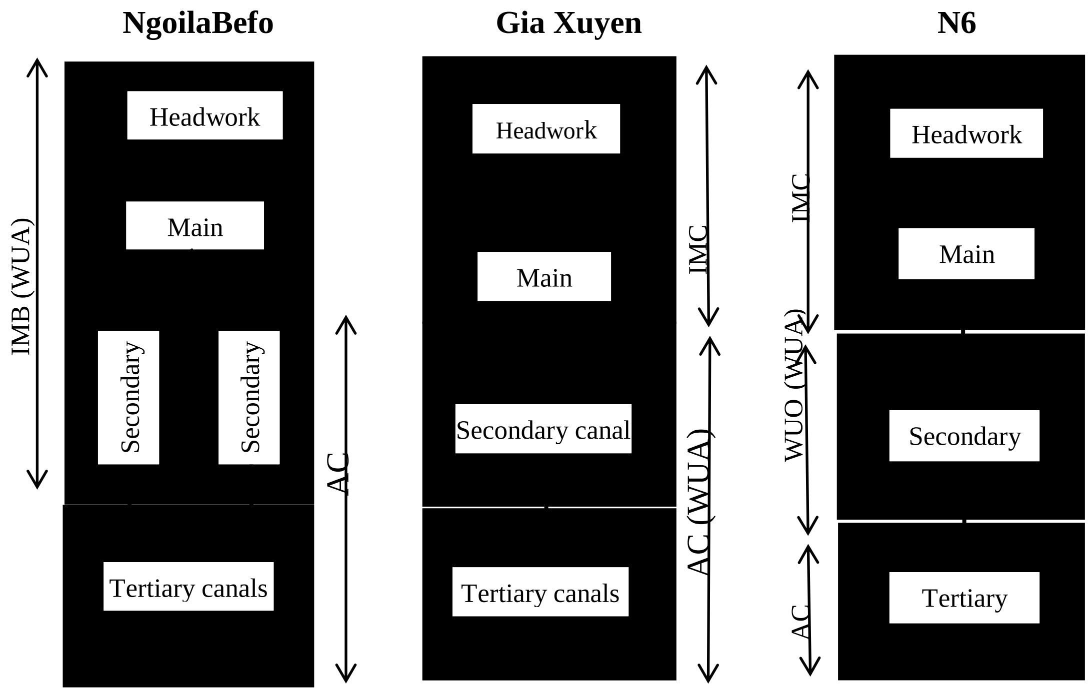

Figure 8-2: Operation and Management responsibilities across three locations

Source: Created for this study

Ngoila has a number of advantages compared to the two case studies. It is a complete irrigation system from the headworks to the tail of the scheme. It also has two storage reservoirs. Ngoila IMB has control over gate opening, and control over water supply. In comparison both Gia Xuyen and N6 are sub-schemes. They are subordinate to an outside authority in charge of the main canal operation and regulation of water supply. They therefore have less control over the regulation of water supply.

8.3 Impact of the IMT

The transfer of responsibility for irrigation management has been experienced variously across the case study sites. Using the evaluation framework this section provides an overview of the similarities and differences of the impact and the ongoing legacy of the transfer. Perceptions of water users in terms of both beneficial and challenging aspects of the impact of the IMT are considered. A summary of the overview of the study findings is presented in Table 8-2 and discussed fully in the remainder of this chapter.

Table 8-2: Summary of IMT result across three locations

N0	Indicators/Themes	Ngoila	Gia Xuyen	N6
I	**Financial Arrangements and effects of IMT**			
	Fund distribution between organisations	Fair	Unfair	Unfair
	Government budget spending	Increased	Increased	Increased
	On-farm ISF collection	On-farm ISF insufficient to cover O&M costs	On-farm ISF insufficient to cover O&M costs	On-farm ISF insufficient to cover O&M costs
	Financial management	Good: headwork and main canals Fair: On-farm canals	Fair: headwork and main canals Poor: On-farm canals	Poor: headwork and main canals: Poor: On-farm systems
II	**Water Supply Management**			
	Timeliness of water distribution	Much improved	Improved in initial years	Improved in initial years
	Equity/Fairness of water distribution	Much improved	Improved in initial years	Improved in initial years
	Quantities/Volume of water supply	Much improved	Improved in initial years	Improved in initial years
III	**Operation and Management of Irrigation Facilities**			
	Repair of infrastructure	Improved	Improved in initial years	Improved in initial years
	Canal maintenance	Improved	Improved	Not improved
IV	**Agricultural benefit**			
	Change crop yield	Increased	Increased	Increased
	Crop diversity	Increased	Increased	Increased
	Expansion irrigated area	Increased	No increase	Increased
V	**Economic impact on Farmers**			
	Change to farmer’s income	Increased	Increased	Increased
VI	**Social effects of IMT**			
	Farmer’s participation	Active	Active in initial years	Active in initial years

N0	Indicators/Themes	Ngoila	Gia Xuyen	N6
	Leadership capability	Leaders elected	Leaders elected	No leaders elected
	Productive meetings	Frequent	Frequent	Infrequent
	Conflict	Significant reduction	Significant reduction	Significant reduction
	Roles of women	Active	Inactive	Inactive
VII	**Governance aspects of IMT**			
	Roles and Responsibilities	High level responsibilities	High level responsibilities	Low level responsibilities
	Horizontal links between WUAs	Fair support	Poor support	Poor support
	Vertical linkage	High levels of cooperation	Medium levels of cooperation	Low levels of cooperation

Source: Created for this study

8.3.1 Financial Arrangements

Changes to financing for irrigation management has been one of the most fundamental aspects of the IMT. Payment for the O&M of irrigation systems changed considerably with the transfer. Ongoing financial considerations are important to discuss to ensure the long-term efficiency of irrigation systems and robust governance structures. The significant change of the ISF policy in 2008 makes Vietnam unique compared to the IMT in other countries. Instead of evaluating how the IMT has affected government funding and famers' costs, in Vietnam the government subsidy has affected the way finances are shared between agencies (at provincial and commune levels) and between WUAs.

Different financing arrangements between the different governance structures have affected financial performance of the case studies. They each exhibit different financial problems. There are inconsistencies between provinces as to how finances are distributed between government companies and commune managers (WUAs). Each province has set up its own financial distribution policy.

8.3.1.1 Allocation of government subsidies

As part of the IMT WUAs were introduced as the main body to assist in the management of irrigation systems. They are a signature of the IMT. The introduction of Government subsidies in 2008, to cover the majority of the farmers' ISF, is a significant policy decision based on the early experience of the IMT. The application of the ISF waiver between case studies is quite different due to the difference in governance structures.

For example, the WUA in Ngoila IMB (WUA) receives 100% of the ISF subsidy for O&M of the headwork and one of its two secondary canals. This is the highest allocation of the ISF subsidy to a WUA across the three case studies. Gia Xuyen AC (WUA) is subsidised 50% to conduct O&M of the secondary canal, the remaining 50% is retained by the Gia Loc IMC for the headwork and main canal O&M. N6's WUO (WUA) is allocated 10% of ISF subsidy for O&M of the secondary canal. The other 90% is allocated to the Yen Thanh subsidiary IMC for the headwork and main canal. See Table 8-3 for the detail of financial distribution between IMCs and WUAs across the three case studies.

Table 8-3: Financial distribution of the ISF waiver between IMCs and WUAs

Model	Entity	Type of Entity	Role	ISF waiver subsidy
Ngoila	IMB (WUA)	Quasi-state organization	Manages the headworks and inter-commune secondary canals	100%
	AC	Farmer organization	Manages commune-based secondary and tertiary canals	-
Gia Xuyen	IMC	State company	Manages headwork	50%
	AC (WUA)	Farmer organization	Manages commune-based secondary and tertiary canals	50%
N6	IMC	State company	Manages headworks	90%
	WUO (WUA)	Farmer organizations	Manages whole inter-commune secondary canals	10%
	AC	Farmer organization	Manages commune-based tertiary canals	-

Note: IMB = Irrigation Management Board, AC = Agricultural Cooperative, IMC = Irrigation Management Company, WUA = Water User Association

Ssource: document citation, field work

These differences in financial distribution have led to different financial management outcomes. Study participants perceived that Ngoila has sufficient funding for its O&M responsibilities. However, despite receiving sufficient funding, the arrival of the government subsidy is sometimes very slow and this is a problem for the IMB (WUA). It is extremely difficult to create an O&M implementation plan for irrigation systems with budget uncertainties such as this while it was only Ngoila respondents that raised this as a concern, the unwieldy bureaucratic process of applying for the ISF waiver and subsequent receipt of funds is shared across Vietnam.

Budget constraints directly affect irrigation infrastructure O&M for headworks and secondary canals in Gia Xuyen and N6. They receive much lower subsidies than N6. More detail about financial distribution and its effect on O&M irrigation systems is discussed later.

8.3.1.2 On-farm ISF collection

After 2008 the only fees charged to farmers, in all three case studies, are the on-farm ISFs to assist with the O&M of on-farm canals. There is a discrepancy between how the farmers think about this fee and how managers perceive it. Farmers are satisfied with the amount they currently pay through the on-farm ISF. However, it has come to light through this study that managers identify a budget shortfall. The on-farm ISF is insufficient to cover existing O&M costs. For all of the three case studies some participants expressed concerns about the shortage of funds generated though this on-farm ISF. Provincial governments have the authority to set the limits of the on-farm ISF (the highest and lowest price acceptable for the costs of water use). WUAs send out the bills to the farmers. WUAs do not have the authority to charge a fee greater than that set by the provincial government. This study has revealed that the fee limits set by the provincial government are insufficient to cover the O&M costs of tertiary irrigation systems. Farmers are therefore not paying enough to cover the costs for O&M of their tertiary canals.

In one commune (Kim Phu commune, Ngoila) this situation is very serious because all farmers are refusing to pay their ISF. This is due to a misunderstanding of farmers in this commune about the details of Government's 2008 fee waiver. Farmers in Kim Phu assume the Government subsidy will pay for O&M from the headwork to the end of tertiary canals. Conversations with IMT consultants during field work confirmed that this situation in Kim Phu is not unusual across Vietnam. In many places farmers are refusing to pay their water use fees due to the same misunderstanding. A consequence of this misinterpretation is that the irrigation system in Kim Phu commune is run-down and functions poorly. This study has also shown that farmers in Ngoila were amenable to paying an ISF if the canal systems are maintained and supply improves.

Having explained that the province is setting the ISF too low, N6 raising the on-farm ISF would lead to great hardship for farming communities who are very poor. Finding alternative funding support to improve the quality of the N6 system is a real need.

8.3.1.3 Salaries of WUA staff and on-farm irrigators

With the introduction of WUAs came a suite of management roles for WUA members. This study has revealed differences in perception about the roles and payment to WUA members in the case studies. In Gia Xuyen and N6 the perception is that the wages of WUA employees are too low for the work being conducted. In N6 this problem is very serious. Respondents claimed that WUA members have not been paid for several years because the WUA budget is spent on operation costs. Despite the responsibility of the WUA members across the three case studies being the same or very similar, they are paid different salaries (See Table 8-4).

Table 8-4: Monthly WUA member's salary in Gia Xuyen and N6 systems, 2012

No	Position	N6 (103VND/month)	Gia Xuyen (10^3VND/month)
1	Chairman of WUA	800	1.450
2	Vice of chairman	700	1.000
3	Technical staff	700	800
4	Accountant	500	700

Source: Focus Group discussion with N6 and Gia Xuyen WUA members in 2013

A consequence of this budgeting crisis is that it is very difficult to attract qualified people to apply for these roles.

Table 8-5: Education level of WUA members

No	Position	Ngoila	Gia Xuyen	N6
1	Leader of WUA	College	Vocational	Vocational
2	Vice	College	High school	High school
3	Technical staff	Vocational	High school	High school
4	Accountant	Vocational	High school	High school
5	Irrigation teams	Secondary school	Secondary school	Secondary school

Source: WUA members Interview and focus group discussion 2013

In this study, on-farm irrigators have been shown to play a very important role in irrigation management. They help farmers by reminding them about the water supply calendar, they help tertiary canals function properly by keeping them clean and repairing damage. Importantly presence of on-farm irrigators in the fields helps to maintain good-will between farmers because they help prevent unlawful breaches of the supply calendar. This has reduced some of the persistent upstream/downstream tension. It is of note that across all of the case studies the perception of respondents was that the salaries of on-farm irrigators are very low. They are paid less than those who do equivalent types of work, and well below Vietnam's legislated minimum wage. Ngoila's WUA (which receives 100% of the Government ISF waiver subsidy) is able to buffer the low wage by providing additional support to encourage on-farm irrigators to work. Findings in this study suggest that in many cases on-farm irrigators do not want to stay in these jobs. An inability to fill these on-farm irrigator positions has obvious implications for the operation of on-farm canals.

In terms of financial management important messages resulting from this study show that there are problems with:

- The process to apply for and receive the government subsidy is exceedingly bureaucratic and leads to long delays and confusion;
- Provincial responsibility in setting the limits for the on-farm ISF is leading to a budget deficit and an inability to perform tertiary canal maintenance to best effect;

- In N6 it is not possible to ask farmers to contribute more than they already do without leading them into great financial hardship. Alternative funding support is needed (e.g. new donor support) in this region;
- An improvement in communication by Government with farmers about the ISF waiver subsidies and the distribution of the subsidies may improve the payment of the on-farm ISF;
- There are inequities between the salary payments of WUA members across the three case studies;
- Unless budget crises are resolved the roles of on-farm irrigators who play a vital role in irrigation management may collapse.

8.3.2 Water Supply Management

WUAs and on-farm irrigators, both features introduced as part of the IMT, have made a difference to the way water is delivered to farmers and in helping maintain condition of the canals. The conversion of canals from earth to cement, largely possible with the injection of donor funding and farmer labour at the time of the transfer has also served to greatly improve water supply to many farmers. Three measures were used to evaluate the effectiveness of water supply including timeliness, fairness, and adequacy of supply. Table 8-6 is a summary of farmers' satisfaction in regard to each of these measures both before and after the IMT.

Table 8-6: Effectiveness of water supply using three measures (timeliness, fairness, and adequacy) before and after the IMT

	Perception of farmers either satisfied or strongly satisfied with water delivery by measure		
Irrigation System	**Timeliness (%)**	**Fairness (%)**	**Adequacy (%)**
Ngoila BEFORE	40	40	40
Ngoila **AFTER**	**76**	**86**	**82**
Gia Xuyen BEFORE	38	50	48
Gia Xuyen **AFTER**	**66**	**70**	**68**
N6 BEFORE	44	38	36
N6 **AFTER**	**72**	**60**	**48**

Source: Farmer's questionnaire

Table 8-6 suggests that overall, the level of satisfaction among farmers improved for all measures after the IMT. The majority of farmers perceived that water delivery was more reliable, received in sufficient volume to cultivate, and the distribution of supply was better than before with an improvement in access to water by farms along canals, especially for those at the tail of canals.

8.3.2.1 Timeliness of water distribution

Knowing the anticipated arrival time of water to individual farms is critical. There need to be people on hand to get water from secondary canals to on-farm canals when water is released from the headworks, it helps farmers to protect their farm borders and to prevent water flowing by gravity from one farm to another. Three main reasons were identified through the study explaining the improvement to timeliness of water supply. When responsibility for irrigation systems management was transferred from government to WUAs there was an enhanced role for farmers. Farmers elected to positions within WUAs were able to influence water supply decisions. Famers have an intimate understanding of the water supply needs within their particular region/commune. As such, water supply decisions have become more refined and water supply schedules have been tailored to the needs of particular places. On-farm irrigators' positions helped maintain flow through the canals, by removing debris and waste, reminding farmers about expected supply times and bringing in extra help when needed to get water to farms. These actions have given farmers greater certainty and assisted with better management of water on its arrival to their farms.

After the IMT the majority of headworks and canals were concreted and upgraded through donor funding and development projects. The improvement to infrastructure has achieved better and faster water flows through the canals, and less water loss through the system. Both of these things have reduced the time it takes for water to move through the system from the headworks to individual farms.

One exception to the overall success was reported in Gia Xuyen where inappropriate canal design has made the time taken for delivery longer.

8.3.2.2 Equity of water supply

Of all the three measures it is the change in perception about fairness of water delivery that has improved most across all three case studies. Prior to the IMT farmers situated closest to the headworks of canals were advantaged by accessing water most easily. A lack of regulation around supply access resulted in a disorderly approach to the way farmers accessed water. After the IMT with the introduction of water supply calendars and a policy that prioritised downstream users (Ngoila and N6) this disorderliness has been somewhat improved. Protection of the locks on in-take canals so they may be opened only by authorised members (Ngoila) and the presence of on-farm irrigators in the field have also helped to reduce farmers accessing water unlawfully or out of turn.

8.3.2.3 Adequacy of water supply

Rice cultivation and other agricultural activities rely on an adequate volume of water to produce crops. Prior to the IMT agricultural output was lower. An improved supply of water in sufficient amounts has led to reported increased yields and diversity.

In all three case studies overall, there is a perception that the volume of water supply is more adequate than it was prior to the IMT. Again, improvements in irrigation infrastructure, the effort of WUA members and on-farm irrigators managing the water supply and its distribution have made a big difference to guarantee supply (through canal maintenance), and to reduce water losses and water wastage.

In some cases educating farmers about the finite supply has also made a difference and resolved wasting and unlawful use of water. The period immediately following the IMT seemed to have been more successful for this measure than more recently. Of all the water supply measures, water adequacy, or rather, water shortages were mentioned as a persistent problem in some places and for some people. Some farmers have not cultivated crops due to lack of water (N6). The degradation or poor quality of tertiary canals in both N6 and Gia Xuyen are given as reasons for this. In Ngoila participants claimed that changes to the 2004 Vietnam Agricultural Land Use law affected water supply by allowing extension of farm borders.

In terms of water supply management, important messages resulting from this study show that some problems persist and act to reduce the potential of agricultural output. There are some actions that could be taken to further improve benefits accredited to the IMT:

- Changes to the 2004 Land ownership laws have had an unanticipated knock-on effect reducing farming plot border protection;
- While there are reported reductions in the unlawful access of water outside of supply schedules this is still a persistent problem that continues to disadvantage downstream users;
- Lack of farmers' participation during the preparation phase of donor funding has lead to poor design of infrastructure with the outcome of an increase in the time taken to deliver water (Gia Xuyen);
- The delivery of water to individual farms is open to corruption. It has been reported that in some cases the supply calendar is overridden and some farms are being supplied water out-of-turn;
- Irrigation systems at the mercy of headworks (N6) suffer water shortages. There is a limited ability of WUAs in partial systems to influence the supply. This leads some systems to be vulnerable to water shortages with an inability to cultivate (N6).

8.3.3 Operation and Management of Irrigation Facilities

Effective O&M of irrigation infrastructure is central to the success of irrigation management. Activities include inspection and repair of infrastructure and construction of new canals and protective devices. Overall, the results from this study indicate variability between case studies and between them in regard to efforts to maintain headworks/secondary canals compared to tertiary canals.

8.3.3.1 O&M of headwork and main canals

The introduction of government subsidies in 2008 significantly increased the budget for O&M because Decree 115 identified the need to increase the amount spent of irrigation systems and subsidies were increased accordingly. Table 8-7 compares WUA respondents’ perceptions in regard to the adequacy of government subsidies across the three case studies. This is an indicator as to whether WUAs have sufficient funding to maintain their canal systems. Table 8-7 shows that of all the case studies

Ngolia's subsidy is perceived to cover O&M costs but for the other two the subsidy only partially covers all O&M costs. This shortfall has the potential to lead to degradation of irrigation infrastructure and to deprive spending on other things such as salaries.

Table 8-7: WUA perceptions as to the adequacy of the Government ISF waiver subsidy to cover O&M costs

Irrigaiton Systems	**Government subsidies**		
	Fully cover the cost	Partially cover the cost	Marginally cover the cost
Ngoila IMB	✓		
Gia Xuyen AC		✓	
N6 WUO			✓

Source: from study results

The increase in funding has assisted with improvements to infrastructure. For example, as mentioned previously there have been upgrades from earthen to concrete canals. Under the management of WUAs in Ngoila and Gia Xuyen there have been significant improvements to headworks and main canal infrastructure, mainly through concreting. Here irrigation systems have been inspected regularly by WUA members. In addition, every intake along the main and secondary canals in Ngoila have been well protected.

In contrast WUA members in the N6 system thought that canals were in poor condition and have been degrading over time. In N6 there are a large number of earthen canals along the whole of its system, both secondary and tertiary canals. Lack of funding for O&M was considered to be a real impediment to improvement. WUA staff stressed that the majority of funding was spent on collecting rubbish and cleaning canals. Consequently, there was no money left to upgrade or concrete the canal systems.

8.3.3.2 O&M of tertiary canals

Although there was a perception that there had been an improvement in the O&M of tertiary canal systems after IMT, the majority of farmers (with the exception of those in the Kim Phu commune) said that construction works, irrigation and drainage had improved immediately post the transfer. However, there were concerns made by respondents about the current O&M of tertiary canals. The reported challenges facing managers of the tertiary systems varied between case studies.

In Gia Xuyen, although WUA members indicated that the maintenance of tertiary canals has been implemented frequently a large number of farmers stated that operational activities have been ignored by WUA staff. Canals and protective devices broken by farmers to access water out of turn were not repaired.

In N6, the problem of canal degradation was the most serious. Respondents claimed that many tertiary canal sections were no longer maintained and dredged and maintenance activities are overlooked. Earthen canals are more easily manipulated by farmers to take water out of turn. They are easily damaged, blocked or opened. Serious funding shortages limit the possibility of concreting these canals.

Table 8-8 summaries the results across three locations of O&M from the headwork to the on-farm canals.

Table 8-8: Frequency of O&M of irrigation infrastructure across three case studies

Model	Entity	Type of Entity	Role	Frequency of O&M activities
Ngoila	IMB	Quasi-state organization	Manages the headwork and inter-commune canals (main & secondary)	Regular
	AC	Farmer organization	Manages commune-based secondary and tertiary irrigation systems	Regular (with the exception of Kim Phu commune)
Gia Xuyen	IMC	State agency	Manages headwork and main canals	Regular
	AC	Farmer organization	Manages commune-based canals (secondary & tertiary)	Irregular and poor quality
N6	WUA	Farmer organizations	Manages whole inter-commune secondary canal system	Irregular and poor quality IMC have to assist and take over responsibility
	AC	Farmer organization	Manages commune-based tertiary canals	Irregular and poor quality

Source: Created for this study

8.3.3.3 Waste management

An emerging issue that is not specifically related to water supply is management of waste. In all three case studies agricultural, household, and construction (roads and housing) waste were reported to be a problem for canal maintenance. One of the challenges across the three case studies is dealing with the large volume of rubbish disposed into canal systems. Waste management consumes a large portion of O&M budgets.

Ngoila has responded to the problem by building waste collection containers. Large concrete containers have been constructed in convenient locations to assist in the correct disposal of solid waste.

The majority of O&M funding in Gia Xuyen and N6 is spent on collecting rubbish from canals. The problem of dumping unsold agricultural products into canals was reported in the Gia Xuyen system. In one village (Tang Ha) in Gia Xuyen waste water discharged from local business is reported to have been disposed into canals. This source of water has been used to irrigate agricultural crops which has the potential to poison or pollute and negatively affect agricultural production.

- Budget shortfalls have the potential to undermine the condition of irrigation infrastructure. This is especially so for Gia Xuyen and N6;
- Tertiary canal systems are most in need of attention. The earthen canals are reported to be rapidly degrading;
- Provincial governments need to become involved in better waste management systems. Educating farmers about biodegradable options to manage unwanted/surplus agricultural waste should be a priority.

8.3.4 Agricultural Benefits

A primary intent of the IMT was to boost agricultural output. The theory behind the IMT was that if farmers were in control of their decisions and finances then there should be a matched improvement in productivity. In this study the majority of farmers agreed that agricultural production had increased after the transfer (see Table 8-9).

Table 8-9: Farmers' perception that IMT improved agricultural production

Farmers' perception	Strongly Disagree/ Disagree (%)	Neither Agree nor Disagree (%)	Agree and Strongly Agree (%)
Ngoila	0	4	96
Gia Xuyen	8	4	88
N6	30	20	50

Source: Fieldtrip investigation 2013-2014

Better water distribution and improvement of irrigation infrastructure maintenance after the IMT were seen to have led to increased crop yields and a diversity of crops in all three locations. The IMT process has allowed for an increase in cropping frequency and a move from only rice production to vegetables which have two or three times higher productivity than rice production. In N6 adequate water supply is also reported to have reduced crop diseases and pests that have led to increased agricultural production.

Respondents reported that after the IMT there has been an increase in the area of land under irrigation in Ngoila and N6. This increase has boosted agricultural production in these two systems.

Only half of the farmer respondents in N6 replied positively. It had the largest number of farmers registering either a neutral or negative response. This sentiment is closely linked to problems associated with water supply. This region also experiences a large number of flood and drought compared to the other case study locations.

8.3.5 Economic Impact on Water Users

For all three case studies farmers in this study stated that after the IMT their income increased from improvements in agricultural productivity (see Table 8-10).

Table 8-10: Percentage of farmers who perceive farmers' income increased after the IMT

Farmers' perception	Disagree or Strongly Disagree (%)	Neither Agree or Disagree (%)	Agree and Strongly Agree (%)
Ngoila	6	6	88
Gia Xuyen	10	4	86
N6	32	22	46

Source: Fieldtrip investigation 2013-2014

In addition to increased yields and crop diversity, the release of farmers from agricultural activities to pursue other income generation (in construction companies or opening small businesses) was explained as a reason for the increase. Whereas farmers in Gia Xuyen income increased based on an expansion of agricultural trading.

One of the most important positive outcomes is the confirmation from farmers that they have directly benefitted from the IMT though an improvement to their livelihoods both in terms of increased household income but also in the diversification of agriculture and of sources of income.

Of the three case studies, N6 had the largest number of farmers who thought their incomes had not improved since the transfer.

- N6 has been least able to reap benefits from the IMT. Reasons for this are closely linked to water supply.

8.3.6 Social Effects of IMT

A fundamental principle embedded within the transfer of responsibility for water management through the IMT is that water users are encouraged to participate in irrigation management. Increased engagement has brought with it social changes. Heightened responsibilities for farmers and improved deliberation about irrigation decisions have had effects on farming communities.

In terms of social effects of the IMT, four aspects have been evaluated: farmers' participation in decision-making, leadership capacity, conflict resolution and the role of women in irrigation systems management.

8.3.6.1 Farmer's participation in irrigation system management

Respondents in this study claimed that immediately after the transfer farmers' ownership of decisions in irrigation systems improved. Famers engaged in canal construction, were given a voice, and responsibility to protect and maintain irrigation systems, and to resolve water shortages. Farmers took part in the governance process by electing members to WUAs. Elected farmers shared in the governance of irrigation systems through the WUA, sharing in decisions as to how to implement O&M. Famers also said that they were encouraged to participate through their support by giving money or materials to assist with the upgrade of on-farm tertiary canals.

However, a large number of farmers who contributed to this study said that they were not encouraged to give their ideas or participate in the design and construction of irrigation infrastructure (Gia Xuyen and N6). They gave examples as to how their disengagement from the decision-making process led to poor outcomes. Inappropriate canal design has resulted in greater effort to allocate water. The commencement of Government subsidies (through the ISF waiver) whilst relieving farmers of a financial burden has simultaneously reduced farmers' sense of responsibility.

Regular meetings with farmers and the WUA is a central mechanism to engage meaningfully with farmers and to bring their ideas and concerns to the fore. Regular meetings (several times a year) between WUA members and on-farm irrigators deal with water supply management matters and urgent situations (e.g. canal dysfunction). In addition, in Ngoila and Gia Xuyen, the election of WUA members takes place during a general assembly meetings (congress) held once a year.

Results from this study suggest that in N6 meetings between the WUA and farmers have fallen away. They have not had a general assembly meeting since 2008. Rather decisions about irrigation management are made during internal meetings between the now reduced number of WUA members. Instead of N6 WUA members being elected by farmers, subsidiary IMC managers have taken over the delegation of these roles.

8.3.6.2 *Leadership capacity*

Farmer engagement in the WUAs presents an opportunity for leadership development. Farmers elect people considered to be most suited to such a role. These positions allow for capacity building of the person in the leader role, which may contribute to dissemination of skills back through communities when farmers take back to their peers ideas and knowledge gained through their engagement in the WUA. At the same time, theoretically, farmers representing their communities are able to share, on behalf of their constituents, key local matters of concern emanating from their communities.

8.3.6.3 *Conflict resolution*

Before the IMT farmers' roles in O&M and accessing water from canals took place in a self-serving manner. Communes were withdrawing water from headworks and main channels when it suited them. There were no supply schedules. This lack of process served to create conflict especially during peak production periods when every commune needed water at the same time, or, during dry seasons when water volumes were low. Some farmers were automatically advantaged by their position along the canals. Upstream farmers had a greater advantage than those at the tail of canals because of ease of access to water and often took more than needed. As a consequence downstream farmers had greater difficulty accessing water. Severe clashes have been reported during drought conditions. Conflicts became extremely serious when upstream farmers closed canals and withdrew large, even excessive volumes of water for their own farms.

Respondents in this study reported that with the introduction of WUAs who regulated supply more stringently that there has been a significant reduction in both the number of conflicts and disputes between farmers in every village (with Gia Xuyen is the on-commune system) and between communes (with inter-commune systems in Ngoila and N6). There are key WUA activities and actions that have worked to improve social conditions:

- The introduction of water supply contracts signed between WUAs and individual communes every season, WUAs accept responsibility for supplying water to individual farms for every crop. The water supply service contract is a critical factor to force obligations between IMCs, WUAs and farmers;

- WUAs develop detailed water supply schedules for individual villages to ensure water supply is adequate and on time;
- The on-farm irrigators, who are also farmers from villages in each commune, and manage the tertiary canals which flow through their villages;
- WUA are seen to be important in allowing the exchange of ideas and for capacity building. Not all water user associations are functioning in this way. N6 is dysfunctional.

These things have brought more certainty in regard to water supply for farmers and households thereby reducing conflicts.

8.3.6.4 Roles of women:

The literature review identified that women should be recognised for the central part they play in irrigation management. It also explained that the role of women in agricultural production has not yet been very well researched. Recommendations have been made that policies should address women's specific needs and that there should be gender specific programs to equip and empower women to participate in decision-making and agricultural practice.

Results of this study have confirmed that women do play important roles in agricultural decision making in all three case studies. Women dominate agricultural production decision- making (e.g. crop decisions, water delivery calculations, kind and volume of pesticide to be applied) and provide labour.

Table 8-11: Women holding positions in WUAs

Irrigation systems	No. of Women WUA members	On-farm irrigators
Ngoila	3/4 members	Few
Gia Xuyen	0/4 members	None
N6	1/4 members	None

Source: Created by the researcher

In Ngoila three out of four WUA members are women. Of note however, is the absence of women holding WUA member positions in N6 and Gia Xuyen.

The physical demands of the on-farm irrigators were thought by respondents to be unsuitable for women. The night-shifts and hard work of delivering water was considered too hard for women.

- While famers said that they participated through giving money or materials to assist with the upgrade of on-farm tertiary canals, this level of participation could be considered quite passive;
- Farmer’s opinions have been disregarded. Poor canal design has resulted;
- WUA meetings are critical for engendering a powerful and meaningful role for farmer participation in irrigation systems management;
- The structure of governance in N6 is questionable where the WUA role has withered and is no longer functional. The benefits attributed to functioning WUA will not be possible in N6;
- Work of the WUAs (introducing orderly and equitable water supply) has reduced tension and conflict between upstream and downstream users;
- Women play a central role in agricultural production and water supply. Their engagement in the Ngoila WUA meets international principles for recognising the important contribution made by women;
- There is capacity to increase the role of women in Gia Xuyen and N6. The WUA in N6 needs closer attention, not simply in regard to improving the participation of women.

8.3.7 Governance aspects of IMT

Managing irrigation systems is complex partly due to the array of different spheres of government (national, provincial, district and commune) and due to the different governance structures between provinces. As the canal systems cross administrative boundaries successful irrigation management and agricultural productivity rely on effective communication and cooperation between spheres and tiers of government.

8.3.7.1 Rights, roles and responsibilities

After the IMT new governance arrangements introduced important new roles for farmers that in turn demanded new working relationships between tiers of government. Across the case studies there is variation in respondent reports as to the functionality of the relationships developed between organisations with responsibility for irrigation management.

8.3.7.2 Vertical linkage/coordination/communication between tiers of government

Functional organisational relationships may be defined by sound and helpful support, functional meetings, and improved outcomes. Such elements are evident in Ngoila. Respondents reported provision of support from higher tiers of government to lower (ACs), made evident by readily accessible financial and technical assistance, essential administrative support (official materials such as computers, and furniture) and training. This quasi-state managed WUA presents a successful example for irrigation management. Ngoila, has benefitted by having authority to manage the whole irrigation system form headworks to tertiary canals.

N6 provides a direct contrast. It is part of a highly complex irrigation system. It does not have authority above the secondary canals and so, to some extent is at the mercy of authorities beyond its administration. It is also a system facing distinct financial hardship. Respondents reported a lack of support from immediate higher tiers of government (the IMC). The WUO is dysfunctional and has no place to meet and it is difficult to find willing staff. The IMC has overridden process by nominating members. There is no long-term strategy in place for the WUA. There is an absence of training and institutional support. This farmer based WUA does not present as a successful model for IMT. Indeed IMC officials are of the opinion that governance structure should revert back to its pre-IMT structure.

The Gia Xuyen irrigation system governance structure has changed least of all case studies since the turnover of management. Its WUA association is a farmer-managed entity. According to respondents representing top tier administration there has been a long history of strong coordination between the tiers of irrigation managers in Gia Xuyen. Farmers agreed that they are well supported for short-term needs but that more could be done in terms of training and strategic planning.

8.3.7.3 Horizontal linkage/coordination/communication between tiers of government

The horizontal link between WUAs, ACs and other organisations is reflected in their willingness to share water supply and support each in dealing with challenges as they arise.

Ngoila exhibited strong horizontal relationships between former and current members of its WUA. This has allowed for transference of skills and sharing of experiences. In addition, there is also strong support between the four ACs, especially in terms of water allocation.

In the two other systems there is a lack of horizontal cooperation. In N6, there is no sharing of experience between former and current members of the N6 WUA. They have been unable to seek the same kind of support from ACs in terms of financial assistance. This is a very poor community and farmers are not in a position to make substantial additional contributions.

There is also a lack of cooperation between different sectors. Irrigation management occurs in isolation from other civic services such as road construction and waste management. As a result, there is a clash of interests with canals being used as vessels to conveniently dispose of unwanted products and wastes.

8.4 Case study overview: advantages and disadvantages

8.4.1 Ngoila

Of the three case studies IMT implementation based on the evaluation framework is the most successful in Ngoila. Ngoila respondents reported that there was significant increases in the ISF waiver. This meant that WUAs have adequate financial resources to undertake O&M on the headworks and secondary canals which resulted in gradual improvement in O&M of irrigation systems from headworks to the end of tertiary canals systems. Systems have been regularly upgraded and maintained and Of the three case studies Ngoila has the highest rate of concreted canal systems. In terms of water supply management, Ngoila respondents reported the greatest level of farmer satisfaction for timeliness, equity and volume of water distribution. Ngoila also respondents reported an increase in agricultural productivity and household income. The improvement of water supply has reportedly assisted farmers to import many new kinds of crops and extend their area of irrigated land. Household income has increased significantly as a result.

In terms of social impact, there has been a reported significant reduction of conflicts between upstream and downstream farmers or between villages in Ngoila. From the commencement of the IMT farmers have been active participants. Farmers continue to be willing to participate in the O&M of on-farm canals every year either through provision of labour or money. Meetings between the WUA and farmers are organised regularly with WUA leaders and on-farm irrigators elected during agricultural meetings.

Ngoila is considered to have high levels of horizontal and vertical co-operation. The responsibilities of WUA members, on-farm irrigators and leaders of ACs have been important in improving the O&M irrigation systems. Financial support, instruction and training program support from the WUA and the have played a role in this. In addition, water supply schedules are discussed and agreed upon throughout the system. One of the reasons why Ngoila has achieved a higher performance, compared to two other systems, is because the head of the WUA is appointed by PPC. This person is paid a government salary. The government has ensured financial support to ensure sustainability of this WUA.

Although Ngoila is considered to have received significant benefits from the IMT, there are still several constrains that weaken irrigation performance. The highly bureaucratic accounting and payment process is a problem that leads to delay of O&M of the irrigation systems in Ngoila. In addition, misunderstanding about the ISF waiver has led to insufficient funding to cover O&M costs for tertiary canal systems. Lastly, there is concern about the gradual increase in rubbish disposed into canal systems, which not only blocks water supply but also negatively impacts on the environment.

8.4.2 Gia Xuyen

Gia Xuyen also is representative for the majority of irrigation systems that supplies for only one commune and is managed by one Agricultural Co-operatives (ACs). On the base this study's evaluation, Gia Xuyen also is considered a success case study of IMT.

In terms of financial management, since the system was first transferred in Gia Xuyen, the headworks and seven pumping stations have been upgraded with donor funding. Gia Xuyen is considered to have achieved high performance of O&M in the initial years after IMT. Significant increases in agricultural production and household income are two main benefits brought by IMT to the Gia Xuyen commune. More reliable, adequate, and equitable of water supply has enabled farmers to increase the number of crops and as a result, to increase productivity. Furthermore, Gia Xuyen has fertile agricultural land, and convenient transport links bringing significant benefits to the Gia Xuyen commune. They are able to export agricultural produce to other provinces. Household income has increased as a result. In terms of social achievements of the IMT there has been a reorted reduction of conflicts between farmers in both number and degree of tension. Furthermore, meetings between the WUA and farmers are convened regularly and farmers have the right to elect their leaders.

However, Gia Xuyen still faces several challenges that need some adjustment. It faces the same problems as Ngoila and N6 in terms of financial issues. The wages for on-farm irrigators should be increased and more financial resources need to be spent on O& M of tertiary canal systems. Lack of payment to on-farm irrigators is the problem that leads to the lower efficiency of tertiary canals. Another problem is the degradation of canal systems and the reduction of farmer's participation in O&M of canal systems. By not including farmers canal designs are not as good as they might have been and have resulted in inefficiencies. Waste management is also serious problem in Gia Xuyen.

Gia Xuyen achieved positive outcomes from the IMT in terms of governance. There is strong horizontal and vertical co-operation including support between the IMC and the WUA and between villages in communes in Gia Xuyen during times of water shortage. Support and commuication between IMCs, the WUAs and villages are present. However, there complaints continue in regard to unfair distribution of funds between the Gia Loc IMC and Gia Xuyen WUAs.

8.4.3 N6

Although N6 is one of the early systems implementing IMT in Vietnam, it has experienced the worst performance compared to the other two systems. In terms of financial arrangements, N6's IMC recieved a significant increase in total funding after the ISF waiver in 2008. However, the N6 WUA suffers funding shortages. Donor projects supported O&M of N6 irrigation system immediately after the transfer. Over the time, irrigation systems have degraded and a shortage of water has resulted in a large number of disatisfied farmers in downstream villages. In addition inadequate timeliness of water supply has negatively affected agricultural production. This resulted in significant reduction in rice production. In terms of social impacts of IMT, there has been reportedly a significant reduction in the number of disputes between the four ACs, and between upstream and downstream farmers. However, participation of farmers in irrigation systems management was viewed as inadequate in the N6 system, especially for women. Women play an important role in making decisions in agricultural production but they were considered absent in the governance of the WUA. Another serious problem in N6 systems is the autonomy of N6 WUA. As mentioned above, lack of funding has resulted in cessation of meetings for the last 10 years. Members of the N6 WUA did not stand for election because of the low salary and lack of support provided by the national government. A long-term strategy is needed to increase the performance of WUAs. In addition, N6 is an inter-commune system irrigating four ACs. It will be necessary to have strong co-operation between the four ACs and the N6 WUAs to solve problems of water shortages and to improve the quality of O&M of the irrigation system.

Overall, in order to prevent the collapse of the N6 WUA changes to government policy will be necessary, especially regarding the distribution of the ISF waiver.

8.5 Conclusion

This chapter has brought together the findings from the three case studies. They are comparable in terms of area irrigated but otherwise represent distinct systems in terms of climate, topography, irrigation system complexity, and governance structure. As such the three cases provide important illustrations that may be applicable to structures similar to each, in Vietnam.

Perceptions of respondents in this study show that in general terms the IMT has brought considerable benefits. Positive outcomes can be seen from improvements in financing, water supply management, increased agricultural production, improved household incomes and livelihoods for farmers, a reduction in the conflicts between upstream and downstream farmers, and between communes. However, across three case studies, there are number of constraints that need to be adjusted in order to ensure the original intent of the IMT is sustained over the long-term.

Overall, the results of this study show that of all three cases the Ngoila irrigation system has achieved the most positive outcomes. It has the advantage of being a whole system complete with authority for headworks (with reservoirs) to the end of the system. Its canals are concreted. The WUA has had more active control over water supply compared to the two other systems. The governance of Ngoila's WUA is a quasi-state organisation. Members of the WUA represent both government and local farmers. They have the right to decide the allocation of the government subsidy and collectively develop O&M plans. Farmer partners gain skills from the government staff and government staff learns about local needs from the farmers.

Many of the barriers illustrated in the previous section of this chapter require high-level action and change. Provincial governments need to readdress the price setting to generate realistic budges for WUAs. They have a responsibility to try to improve the funding distribution to lower tiers of government. Better vertical integration between provincial and lower tiers of government would assist in development of technical capacity across tiers of government.

There is considerable difference between case studies in terms of the functioning of WUAs. Without meaningful engagement of farmers WUAs will not be able to bring about the expected benefits to agricultural productivity. One key to farmer participation and WUA success is clear communication and education. Misunderstanding has shown to reduce farmer engagement and motivation. Responsibility for educating farmers about high tier policy development should probably lie with WUAs. However, this responsibility needs to be clearly assigned and supported. Lack of resources to provide education to farmers needs to be addressed. Similarly, farmers have explained they would appreciate skill development and training. Perhaps cross-regional strategies might be appropriate, taking successful methods and transferring them to like systems, following train-the-trainer strategies.

There are obvious benefits for communes with concreted canal systems. Water flow, reduced loss and capacity for canal protection are such benefits. Higher tiers of government should work to redress these canal condition inequities by helping to upgrade primitive canal systems. Improved vertical integration between those managing headworks and those managing lower level canals may be appropriate to present applications for donor funding support.

The importance of on-farm irrigator positions needs to be addressed at numerous levels. They need to be given higher status. Lack of appreciation for these positions is leading to their potential collapse in some places. Better financial support, reflected in a rise in salary, to recognise the value of their effort is a solution. These people have been shown to be critical for assisting in the protection of water resources and water supply efficiencies, which in turn has brought greater harmony to communities and improved agricultural productivity.

Waste management is been reported as a problem across all three case studies. Dealing with municipal household waste and construction waste should not fall to irrigation managers. This problem should be addressed at district or provincial level and brought to the attention of those with responsibility for waste management. Having said that, the organic waste from surplus unsold produce and agricultural by-products could be better managed by farmers. Composting systems could be constructed to better control this type of output. WUAs are in an ideal position to implement strategies to deal collectively with such challenges.

Chapter 9 CONCLUSION AND RECOMMENDATIONS

IMT has been adopted globally as a means of resolving complex governance challenges for large to small-scale irrigation management. The process of transfer of responsibility is designed to reduce financial pressures on governments both in operation and labour force payments. At the same time it is intended to increase performance of irrigation systems and to encourage farmers to participate in irrigation infrastructure management. Increased accountability of water providers and an enhanced water security supply for farmers are part of the signature of IMT. It is claimed that such improvements will lead to enhanced sustainability and reduction in detrimental environmental impacts of irrigation systems. The adoption of IMT in Vietnam has not followed the exact recipe for transfer followed by most countries. After early years the financial burden of devolved governance on farmers encouraged the government to once again take over the majority of the financial costs of irrigation management.

While there have been many studies exploring results of the IMT none have viewed it from the perspective of farmers, or water users, and most were conducted immediately post transfer. Very few studies have explored the impacts of the government's financial policy (fee waivers). This study responds to these gaps. It is strongly focussed on the farmer perspective and it is now almost two decades since the earliest transfer and nearly one decade since the introduction of the government subsidies or fee waivers.

This research met the following specific objectives:

- To develop an evaluation framework by which to examine the results of the transfer of irrigation management responsibility in Vietnam; (The framework was a culmination of the literature review and is detailed in Chapter 2).

- To explore the perceptions of farmers within the case study areas regarding: current performance of irrigation systems in terms of O&M; and agricultural productivity; the effectiveness of governance of irrigation system management; the legacy of government IMT policies including funding arrangements

(Chapters 5, 6 and 7 provided the results obtained from this study, focusing on field observations and perspectives of farmers and some senior water providers. These opinions are taken as the main source of insight about the current status and effectiveness of irrigation management, the effectiveness of irrigation performance, and barriers to effective irrigation management.

This final chapter attends to the remaining objectives:

- To identify barriers to effective irrigation management in selected case studies;
- To propose possible solutions to overcome barriers to irrigation management in Vietnam.

Section 9.1 provides a synthesis of the findings to illustrate the success of the study in meeting the original objectives and to point of the significant contributions of this research. **Section 9.2** presents the contribution has the thesis made to debates about IMT globally and in the South- Asian context. Section 9.3 explains the study's limitations and future research possibilities.

9.1 Study synthesis

The following section provides a synthesis of key findings generalised for the three cases.

9.1.1 Evaluation framework

Pre-existing evaluation studies contributed to the construction of the evaluation framework for this study. Criteria used previously to evaluate PIM/IMT and WUAs has been synthesised. The framework applied in this study is more comprehensive than those applied in previous evaluations. It has combined and expanded governance, management and participatory attributes used previously (e.g. financial arrangements, water supply management, O&M of infrastructure, agricultural and economic benefits, social and governance performance). The framework has proven to be a solid and robust means by which to systematically consider each case study.

9.1.2 Perceptions of water users: irrigation system performance, governance and productivity-barriers and solutions

9.1.2.1 Irrigation system performance and agricultural productivity

This study has shown that while there have been reported gains in terms of water supply management, increased agricultural productivity, improved livelihoods and enhanced social cohesion, there are some persistent problems in the management of irrigation infrastructure.

Infrastructure condition

The condition of canals is degrading and the original donor funding that assisted in the construction and concreting of irrigation works has long since been used up. WUAs lack the finances to regularly implement major repairs or to concrete whole systems. The problem of degrading canals is exacerbated when governance arrangements falter. Weak WUAs have shown to be unable to adequately resolve farmer disputes and inefficient and ineffective in the upkeep and timely repair of infrastructure.

Solutions to improve infrastructure condition

Sufficient financing for upgrade of infrastructure will require high order governmental assistance and targeted budgeting. Some places have never had the benefit of concreted canals. It may be that the Vietnam government again needs to call on donors to assist in the upgrade of these systems, especially given the time that has lapsed since implementation.

Improving governance structures (the role of WUAs in particular) is a key to resolving problems associated with canal degradation. A collective vision is essential in gaining broad support and engagement in maintaining canals especially for tertiary level canals which are in the poorest condition and most easily disrupted. Solutions for governance are taken up in detail in later sections.

Waste Management

Unlawful dumping of waste was reported as a significant impediment to water supply in all three case studies. Irrigation channels are open and run beside residential areas or along roads. Waste management increases O&M costs and increases irrigation inefficiencies. Responsibility for waste lies with other administrative units, outside of water management and resolving this problem will require integration of different sectors. Current regulations have proven insufficient to control community behaviour to minimise inappropriate disposal of waste.

Waste Management Solutions

Waste management solutions will require an investigation into the adequacy of waste management systems and it will demand the integration of water managers, waste managers and the construction industry. It may well be that existing systems are insufficient to manage household waste. ACs or local units of management could most certainly be encouraged to assist in the development of local composting facilities to better manage unsold produce and agricultural by-products, to keep them from being emptied into canals. Recognition of the value of composting may encourage better disposal of organic materials. Farmers need to be better informed about the serious problems of discarded waste and presented with opportunities to manage waste differently.

As a last resort, the government could empower government companies to punish unlawful dumping of waste materials into canal infrastructure.

Water Shortages

Water shortages were reported across the three case studies. It is difficult for water managers to guarantee an adequate water supply in times of extreme drought. Anticipated and realised climate change impacts reduce water volume in rivers and reservoirs and increase the frequency of times of water scarcity. Such pressure affects water managers who must decide water allocation.

Water Shortages solutions

Wasting of water is also evident. Water shortage challenges may be partly resolved by reducing loss of water from farms. This will involve placing greater effort on informing farmers of supply schedules and refusing to deliver water to farms where farmers are absent and therefore unable to protect loss from their farming square. A stronger recognition of the importance of drainage canals may also lead to improvements in saving water. Educating farmers about the finite supply of water and the impact of their actions may also serve to reduce unlawful acts (such as breaking canals). In addition, other actions to reduce water loss include the upgrading of earthen canals, and researching and applying water saving infrastructure design from already dry countries.

9.1.2.2 Effectiveness of governance structures

The creation of WUAs with responsibility to control and deliver water for individual communes is a central feature of IMT. The case studies show that there is considerable variation in staffing skills, wages paid and rights attached to these entities. Their functioning is directly related to governance and funding arrangements.

WUA ineffectiveness

WUA ineffectiveness is illustrated through complaints of inequity and inefficiency of water allocation along tertiary canal systems. These challenges were reported for all three case studies. Over time there has been a growing reluctance of farmers to take on leadership roles, especially in the poorest region in this study. Inadequate wages, lack of institutional support, and insufficient training and skill development contribute to weak WUAs.

Improving WUA effectiveness

Improving WUA effectiveness requires complex solutions. Support from both national and provincial government is needed. Weaknesses in WUA organisations (e.g lack of capacity, lack of autonomy and funding limitations) suggest the need for policy review. Improving the autonomy of WUA by allowing them to set the price of ISF in discussion with water users is one such change. Training programs provided more frequently by both government companies, provincial and government will greatly assist farmer-leaders to develop their skills.

Challenges facing on-farm irrigator roles

This study has illustrated the critical role performed by on-farm irrigators. They are at the heart of a number of key water supply and social cohesion matters. They have proven to assist in water delivery, educating farmers and by their actions reducing conflict. However, their positions are seriously under-rated and in peril. To lose this on-farm presence would undermine productivity and livelihood advances.

Solutions to improving reliance of on-farm irrigator roles

An immediate response would be to bring on-farm irrigator salaries in line with basic wages. There should probably be community recognition of the hard work put-in by these people and incentivisation strategies devised to encourage longer term holding of such positions.

Farmer participation

Farmer participation is encouraged in building of irrigation systems and in decision-making through the election of WUA members. Meaningful participation (as identified in the literature review) suggests the ability to influence decision-making processes. This study has shown that according to Pretty's typology levels of participation (Pretty, 1995) as identified by the conversations with farmers in this study tend to fall within the levels 3 'Participation by consultation', 4 'Participation for material incentives', and 5 'Functional participation'. For example, respondents in this study thought that making a financial contribution or giving materials equated with participation. The typology rates this as 4 'Participation for material incentives'. As such, in terms of self-determination and citizen power the study reveals that the IMT has been limited in this respect. In fact there has been a reduction in the capacity of farmers to engage. The unanticipated outcome of the government subsidy has diminished opportunities for farmer engagement. A consequence of a lack of engagement and shared responsibility by farmers is disrespect for infrastructure. This is illustrated by the unlawful destruction of infrastructure and lack of adherence to supply schedules.

Solutions to encourage farmer participation

Changing the top-down paradigm of water governance and financial support will take time and carefully constructed policy development. While there have been real efforts to encourage farmer participation the driving of projects and programs from out-side of communities has reduced their potential to engage farmers meaningfully. In the history of irrigation management in Vietnam farmers themselves have had very little experience in owning management decisions. Ownership has been retained largely by the government. Farmers have been able to make household level decisions (about crop and income diversity) and to some extent by voting in their local leaders they have influenced change. They are represented by leaders. Farmers' responses in this study suggest that farmers have yet to realise their full potential as decision-makers.

9.1.2.3 Legacy of government policies

Government subsidies providing the ISF waiver for farmers have had a retrograde effect on the intended benefits of IMT. Farmers again depend on the Government in Vietnam. The subsidy has affected the interaction between Province level organisations (IMCs) and local organisations (WUAs). It has served to reduce the power of lower tier water providers. WUAs are vulnerable due to their financial dependence on government. Misunderstanding about what the subsidy covers has led to farmers defaulting on their fees. Cumbersome bureaucracy leads to delayed payments to water mangers making it difficult for them to perform their roles and leads to personal hardship for staff who work unpaid.

The distribution of the government subsidy between agencies and WUAs is perceived to be unfair, leading to serious funding shortages for O&M of irrigation systems under WUA responsibility.

There are problems associated with provincial governments setting the limits of the on-farm ISF. Under-estimation of budget requirements for the O&M of tertiary canals has reportedly led to significant funding shortfalls. The knock-on effect of this is that on-farm irrigators are not paid properly and there are insufficient funds to undertake necessary maintenance works and canals degrade.

Overcoming the legacy of government policy

To overcome unwieldy and unfair funding mechanisms, robust policy is needed to ensure equitable distribution of funds between government authorities and WUAs need better protection to overcome the problem of higher tiers of government holding back subsidies for their own use. Alternative funding models are worthy of investigation.

To avoid inconsistent dispersal of central funds to provinces a detailed funding formula is needed which determines the amount of funding according to specific criteria.

An increase to the on-farm ISF requires careful consideration. There are two challenges to overcome. First, not all farmer groups of WUAs are financially secure. Where a fee increase is warranted a targeted communication strategy (designed by the provincial government and the WUA) should be devised. In places where farmers already struggle to pay their fees, alternative support mechanisms are needed to bring these groups in line with other financially viable regions. Some regions will be better able to accommodate a fee increase than others. Second, to encourage farmer payments is the need to raise awareness about the importance of the ISF, and the services it provides to farmers.

The ceiling price of the ISF should be negotiated between the provincial government and the WUA which has a clear understanding of the likely budget required for canal O&M.

9.2 The study in global context

The central purpose of this research was to develop a better understanding regarding the results of IMT through three case studies in the North of Vietnam.

According to the literature, irrigation systems are successful if disputes among water users are solved internally and graduated sanctions are applied that take into account the extent and damage caused by infractions (Satoh et al., 2007; Koso, 2008; Uysal & Atış, 2010). This study found that disputes have been largely overcome, however, there is reportedly continued unlawful accessing of water and over-use of water by some that is disadvantageous to others. The undervalued role of on-farm irrigators serves to undermine the work they have achieved in improving and protecting water supplies.

Furthermore, one of the conditions considered essential for IMT success identified by many authors (Groenfeldt &Svendsen, 2000; Raby, 2000; Shioda & Omimaru, 2007; FAO, 2007) is cost sharing of O&M and financial transparency—individual water users understand funding arrangements. Financial barriers are at the centre of problems arising around irrigation management in this study. Government subsidy has made a difference to the O&M of irrigation systems and farmers have had lifted from them the burden of financing whole systems. The distribution of the subsidy however, is complex, bureaucratic and slow. It has not benefitted all farmers as intended. A considerable number of farmers continue to struggle, especially in regions where canals have not been concreted. There have been some unanticipated outcomes from the introduction of the subsidy. A shift in responsibility has had an associated shift in attitude, and in some places farmers have shown a reluctance to engage in the governance and sharing of management of tertiary systems. In addition, Provincial on-farm ISF price setting is also problematic as the result of this finding. This needs to be closely considered. This fee needs to reflect current pricing so that budgets generated for on-farm O&M can meet demand. Having said that, in N6 where farmers are already reported to be struggling, it is perhaps not possible to ask them to contribute more than they already do without leading them into great financial hardship. In this instance, alternative funding support is needed (e.g. new donor support) in this region. The situation in N6 is partly related to canal condition, and this is taken up below. In addition, what has emerged from this study is that salaries of WUA staff and on-farm irrigators also need to be closely considered. There is a discrepancy between regions with the salaries paid to people for doing the same work. Budget crises are threatening the performance of on-farm irrigators, paid too little for their hard work. This leads to greater chance of corruption where irrigators may be ‘bought’ and supply water out of turn to those who can pay them the best price. Furthermore, this research also indicates that not all farmers understood the distribution of funding between different tiers and why they needed to pay an on-farm fee.

Recent studies illustrate that the investment in irrigation and the rate of growth in the coverage of irrigated areas has begun to reduce in Asian countries, including Vietnam (FAO, 2003; Lipton et al., 2003). This study is in keeping. The introduction of the ISF waiver while resulting in revenue raising for O&M of irrigation systems, the coverage of irrigated areas is declining.

It is widely acknowledged that a number of water supply conditions are necessary for IMT success incuding guaranteed supply of water to users; equality in water allocation and security of supply (Pant, 2007; Uysal & Atış, 2010; Hamada & Samad, 2011). Across these measures overall conditions have improved for the three case studies in this research. There is room for improvement in terms of equity of supply. The most vulnerable are those at the tail of canals. Water use is linked to canal design and also to human action. The narrowing of farm borders (following changes to policy), poor designs and destructive or unlawful behaviours are each leading to unnecessary water loss. Equality in water supply and security require greater attention. Moreover, knowing exactly how much water supply is available and the timing of the expected delivery by irrigators and the ability to monitor compliance of irrigation delivery to individual farmers are also considered essential in the success of irrigation systems. Achieving these measures helps to ensure equitable O&M costs and reduce conflicts. The case studies in this research have confirmed successes across these measures. The role of the on-farm irrigators has contributed to large gains in this respect. The breaking of canals and unlawful out-of-turn withdrawal of water is a persistent challenge.

Moreover, water theory suggests that a condition of IMT success is that farmers receive benefits from their involvement on irrigation management and from the ISF they pay (Hamada & Samad, 2011). This study found that there is no active engagement of farmers in irrigation systems management, especially, since the introduction of the ISF waiver in 2008. This seems to have lessened farmer's participation, especially in tertiary irrigation systems management. Not all farmers were in receipt of an equitable share of the on-farm ISF or the subsidy paid by government. Furthermore, the come out of my finding is that respondents also raised concerns about the physical condition of infrastructure especially the degradation of tertiary canal systems. For many systems considerable time has passed since the IMT when many systems were constructed with assistance from donors.

There are a number of success criteria around governance and IMT in the literature (Raymond, 2004a; Yildirim & Çakmak, 2004; Pant, 2007). There should be clear and adequate roles split between the WUA and other government agencies. Decision-making should be equal between water users. Those who build the irrigation systems have the right to be supplied water from the system, and are recognized as being responsible for operation and maintain the system. Members help define water allocation rules. Organisations are strong when they have adequate labour to maintain systems and the ability to distribute adequate water supply. In small systems, a high rate of member attendance in general meetings ensures that decisions have strong member support. Communication between members ensures the success of the system because it helps members to share information and enables timely response to emergency situations. However, what come out from this study indicates that Governance differences are prominent. Not all systems have achieved equity and an equal voice for decision makers. The partial systems are at a disadvantage in terms of defining allocation rules. While there have been improvements around policy decisions for 'end of pipe' water users these people still seem to have least voice. Currently, in partial systems there is a limitation for lower level management to influence supply; Moreover, the lack of ability or unwillingness by some farmers to contribute labour and/or sufficient financial resources for O&M suggests weaknesses in governance. Poor communication and unrealistic expectations have led to this position. Some respondents (N6) suggest that general meetings have not been called. Decision-making is taken out of the hands of farmers. This is a retrograde step for IMT principles. Furthermore, communication (vertical and horizontal) is a problem linking to misunderstanding about supply schedules, payment of fees, and interpretation of government policies and contracting roles of WUAs

Another urgent issue not mentioned by other studies is increasing environmental problems which directly impact upon irrigation systems management. Vietnam like several other countries in Asia where rice production is the main agricultural product, is challengved by waste management. Waste collection systems are inadequate and polluting of rice fields a growing problem interfereing with productivity.

9.3 Limitations of the study and further research

This research explored irrigation management through the lens of three case studies, each with a unique regional setting and governance structure. In hindsight it would have been powerful to use cases from similar regions, sharing similar governance structures. This may well have assisted in enhancing the application of the framework to identify with greater specificity challenges and solutions for like places.

The case studies used in this research are largely from the north of Vietnam which has a history of government influence over irrigation system management. It would be very interesting to investigate perspectives from Southern Vietnam, especially in the Mekong River Delta, which has a different history and more privately owned irrigation systems. Language barriers, time and financial limitations prevented such a selection.

Working across two languages has been a challenge. Data translation was a difficult process as the researcher is not a native English speaker. Interviews and questionnaire data were collected in Vietnamese and later translated to English. This process may have lost some of the finer nuances of the rich data set.

It would have been beneficial to speak to more water managers. In this way it would have been possible to contrast whether or not the perspective of farmers is in agreeance with higher level authorities. Such an understanding would help pinpoint where blockages exist or where strategies to improve irrigation management might be best targeted.

It would also have been beneficial to attend farmer general meetings, 'congresses', to observe first-hand the nature of discussion and the difference in decision-making processes between places.

This research focused on irrigation canals. An outcome of this study is an understanding that drainage canals, which provide a vital role in flood management, are undervalued and their management is not well understood.

Waste management is worthy of greater exploration. Farmers are chastised for polluting, yet there may not be a system in place to assist in the proper disposal of waste products. The adequacy of waste management systems is not well understood.

Climate change associated water shortages are anticipated in Vietnam. It would be beneficial to explore the development of drought resistant crops and water-saving irrigation practices.

9.4 Conclusion

This study successfully achieved its overall aim of evaluating the transfer of irrigation management responsibility from government to water users from a number of aspects. The application of the evaluation framework assisted in responding to the stated objectives exploring irrigation system performance and governance. The framework adds a new dimension to the literature by integrating previous evaluations of IMT and presenting a more holistic set of criteria spanning performance and governance aspects. The mixed method approach, with a significant leaning to qualitative data, has made a significant contribution by detailing from the farmers' perspective challenges facing irrigation managers, including their participation, sense of ownership, and long-term sustainability. The framework and findings of this study whilst focussed on three case studies has the potential to contribute to the enhancement of irrigation management processes both within the case study regions but also for other irrigation systems in Vietnam, and potentially elsewhere.

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APPENDIXES

Appendix 1: Letters of Introduction

LETTER OF INTRODUCTION

Dear Sir/Madam:

This letter is to introduce Thi Thanh Trang Pham who is a Phd student in the School of Environment at Flinders University. She will produce her student card, which carries a photograph, as proof of identity.

She is undertaking research leading to the production of a thesis or other publications on the subject of "Improving the efficiency of Management and Operation of Small and Medium Irrigation Systems in Vietnam".

She would be most grateful if you would volunteer to assist in this project, by granting structured interview which covers certain aspects of this topic. No more than 30 minutes on one occasion would be required.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on +61 8 82015994, by fax on +61 8 82013521 or by e-mail (Simon.benger@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

Dr Simon Benger
Senior Lecturer in Spatial Information Systems
School of the Environment

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee. For more information regarding ethical approval of the project the Secretary of the Committee can be contacted by telephone on 8201 5962, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

Updated 28 September 2007

Flinders
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ADELAIDE • AUSTRALIA

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INFORMATION SHEET

Title of the Project

Improving the efficiency of Management and Operation of Small and Medium Irrigation Systems in Vietnam

Investigator:
Thi Thanh Trang Pham
School of Environment
Flinders University
Ph: +61424747768

Description of the study:
This study is part of the project entitled "Improving the efficiency of Management and Operation of Small and Medium Irrigation Systems in Vietnam". This project is supported by the School of Environment, Flinders University, South Australia.

Purpose of the study:
This research aims to identify more effective approaches to water management that could provide significant economic benefits. Benefits would include:

- Improved farm performance initiating higher household incomes through increased gross agriculture production and crop diversification.
- Improved irrigation efficiency can help contribute to the development of rural economies and Vietnam's economic growth.

What will I be asked to do?

- You are invited to attend a one-on-one conversation with researcher who will ask you a few structured interviews questions about investment capital of irrigation systems, functional condition of irrigation works, cost of irrigation, ratio between cost of operation and maintenance and water fees and government funding. The interview will take you about 20-30 minutes. The interview will be recorded using a digital voice recorder to help with transcribing at the results. This is voluntary.

inspiring
achievement

What benefit will I gain from being involved in this study?

The sharing of your experiences is the valuable contribution in order to find the solutions to improve the efficiency of irrigation system management. As a result, it may reduce financial burden on your company for operation and maintenance through better collection of irrigation fees and reduce your time in dealing with conflicts between water users in water delivery.

Will I be identifiable by being involved in this study?
While the information gained in this study may be published, you will not be identified, and individual information will remain confidential.

Are there any risks or discomforts if I am involved?
There are no risks or burdens for you when you participate in this study.

How do I agree to participate?

Participation is voluntary. You will be asked your willingness to be audio recorded to support this research. You are free to withdraw at any time from the session or the research without disadvantage. A consent form accompanies this information sheet. If you agree to participate please read and sign the form and return it to me.

How will I contact?
The researched will be contacted via E-mail: Pham0102@flinders.edu.au and phone number: +84982054099 (Vietnam) and +61424747768 (Australia)

Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number INSERT PROJECT No. here following approval). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

Appendix 2: The reference letter from the Vietnamese Academy for Water Resources

Kc A. Hưng

VIỆN KH TL VIỆT NAM VIỆN KINH TẾ VÀ QUẢN LÝ THỦY LỢI	CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM Độc lập - Tự do - Hạnh phúc
Số: 82 /VKT-HTQT V/v nghiên cứu mô hình quản lý thủy lợi tại tỉnh Tuyên Quang	*Hà Nội, ngày 16 tháng 9 năm* 2013

Kính gửi: Ban Quản lý khai thác công trình thủy lợi Tuyên Quang.

Viện Kinh tế và Quản lý thủy lợi đang phối hợp với trường Đại học Flinders Úc hướng dẫn luận án tiến sỹ cho nghiên cứu sinh Phạm Thị Thanh Trang. Chị Phạm Thị Thanh Trang là giảng viên của trường Đại học Thủy lợi Hà Nội, hiện đang nghiên cứu luận án tiến sỹ tại trường đại học Flinders, Úc.

Hiện nay Chị Trang được nhà trường cho về Việt Nam khảo sát và thu thập số liệu phục vụ cho viết luận án (tại Tuyên Quang và An Giang).

Theo kế hoạch, từ ngày 20 đến ngày 21/9/2013 Chị Phạm Thị Thanh Trang và Giáo viên hướng dẫn là Tiến sĩ Simon Benger của trường đại học Flinders-Úc đến Tuyên Quang để khảo sát, tìm hiểu về chuyển giao công tác quản lý thủy lợi cho cộng đồng. Đoàn gồm có 2 người.

1. Dr. Simon Benger. Giảng viên cao cấp khoa môi trường Trường Đại học Flinders, Úc (Quốc tịch Úc, Số hộ chiếu: M3198246, hạn sử dụng đến ngày 05 tháng 11năm 2015); số điện thoại +61882015994).

2. Phạm Thị Thanh Trang. Nghiên cứu sinh (Quốc Tịch Việt Nam; Số hộ chiếu: B3256972, hạn sử dụng đến 23 tháng 6 năm 2019).

Đề nghị Ban Quản lý khai thác công trình thủy lợi Tuyên Quang tạo điều kiện, sắp xếp làm việc với đoàn.

Trân trọng cảm ơn./.

Nơi nhận:
- Như kính gửi;
- Sở NN&PTNT Tuyên Quang(báo cáo);
- Chi cục TL Tuyên Quang;
- Lưu: VT, THQT.

VIỆN TRƯỞNG

KINH TẾ VÀ QUẢN THỦY LỢI

Đoàn Thế Lợi

Appendix 3: Interview Forms

IMCs/BoT staff

Section 1: Organisation of Irrigation Management Company and Irrigation System management

To begin I would like to ask you for some information about your company and the operation of this irrigation system.

1. How many staff work in your Irrigation Management Company (IMC)/ Board of Tuyen Quang?
2. How many departments are in your IMC/BoT?
3. What is the function of each Department?
4. What was the cost to construct this irrigation system?
5. How long did it take to construct?
6. What are the management unit boundaries?
   [ ] Civil administrative boundaries
   [ ] Hydrological boundaries
7. What is Water Fee Decree (regulation) being implemented in this irrigation system?
8. How many irrigated hectares do the IMC serve?
9. How many households are served by this irrigation system?
10. To what extent does the system operate at this design capacity?

    [ ] Always operates at design capacity
    [ ] Sometimes operates at design capacity
    [ ] Never operates at design capacity
    [ ] Don't know [ ] No response

Section 2: Irrigation system transfer program

In this part, I would like to know your opinion about the irrigation system transfer program and some data related to operation and management cost of this irrigation system.

11. In which year was PIM/IMT implemented in this system?
12. Which kind of transfer
    [ ] Partial transfer; [ ] Full transfer?
13. What is level of transfer?
    [ ] Management; [ ] Ownership; [ ] Other:
14. Did your company conduct **technical** education programs for farmers?
    [ ] Before transfer [ ] During transfer
    [ ] After transfer [ ] No
15. Did your company conduct **management** education programs for farmers?
    [ ] Before transfer [ ] During transfer
    [ ] After transfer [ ] No
16. Did the number of staff in your organisation reduce after irrigation system transfer?
    [ ] Yes If yes by how many people?_________________

[ ] No

17. How much money is spent on operation and management (O&M) of irrigation system per year in average?
    [ ] Before transfer: ______________________________
    [ ] After transfer: _______________________________
18. How much in water fees are collected each year (on average)?
    [ ] Before transfer: __________________
    [ ] After transfer: ____________________
19. Does your company receive subsidises from the Government (on average)
    [ ] Before transfer: __________________
    [ ] After transfer: ____________________

20. To what extent do the water fees cover the total costs (operation and management) of the scheme before and after transfer?

Costs	**Before**	**After**
[ ] Fully cover the cost [ ] Partially cover the cost [ ] Marginally cover the cost [ ] Don't know [ ] No response		

Section 3:

The following section seeks your opinions about WUAs, main strengths and challenges of irrigation system transfer program. It also seeks your views in supporting an increase in the performance of irrigation system.

21. How successful has the irrigation transfer program been in reducing Operation and Management cost (O&M) of irrigation system?

Very Unsuccessful	Unsuccessful	Uncertain	Successful	Very Successful	Don't Know

Please give a reason for your choice:

22. In your opinion, how effective is the irrigation systems transfer?

Very Ineffective	Ineffective	Uncertain	Effective	Very Effective	Don't Know

Please give a reason for your choice:

23. What are the main strengths of the irrigation system transfer program?
24. What are the main challenges faced by irrigation system transfer program?

25. If you think the effectiveness of the management of irrigation works should be improved, how will your organisation support such an improvement?

Agricultural Co-operative members

1. When did you start take this role?
2. Could you tell me the irrigated water delivery process in your commune?
3. What did you do when you receive complaints from farmers about water shortage?
4. Did you collect on-farm ISF?
5. What do you evaluate the impact of WUAs on your commune in term of water distribution?
6. Did your AC give any support for WUA in your commune?
7. What are the difficulties in terms of water management in your commune at present?
8. What are your opinions to efficiently improve water supply the commune

Questions asked of WUA members

Section 1: Nature of WUA

First of all I'd like to ask you some general questions about your organisation and WUA capacity.

1. How many members does your association have, and what are their roles?
2. How many water users are served by your WUA?
3. How many irrigated hectares are served by your WUA?
4. Are leaders your WUA elected?
   [ ] Yes
   [ ] If No, how are leaders assigned such roles?
5. Do WUAs organise meetings with water users?
   [ ] Yes If yes go to question 6
   [ ] If No, Why not?
6. How often do meetings take place?
7. Is your WUA financially self-sufficient?
   [ ] Yes
   [ ] No
8. Does your organisation receive a budget from the government or other resources?
   [ ] Yes if Yes go to question 9
   [ ] No if No go to question 10
9. How much per year?
10. Who makes the decisions about water distribution?

Section 2: Gender in irrigation management

The following section seeks information about the roles of women in increasing the effectiveness of the WUA.

11. Does your organisation encourage women participating in irrigation management?
    [ ] Yes If yes in what way?; [ ] No, If no, why not?
12. Are women represented in irrigation system management?
    [ ] Yes If yes go to question 13
    [ ] No, If no, why not?
13. How many women in your WUA?
- Members:
- As group leaders:
14. What is the role of the Women's Union in relation to the operation of WUAs?
15. How important is the role of women in promoting effectiveness of WUAs?

Not at all important	*Not important*	*Undecided*	*Important*	*Extremely important*

Please explain to your choice?

Section 3:

In the final part of this interview I am interested in your evaluation of the WUA and what support you can provide in order to improve the effectiveness of WUA in irrigation system management.

16. How successful do you think the WUA has been in managing the irrigation system?

Very Unsuccessful	Unsuccessful	Uncertain	Successful	Very Successful	Don't Know

17. What are the main strengthens of your WUA
18. What are the main challenges facing to your WUA
19. What could be done to improve the effectiveness of WUA?
20. Who should be responsible for this improvement?

Questions asked of Manager of Ministry of Agricultural and Rural Development

1. How do you think are the results/achievements of the IMT?
2. What conditions have made the IMT a success?
3. What have been the main barriers for achieving successful implementation of the IMT?
4. How important do you consider the role of training programs helping WUAs to implementation the IMT?
5. What is your opinion about the change to the ISF policy in 2008 (Decree 115/2008/ND-CP)?
6. What is your opinion about the role of WUAs in the O&M of irrigaiton systems?
7. Large numbers of WUAs were established when the IMT was implemented, however, WUAs seem to not be ineffective, leading to low quality O&M. In some systems, the IMC seems to have taken over support to ensure O&M What are the main challenges facin WUAs do you think?
8. What current policies have been issued to support and improve the effectiveness of the IMT?

Questions asked of PIM/IMT consultant

9. Could you tell me the history of PIM/IMT in Vietnam?
10. Could you tell me the achivements and challenges since PIM/IMT started?
11. You are the person directly responsible for establishing and implementing the IMT in the N6 system Could you tell me when difficulties commenced in regard to the IMT in N6. What did projects do to overcome the problems?
12. What are current difficulties implement IMT/PIM?
13. What do you think are the impacts of the 2008 ISF waiver policies (Decree 115/2008/ND-CP) impact on IMT?
14. What do you think are the main solutions to improve the outcome of PIM/IMT?

Appendix 4: Farmers' Questionnaire Form

The purpose of this study is to find the solution to improve the efficiency of Management and the Operation of Small and Medium Irrigation Systems in Vietnam. Irrigation systems in your areas have been chosen because of different conditions impacting on irrigation management in terms of scale cultivation, agricultural products and typical irrigation system management in the North and centre of Vietnam. The researcher would highly appropriate your participation in answering the following questions: the information on the irrigation scheme, what your level of satisfaction of irrigation management and water distribution, In addition, the researcher also would like to know the information relates to change in the farm sizes and irrigated hectares, the relation between costs and benefits of irrigation to farm families before and after irrigation system transfer.

The sharing of your knowledge and experience will help the researcher having a systematic understanding about current irrigation system management. From this a model for irrigation management will be developed which is suitable for your cultural, economic and social situation.

PART ONE

I. General information on farmer

1. Gender:
   - [ ] Male [ ] Female
2. Age:
3. Ethnic background
   - [ ] Kinh [ ] Other:
4. Highest education level:
   - [ ] Did not go to school [ ] Primary
   - [ ] Secondary [ ] High school
   - [ ] Vocational training [ ] University
   - [ ] Other:
5. Main occupation:
   - [ ] Official [ ] Worker
   - [ ] Small business [ ] Farmer
   - [ ] Housewife [ ] Other:
6. How many people live in your household?

PART TWO

The following section is designed to find out your opinions about various conditions since the transfer of the irrigation system from government to water user. I will ask you to think about the situation both before and after the changes in the governance of the irrigation system including fees for water, changes in agricultural production and so on.

II. Information on the irrigation scheme

1. Which year was this irrigation system transferred from IMC to the farmer?
2. What is the highest hydraulic level transferred to the WUA?
   - [ ] Headworks [ ] Tertiary canals
   - [ ] Main canals [ ] Don't know
   - [ ] Secondary canals [ ] No response

Overall, how satisfied are you with the functioning of the current irrigation system

   - [ ] Headworks [ ] Tertiary canals
   - [ ] Main canals [ ] Don't know

[ ] Secondary canals [ ] No response

Please give a reason for your choice

3. Do you think quality of maintenance of the system has changed since the transfer?

[ ] Significantly Better Quality [ ] Don't know
[ ] Moderately Better Quality [ ] No response
[ ] Marginally Better Quality

4. Do you pay an annual water fee? (crop)

[ ] If Yes go to question 5 [ ] Don't know
[ ] If No go to question 6 [ ] No response

5. Amount paid in water fees/year/sao?

Before transferring? [ ] [ ] Don't know
After transferring? [ ] [ ] No response

6. What do your opinion about the cost of the water fee?

[ ] Too Low [ ] Too High
[ ] Acceptable [ ] Don't know
[ ] High [ ] No response

Please give a reason for your choice:

In terms of water-related disputes among farmers, how have these disputes changed after the transfer of the irrigation system?

[ ] Reduced [ ] Don't know
[ ] About the same [ ] No response
[ ] Increased

7. How would you evaluate the changes in volume of agricultural production since the transfer?

[ ] volume has reduced [ ] volume has increased significantly
[ ] volume is about the same [ ] Don't know
[ ] volume has increased moderately [ ] No response

III. Water user's satisfaction of irrigation management and water distribution

I would like to know your opinion of the following statements about your perception towards the performance of irrigation system before and after irrigation transfer to WUA. There are no right or wrong answer, I have just interested in your opinion. Would you say you strongly satisfied, satisfied, neither satisfied or dissatisfied, dissatisfied, and strongly dissatisfied. Please interrupt me if you are not sure about the content.

No	**Respondent's perception towards the performance of irrigation system**	**Response***				
		Before Transfer				
		Strongly Dissatisfied	*Dissatisfied*	*Neither satisfied or dissatisfied*	*Satisfied*	*Strongly satisfied*
1	The timeliness of water delivery					
Please give a reason for your choice:						
2	The fairness of water distribution					
Please give a reason for your choice:						
3	Volumes/quantities of water delivered adequate					
Please give a reason for your choice:						
4	Quality of maintenance of irrigation system					
Please give a reason for your choice:						
5	The level of water fee					
Please give a reason for your choice						

No	**Respondent's perception towards the performance of irrigation system**	**Response***				
		After Transfer				
		Strongly Dissatisfied	*Dissatisfied*	*Neither satisfied or dissatisfied*	*Satisfied*	*Strongly satisfied*
1	The timeliness of water delivery					
Please give a reason for your choice:						

2	The fairness of water distribution					
Please give a reason for your choice:						
3	Volumes/quantities of water delivered adequate					
Please give a reason for your choice:						
4	Quality of maintenance of irrigation system					
Please give a reason for your choice:						
5	The level of water fee					
Please give a reason for your choice:						

IV. WUA activities evaluation

In this part of the questionnaire, I would like to know your opinion of the following statements about your perception towards the roles and performance of WUA. There are no right or wrong answer, I have just interested in your opinion. Would you say you strongly agree, agree, neither agree nor disagree, disagree or you strongly disagree. Please give the reasons why for your answer.

No	**Respondent's perception towards the roles and the performance of WUA's**	**Response***				
		Strongly disagree	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*
1	The irrigation system is for farmer/community					
Please give a reason for your choice:						
2	Water users participated in design, investigate of the irrigation system					
Please give a reason for your choice:						
3	Productivity of your farm has increased through this irrigation system					
Please give a reason for your choice:						
4	Your household income has increased through this irrigation					

	system					
Please give a reason for your choice:						
5	Your household income has diversified through this irrigation system					
Please give a reason for your choice:						
6	Employment opportunities in the commune have increased.					
Please give a reason for your choice:						
7	WUA ensures equality between users					
Please give a reason for your choice:						
8	WUA brings the community closer					
Please give a reason for your choice:						
9	Farmer knowledge of water resources and agriculture has increased					
Please give a reason for your choice:						
10	The role of farmer's participation in managing the irrigation system is very important.					
Please give a reason for your choice:						
11	All participants have the same rights in managing the irrigation system					
Please give a reason for your choice:						
12	You are satisfied with the irrigation system managed by WUA					
Please give a reason for your choice:						

V. Participation and Gender issues

In this part, I would like to know information about the participation of women in the irrigation meeting and their roles in the farm compared to the men roles.

1. Do you attend a WUA or other irrigation management meeting in last 3 years?

   [ ] Yes If Yes go to question 2; [ ] No If No go to question 5

2. How often do you attend in WUA or other irrigation meeting?

   [ ] Sometimes; [ ] Usually [ ] Always

3. Do you speak at meeting?

   [ ] Yes [ ] No Why not?

4. Who makes the decisions concerning agricultural prodution?

   [ ] Men: [ ] Women [ ] Both men and women

5. What are major factors that affect your participation in irrigation management on farm?

In conclusion to this section that has sought your opinions about the irrigation system could you please tell me what you think are

1. The greatest strengths of the current irrigation system for you personally?
2. The greatest strengths of the current irrigation system for your community?
3. The greatest challenges of the current irrigation system for you personally and community?
4. What changes do you think should be made to improve the way the irrigation system is currently being delivered?

Appendix 5: Focus Group Discussion Forms

IMC Staff

To begin I would like to ask you for some information about your company and the operation of this irrigation system.

1) In which year was PIM/IMT implemented in this system?
2) Which kind of transfer
3) What is level of transfer?
4) Did your company conduct technical education programs for farmers?
5) Did your company conduct management education programs for farmers?
6) Did the number of staff in your organisation reduce after irrigation system transfer?
7) How much money is spent on operation and management (O&M) of irrigation system per year in average?

   [ ] Before transfer: ___________________________

   [ ] After transfer: ____________________________

8) How much in water fees are subsidised by the Government?
9) To what extent do the water fees cover the total costs (operation and management) of the scheme before and after transfer?
10) How successful has the irrigation transfer program been in reducing Operation and Management cost (O&M) of irrigation system?
11) In your opinion, how effective is the irrigation systems transfer?
12) What are the main strengths of the irrigation system transfer program?
13) What are the main challenges faced by irrigation system transfer program?
14) If you think the effectiveness of the management of irrigation works should be improved, how will your organisation support such an improvement?

AC members

1) Could you indicate the achievements of irrigation system transfer?
2) What advantages of this transfer were gained for you, households and the commune?
3) What about changes of cultivated crop productivity, agricultural production cost and income households before and after transfer are they?
4) What did AC and WUA do to encourage farmers to participate in operation and management irrigation systems?
5) What detail contributions of water users in operation and management irrigation systems are they?
6) What difficulties do your organisation meet with in the process of O&M irrigational management?
7) What changes do you think should be made to improve the way the irrigation system is currently being delivered?

WUA members and On-farm irrigators.

8) How many staff does your association have, and what are their roles?
9) How many water users/irrigated hectares are served by your organisation?
10) Are leaders your WUA/Team (group of on farm irrigator) elected?
11) Do WUAs organise meetings with water users?
12) How often do meetings take place?
13) Is your WUA/Team financially self-sufficient?
14) Does your organisation receive a budget from the government?
15) How many women in your WUA/Team?
16) Could you indicate the achievements of irrigation system transfer?
17) What are the main challenges facing to your WUA/Team?
18) What could be done to improve the effectiveness of WUA/Team?

Appendix 6: The water supply schedule in N6 system

No	Intakes	Commune	Area (ha)	Day (from 00 am to 24 hours) from day 1 to day 9								
1	N6-1	Bac Thanh	22,14	06-24	00-24	00-24	00-24	00-24	00-24	00-24	00-24	00-06
2	N6-2	Bac Thanh	2,5	06-24	00-06							
3	N6-3	Bac Thanh	3	06-24	00-24	00-24	00-06					
4	N6-4	Trung Thanh	3,18	06-24	00-24	00-24	00-06					
5	N6-5	Bac and Trung Thanh	2,42	06-24	00-06							
6	N6-6	Trung Thanh	10,54	06-24	00-24	00-24	00-24	00-24	00-06			
7	N6-7	Bac Thanh	0,71	06-24	00-06							
8	N6-8	Trung Thanh	2,44	06-24	00-24	00-06						
9	N6-9	Bac Thanh	6	06-24	00-24	00-06						
10	N6-10	Trung Thanh	6	06-24	00-06							
11	N6-11	Bac Thanh	17,36	06-24	00-24	00-24	00-24	00-24	00-24	00-24	00-24	00-06
12	N6-12	Bac Thanh	14,88	06-24	00-24	00-24	00-24	00-24	00-24	00-24	00-24	00-06

No	Intakes	Commune	Area (ha)	Day (from 00 am to 24 hours) from day 1 to day 9								
13	N6-13	Bac Thanh	5		06-24	00-24	00-24	00-24	00-06			
14	N6-14	Bac Thanh	3,24				06-24	00-24	00-06			
15	N6-15	Bac Thanh	3,2				06-24	00-24	00-24	00-06		
16	N6-16	Bac Thanh	4,22						06-24	00-06		
17	N6-17	Bac and Xuan Thanh	5,2						06-24	00-06		
18	N6-20	Xuan Thanh	6,72				06-24	00-24	00-06			
19	N6-22	Xuan and Long Thanh	44,03	06-24	00-24	00-24	00-24	00-24	00-24	00-24	00-24	00-06
20	N6-24	Xuan and Long Thanh	6,03						06-24	00-06		
21	N6-26	Xuan and Long Thanh	25,3	06-24	00-24	00-24	00-24	00-24	00-24	00-24	00-24	00-06
22	N6-28	Long Thanh	16,7				06-24	00-24	00-24	00-24	00-24	00-06
23	N6-30	Long Thanh	2,6						06-24	00-06		
24	N6-32	Long Thanh	2,6						06-24	00-06		
25	End N6	Long Thanh	40,58		06-24	00-24	00-24	00-24	00-24	00-24	06-24	00-06

Appendix 7: The management restructure of two former irrigation systems:

QUYẾT ĐỊNH

Về việc kiện toàn Ban quản lý khai thác công trình thủy lợi Tuyên Quang

UỶ BAN NHÂN DÂN TỈNH TUYÊN QUANG

Căn cứ Luật Tổ chức Hội đồng nhân dân và Uỷ ban nhân dân ngày 26 tháng 11 năm 2003;

Căn cứ Luật Tài nguyên nước ngày 20 tháng 5 năm 1998;

Căn cứ Pháp lệnh khai thác và bảo vệ công trình thủy lợi số 32/2001/PL-UBTVQH ngày 04/4/2001;

Căn cứ Nghị định số 143/2003/NĐ-CP ngày 28/11/2003 của Chính phủ quy định chi tiết thi hành một số điều của Pháp lệnh khai thác và bảo vệ công trình thủy lợi; Nghị định số 115/2008/NĐ-CP ngày 14/11/2008 của Chính phủ quy định sửa đổi, bổ sung một số điều của Nghị định số 143/2003/NĐ-CP ngày 28/11/2003;

Căn cứ Thông tư số 36/2009/TT-BTC ngày 26/02/2009 của Bộ Tài chính hướng dẫn thi hành một số điều của Nghị định số 115/2008/NĐ-CP ngày 14/11/2008 sửa đổi, bổ sung một số điều của Nghị định số 143/2003/NĐ-CP ngày 28/11/2003 của Chính phủ quy định chi tiết thi hành một số điều của Pháp lệnh khai thác và bảo vệ công trình thuỷ lợi; Thông tư số 65/2009/TT-BNNPTNT ngày 12/10/2009 của Bộ Nông nghiệp và Phát triển nông thôn hướng dẫn tổ chức hoạt động và phân cấp quản lý, khai thác công trình thuỷ lợi; Thông tư liên tịch số 61/2008/TTLT-BNN-BNV ngày 15/5/2008 của liên Bộ Nông nghiệp và Phát triển nông thôn - Bộ nội vụ hướng dẫn chức năng, nhiệm vụ, quyền hạn và tổ chức cơ quan chuyên môn thuộc Ủy ban nhân dân cấp tỉnh, cấp huyện và nhiệm vụ quản lý nhà nước của Ủy ban nhân dân cấp xã về Nông nghiệp và Phát triển nông thôn; Thông tư 11/2009/TT-BTC ngày 21/01/2009 của Bộ Tài chính hướng dẫn đặt hàng, giao kế hoạch đối với các đơn vị làm nhiệm vụ quản lý, khai thác công trình thuỷ lợi và quy chế quản lý tài chính của công ty nhà nước làm nhiệm vụ quản lý, khai thác công trình thuỷ lợi; Thông tư số 56/2010/TT-BNNPTNT ngày 01/10/2010 của Bộ Nông nghiệp và Phát triển nông thôn quy định một số nội dung trong hoạt động của các tổ chức quản lý, khai thác công trình thuỷ lợi; Thông tư số 40/2011/TT-BNNPTNT ngày 27/5/2011 của Bộ Nông nghiệp và Phát triển nông thôn quy định năng lực của tổ chức, cá nhân tham gia quản lý, khai thác công trình thuỷ lợi;

Căn cứ Chỉ thị số 1268/CT-BNN-TL ngày 12/5/2009 của Bộ Nông nghiệp và Phát triển nông thôn về việc tăng cường công tác quản lý, khai thác công trình thuỷ lợi;

QUYẾT ĐỊNH:

Điều 1. Kiện toàn Ban quản lý khai thác công trình thủy lợi Tuyên Quang trên cơ sở sáp nhập Ban quản lý công trình thủy lợi Hoàng An Lưỡng với Ban quản lý công trình thủy lợi Ngòi Là thành Ban quản lý khai thác công trình thủy lợi Tuyên Quang, như sau:

1. Vị trí, chức năng:

Ban quản lý khai thác công trình thuỷ lợi Tuyên Quang là đơn vị sự nghiệp tự đảm bảo kinh phí hoạt động trực thuộc Chi cục Thuỷ Lợi, Sở Nông nghiệp và Phát triển nông thôn; có chức năng quản lý khai thác công trình thuỷ lợi trên phạm vi toàn tỉnh; có tư cách pháp nhân, có con dấu và được mở tài khoản theo quy định.

Trụ sở làm việc: Tại trụ sở Ban quản lý công trình thuỷ lợi Ngòi Là, phường Ỷ La, thành phố Tuyên Quang.

2. Nhiệm vụ, quyền hạn:

a) Xây dựng kế hoạch tưới, tiêu và hướng dẫn các Ban quản lý công trình thủy lợi cơ sở quản lý vận hành công trình, xây dựng và thực hiện kế hoạch tưới, tiêu đến từng công trình; nhận đặt hàng dịch vụ tưới, tiêu; chịu trách nhiệm tổ chức quản lý, khai thác và bảo vệ hệ thống công trình thủy lợi của tỉnh theo đúng quy định của nhà nước và của tỉnh. Tiếp nhận và tổ chức quản lý sử dụng kinh phí cấp bù thủy lợi phí đúng quy định.

b) Hướng dẫn kỹ thuật quản lý, vận hành, khai thác, bảo vệ công trình thủy lợi cho nhân viên các Ban quản lý công trình thuỷ lợi ở cơ sở; kiểm tra, theo dõi kết quả tưới, tiêu, chất lượng quản lý khai thác và bảo vệ công trình của các Ban quản lý công trình thủy lợi.

c) Xây dựng kế hoạch tu sửa, nâng cấp các công trình thủy lợi; kế hoạch thu, chi thủy lợi phí; kế hoạch phòng chống hạn hán, lũ lụt, trình cấp có thẩm quyền phê duyệt. Hướng dẫn các Ban quản lý công trình thuỷ lợi ở cơ sở lập hồ sơ phát dọn, nạo vét, duy tu, sửa chữa, nâng cấp công trình thuỷ lợi và kiểm tra giám sát chất lượng thi công; tổ chức nghiệm thu, bàn giao công trình đưa vào sử dụng đối với việc sử dụng nguồn kinh phí nhà nước cấp bù thuỷ lợi phí.

d) Hàng năm tổ chức rà soát, tổng hợp diện tích tưới, tiêu đề nghị nhà nước cấp bù thuỷ lợi phí gửi Sở Tài chính, Sở Nông nghiệp và Phát triển nông thôn thẩm định trình Ủy ban nhân dân tỉnh phê duyệt làm cơ sở để thực hiện đặt hàng dịch vụ thuỷ lợi; lập báo cáo quyết toán nguồn kinh phí cấp bù thủy lợi phí với nhà nước theo đúng quy định.

3. Tổ chức bộ máy:

a) Lãnh đạo: Có Giám đốc và không quá 02 Phó Giám đốc.

b) Các phòng chuyên môn, nghiệp vụ:

- Phòng kỹ thuật quản lý, khai thác công trình thuỷ lợi, gồm: Trưởng phòng và cán bộ phụ trách huyện

- Phòng Kế hoạch -Tổng hợp, gồm: Trưởng phòng; kế toán; cán bộ làm công tác: kế hoạch, kiểm tra, kiểm soát hồ sơ thủ tục, công tác tổ chức cán bộ; nhân viên thủ quỹ đánh máy, văn thư.

- Đội quản lý khai thác công trình thuỷ lợi Ngòi Là: Quản lý khai thác công trình hồ Ngòi Là theo Quyết định số 634/QĐ-UB ngày 14/6/1996 của Ủy ban nhân dân tỉnh về việc thành lập Ban quản lý công trình thuỷ lợi Ngòi Là. Cơ cấu tổ chức gồm: Đội trưởng và các cán bộ kỹ thuật.

- Đội quản lý khai thác công trình thuỷ lợi Hoàng Khai: Quản lý khai thác công trình thuỷ lợi Hoàng Khai theo Quyết định số 163/QĐ-UBND ngày 29/4/2009 của Ủy ban nhân dân tỉnh về việc thành lập Ban quản lý công trình thủy lợi Hoàng An Lưỡng. Cơ cấu tổ chức gồm: Đội trưởng và các cán bộ kỹ thuật.

4. Về biên chế:

Ban quản lý khai thác công trình thủy lợi Tuyên Quang căn cứ chức năng, nhiệm vụ được giao, nhu cầu công việc thực tế, định mức và khả năng tài chính tự quyết định biên chế của đơn vị trong phạm vi bộ máy hiện tại đã được cấp có thẩm quyền giao.

Điều 2. Các Ban quản lý công trình thuỷ lợi xã và liên xã:

Giữ nguyên tổ chức các Ban quản lý công trình thuỷ lợi xã và liên xã như hiện nay; xác định lại chức năng, nhiệm vụ để kiện toàn đảm bảo thực hiện tốt nhiệm vụ; Ủy ban nhân dân xã và Ủy ban nhân dân huyện rà soát, sắp xếp, củng cố kiện toàn lại bộ máy của Ban quản lý công trình thuỷ lợi xã và liên xã.

1. Vị trí, chức năng:

a) Ban quản lý công trình thuỷ lợi xã là đơn vị trực thuộc Ủy ban nhân dân xã, chịu sự quản lý của Ủy ban nhân dân xã; hoạt động theo Luật hợp tác xã và các quy định pháp luật khác liên quan; có tư cách pháp nhân, có con dấu riêng và được mở tài khoản theo quy định của pháp luật; tự đảm bảo kinh phí hoạt động.

b) Ban quản lý công trình thuỷ lợi liên xã là đơn vị sự nghiệp trực thuộc Ủy ban nhân huyện; chịu sự quản lý của của Ủy ban nhân dân huyện; có tư cách pháp nhân, có con dấu riêng và được mở tài khoản theo quy định của pháp luật; tự đảm bảo kinh phí hoạt động.

Ban quản lý công trình thuỷ lợi xã và Ban quản lý công trình thuỷ lợi liên xã trực tiếp thực hiện quản lý, vận hành các công trình thuỷ lợi đã được giao; nhận thực hiện hợp đồng cung cấp dịch vụ tưới, tiêu với Ban quản lý khai thác công trình thuỷ lợi Tuyên Quang.

2. Nhiệm vụ:

a) Trên cơ sở hợp đồng cung cấp dịch vụ tưới, tiêu với Ban quản lý khai thác công trình thuỷ lợi Tuyên Quang để thực hiện cung cấp sản phẩm, dịch vụ tưới, tiêu nước phục vụ sản xuất nông nghiệp và các ngành kinh tế khác. Tổ chức quản lý, bảo vệ, duy tu, bảo dưỡng, sửa chữa công trình; vận hành, điều tiết tưới, tiêu, cấp nước theo đúng quy chuẩn, tiêu chuẩn kỹ thuật, đảm bảo an toàn công trình, phục vụ sản xuất và dân sinh kịp thời, hiệu quả.

b) Tiếp nhận kinh phí nhà nước cấp bù thuỷ lợi phí từ Ban quản lý khai thác công trình thuỷ lợi Tuyên Quang, thực hiện quản lý, sử dụng, thanh quyết toán kinh phí theo đúng quy định.

c) Tận dụng công trình, máy móc thiết bị, lao động, kỹ thuật, đất đai, cảnh quan và huy động vốn để thực hiện tốt nhiệm vụ quản lý, khai thác công trình thuỷ lợi và các hoạt động kinh doanh khác theo quy định của pháp luật.

d) Thực hiện các nhiệm vụ đã được quy định tại các Quyết định thành lập Ban quản lý công trình thuỷ lợi xã và liên xã.

3. Tổ chức bộ máy:

Trên cơ sở các Quyết định thành lập Ban quản lý công trình thuỷ lợi xã và liên xã, Ủy ban nhân dân xã và Ủy ban nhân dân huyện thực hiện rà soát, sắp xếp, củng cố bộ máy của Ban quản lý công trình thuỷ lợi xã và liên xã đảm bảo đủ năng lực để hoạt động.

Điều 3. Mối quan hệ, phối hợp công tác giữa Ban quản lý công trình thủy lợi Tuyên Quang với Ban quản lý công trình thuỷ lợi xã và liên xã; kinh phí hoạt động.

1. Hàng năm, Ủy ban nhân dân tỉnh giao cho Sở Nông nghiệp và Phát triển nông thôn ký hợp đồng đặt hàng dịch vụ tưới, tiêu với Ban quản lý khai thác công trình thủy lợi tỉnh Tuyên Quang thực hiện công tác quản lý, khai thác toàn bộ các công trình thủy lợi của tỉnh để phục vụ sản xuất.

2. Ban quản lý khai thác công trình thủy lợi Tuyên Quang chịu trách nhiệm quản lý, sử dụng kinh phí cấp bù thuỷ lợi phí phục vụ công tác quản lý, khai thác hệ thống công trình thuỷ lợi. Thực hiện nghiệm thu, thanh lý hợp đồng và quyết toán việc sử dụng kinh phí cấp bù thuỷ lợi phí phục vụ công tác quản lý, khai thác hệ thống công trình thuỷ lợi theo quy định.

3. Trước vụ sản xuất, Ban quản lý khai thác công trình thủy lợi Tuyên Quang căn cứ vào đặt hàng dịch vụ tưới, tiêu của cơ quan đặt hàng và quy mô, chất lượng công trình thực hiện ký hợp đồng tưới, tiêu với các Ban quản lý công trình thuỷ lợi xã và liên xã.

4. Các ban quản lý công trình thuỷ lợi xã và liên xã ký hợp đồng cung cấp nước với các tổ chức và cá nhân sử dụng nước của công trình; kết thúc vụ sản xuất tiến hành nghiệm thu, thanh lý hợp đồng với các đối tượng sử dụng nước trên cơ sở diện tích và chất lượng tưới tiêu thực tế.

5. Ban quản lý khai thác công trình thủy lợi Tuyên Quang tổ chức nghiệm thu, thanh lý hợp đồng với các Ban quản lý công trình thuỷ lợi xã và liên xã, các đối tượng sử dụng nước công trình thuỷ lợi Ngòi Là, công trình thuỷ lợi Hoàng Khai; đồng thời có trách nhiệm quyết toán nguồn kinh phí cấp bù thuỷ lợi phí với nhà nước.

6. Kinh phí hoạt động của Ban quản lý công trình thủy lợi Tuyên Quang, Ban quản lý công trình thuỷ lợi xã và liên xã được trích từ nguồn kinh phí cấp bù thuỷ lợi phí của công trình thuỷ lợi và các nguồn thu hợp pháp khác.

Điều 4 Quyết định này có hiệu lực thi hành kể từ ngày ký.

Chánh Văn phòng Uỷ ban nhân dân tỉnh, Giám đốc sở: Kế hoạch và Đầu tư, Tài chính, Nông nghiệp và Phát triển nông thôn, Nội vụ; Chủ tịch Uỷ ban nhân dân huyện, thành phố; Thủ trưởng cơ quan, đơn vị liên quan và Giám đốc Ban quản lý khai thác công trình thủy lợi Tuyên Quang chịu trách nhiệm thi hành Quyết định này./.

TM. ỦY BAN NHÂN DÂN TỈNH

CHỦ TỊCH

(Đã ký)

Chẩu Văn Lâm

Nơi nhận:
- Thường trực Tỉnh ủy;
- Thường trực HĐND tỉnh;
- Chủ tịch UBND tỉnh;
- Các PCT UBND tỉnh;
- Như Điều 4;
- Các Phó CVP UBND tỉnh;
- Trưởng, Phó TP KT CNLN;
- Lưu VT, NC.

Appendix 8: The example of training program organised by the BoT in 2013:

KẾ HOẠCH

Tổ chức lớp Đào tạo bồi dưỡng nghiệp vụ về quản lý, khai thác

công trình thuỷ lợi năm 2013

Căn cứ Quyết định số 30/QĐ-UBND ngày 08/01/2013 của UBND tỉnh Tuyên Quang về việc phê duyệt Kế hoạch công tác và Ngân sách năm 2013 của Dự án Hỗ trợ nông nghiệp, nông dân và nông thôn tỉnh Tuyên Quang.

Thực hiện Văn bản số 192/PCU-NV ngày 07/5/2013 của Ban điều phối Dự án hỗ trợ nông nghiệp, nông dân và nông thôn tỉnh Tuyên Quang về việc nhất trí cho sử dụng kinh phí xây dựng mô hình thí điểm nâng cao hiệu quả vận hành bảo dưỡng khai thác công trình thủy lợi (CTTL) xã Đại Phú để tập huấn cho cán bộ các Ban quản lý CTTL ở cơ sở theo đề nghị của Chi cục Thủy lợi tại Văn bản số 42/CCTL-QLCT ngày 24/4/2013.

Chi cục Thuỷ lợi xây dựng kế hoạch tổ chức lớp Đào tạo bồi dưỡng nghiệp vụ về quản lý, khai thác công trình thuỷ lợi như sau:

1- Mục đích:

Đào tạo Nâng cao năng lực, trình độ cho cán bộ trực tiếp quản lý khai thác công trình thuỷ lợi ở cơ sở để nâng cao hiệu quả quản lý, khai thác và bảo vệ công trình theo quy định hiện hành. Cấp giấy chứng nhận bồi dưỡng nghiệp vụ quản lý khai thác CTTL theo quy định tại Thông tư số 40/2011/TT-BNNPTNT ngày 27/5/2011 của Bộ NN và PTNT quy định năng lực của tổ chức, cá nhân tham gia quản lý, khai thác CTTL.

2- Đối tượng tập huấn:

Mỗi Ban quản lý CTTL cơ sở triệu tập 01 người (là Trưởng ban, phó trưởng ban hoặc cán bộ kỹ thuật);

Trường hợp các Ban quản lý CTTL quản lý nhiều công trình hoặc nhiều diện tích tưới triệu tập 02 người (là Trưởng ban và cán bộ kỹ thuật);

Đối với những Ban quản lý CTTL liên xã có Trưởng ban quản lý đã tham dự khóa đào tạo bồi dưỡng nghiệp vụ do Bộ Nông nghiệp và PTNT tổ chức thì triệu tập 02 người là Phó trưởng ban quản lý và cán bộ kỹ thuật.

(Có chi tiết danh sách các BQL và số lượng học viên kèm theo)

3- Nội dung: Đào tạo bồi dưỡng nghiệp vụ về quản lý, khai thác công trình thủy lợi, gồm:

- Giới thiệu các cơ chế chính sách trong quản lý, khai thác CTTL.

- Mô hình tổ chức quản lý, phân cấp quản lý, khai thác CTTL.

- Lập Kế hoạch và vận hành tưới tiêu; Quy định về quản lý, vận hành, tu sửa sửa, bảo quản và bảo vệ CTTL (hồ chứa, trạm bơm, cống, kênh…)

- Phân cấp hạn hán, quy trình vận hành công trình thủy lợi.

- Ký thuật tưới cho một số cây trồng.

- Ứng dụng tin học trong quản lý khai thác CTTL.

- Quy định về quản lý, sử dụng nguồn tài chính của các tổ chức quản lý khai thác CTTL. Hướng dẫn lập hồ sơ, thủ tục sử dụng, thanh quyết toán nguồn kinh phí cấp bù TLP để nạo vét, phát dọn và duy tu, bảo dưỡng, sửa chữa các công trình thuỷ lợi trên địa bàn tỉnh.

4- Số lớp và thời gian tập huấn:

- Số lớp tập huấn: 01 lớp.

- Thời gian tập huấn: 03 ngày từ 25-27/9/2013.

5- Địa điểm tập huấn: Tại Thành phố Tuyên Quang.

6- Giảng viên: Cán bộ Vụ quản lý công trình- Tổng cục Thủy lợi

7- Tài liệu: Giảng viên chuẩn bị tài liệu tập huấn.

8- Kinh Phí:

- Nguồn kinh phí: Năm 2013 dự án TNSP.

- Phòng quản lý công trình và phòng chống lụt bão phối hợp với Phòng Hành chính - Tổng hợp chuẩn bị kinh phí và các điều kiện khác để tổ chức lớp tập huấn theo quy định *(có dự toán chi tiết kèm theo).*

Trên đây là kế hoạch tổ chức lớp Đào tạo bồi dưỡng nghiệp vụ về quản lý, khai thác công trình thủy lợi, Kế hoạch này thay thế Kế hoạch số 57/KH-CCTL ngày 10/5/2013 về Kế hoạch tập huấn công tác quản lý, khai thác và bảo vệ CTTL của Chi cục Thủy lợi.

Chi cục Thuỷ lợi báo cáo và đề nghị Ban điều phối dự án TNSP xem xét, cấp kinh phí để Chi cục thủy lợi tổ chức thực hiện./.

Nơi nhận:	**CHI CỤC TRƯỞNG**
- PCU (cấp kinh phí);	
- Sở NN và PTNT (báo cáo);	
- Lãnh đạo Chi cục;	
- Phòng HC-TH;	
- Phòng QLCT&PCLB;	
- Lưu: VT.	
	Nguyễn Công Hàm