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**Participatory Irrigation Management and the
Factors that Influence the Success of Farmer
Water User Communities: A Case Study in
Cambodia**

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2010

**Participatory Irrigation Management and the
Factors that Influence the Success of Farmer
Water User Communities: A Case Study in
Cambodia**

**A dissertation presented in partial fulfilment of the
requirements for the degree of Master of Applied Science in
Environmental Management**

at

Massey University, New Zealand



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2010

Abstract

The Participatory Irrigation Management approach was introduced into Cambodia in 2000, which was called the Participatory Irrigation Management and Development (PIMD). The goal of PIMD is to establish Farmer Water User Communities (FWUCs) to take over the management of irrigation schemes in their district in order to improve the performance of irrigation schemes and farmers' livelihoods. The implementation of FWUCs has resulted in both failure and success. Several studies have identified factors that influence the failure of FWUCs, but little research has focused on their success. By employing a single embedded case study approach, this research selected the most successful scheme in Cambodia to identify factors that influenced the success of the FWUC in irrigation management. The findings of this research could provide concrete assistance to the government, donors, and non-governmental organisations in improving the performance of less successful FWUCs in Cambodia.

The result of this research showed that the success of the O-treing FWUC was influenced by five internal and two external factors. The internal factors were: 1) the level of local participation, 2) the governance and management of the scheme, 3) the value of the benefits that flow from the irrigation scheme, 4) the quality of the irrigation infrastructure, and 5) the characteristics of the farmer members within the scheme. The external factors were: 1) the level of external support provided to the scheme, and 2) market access.

The success of the FWUC required farmer participation and this participation was enhanced when farmers obtained benefits from it. This research also found that access to markets was critical to make the benefits that flowed from the irrigation scheme more profitable to farmers, leading to farmer participation. Similarly, it was also important to make sure that the irrigation infrastructure was of a high quality to ensure the delivery of an adequate and timely supply of water to farmers so that they could grow crops that provided them with the benefits. This required external support from the Ministry of Water Resources and Meteorology, NGOs, and local authorities to help rehabilitate the scheme. External support was also critical for enhancing the governance and management of the scheme through assistance with the formation process, provision of financial resources, capacity building, rule enforcement, and conflict resolution. The governance and management of the scheme, in particular the leadership capacity of the FWUC was another critical factor because it ensured the maintenance and development of the irrigation infrastructure, the timely and adequate supply of water to farmers, farmers' trust and respect for leaders, and farmer participation. Finally, the success of the FWUC could not be viewed independently from farmer characteristics within the scheme. Farmers tended to participate in irrigation management when they had a history of self-organisation, when they were relatively homogenous, and when they were dependent upon farming for their livelihoods.

This research suggests that the successful implementation of FWUCs requires a focus on the seven factors and the interactions that occur between these factors. Irrigation stakeholders such as the Ministry of Water Resources and Meteorology, donors, NGOs, local authorities, local leaders, and farmers should work together to enhance these factors in order to ensure the success of FWUCs.

Acknowledgements

I would like to start by thanking the New Zealand Government for the scholarship that enabled me to continue my study at Massey University. I acknowledge the relentless support of all the staff at the International Student Support Office – in particular, Olive and Sylvia.

I am very grateful to my supervisors for their patience and the invaluable advice that has guided me throughout my research. I must thank Dr. Terry Kelly for his persistent guidance and encouragement to me. I would also like to specially thank Dr. David Gray for his contribution to this study's analysis and his critical comments on my writing. I thank you both for giving me a new insight into qualitative research methods. It has been a rewarding experience that I am grateful to bring home after two years in New Zealand.

A debt is owed to the lecturers, staff, and post grad students in the Institute of Natural Resources, and to my friends and all Cambodians in Palmerston North. I am very thankful to Assoc. Prof. John Holland for his support during my study in New Zealand. I would like to thank Janet Reid for kindly spending time drawing conclusion with me on my last day. I would also like to voice my appreciation to Denise Stewart for all other ways she helped, and to postgraduate students and friends at Massey University for their assistance they provided to me. I never forget Stewart Hay, his wife Debbie, and their kids for always serving as my relatives in New Zealand. Ngaire and her husband Polin were always friendly and helped sort out my accommodation.

My special thanks also go to Mr. Phim Svay and his family for offering me a stay at their place during my fieldwork. I would like to thank the staff at the Ministry and Department of Water Resources and Meteorology, and the District and Commune authorities for their cooperation in providing good information for this research. I am also thankful to Mr. Chandara Ouk for giving me a ride during my fieldwork. There are not enough ways to say thanks to all the village chiefs and villagers in Chung Rouk and Prey Gniet Communes, Kong Pisei District, Kampong Speu Province for their warm welcome during my visit.

In addition, my gratitude goes to my colleagues at the Cambodia Development Resource Institute (CDRI). I gratefully thank Mr. Sedara Kim and his wife, Boraksmey, for their encouragement and guidance in my study. I would also like to thank Mr. Keosothea Nou for his mentoring over the phone and Susan Watkins for proofreading my last chapter. I thank all the researchers at CDRI for providing comments during my seminar.

A final big debt is owed to my parents, grandparents, aunt (in Wellington), brothers, sisters, brother-in-laws, and sister-in-laws for their ongoing spiritual support. I may never have come this far without their persistent encouragement and belief in me.

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Abbreviations

ADB	Asian Development Bank
CBNRM	Community-Based Natural Resource Management
CPRs	Common Pool Resources
DoWRAM	Department of Water Resources and Meteorology
FAO	Food and Agriculture Organisation
FWUC	Farmer Water User Community
IMT	Irrigation Management Transfer
ISFs	Irrigation Service Fees
MoWRAM	Ministry of Water Resources and Meteorology
NGOs	Non-Governmental Organisations
OECD	Organisation for Economic Co-operation and Development
PIM	Participatory Irrigation Management
PIMD	Participatory Irrigation Management and Development
RGC	Royal Government of Cambodia
TWGAW	Technical Working Group on Agriculture and Water
UNDP	United Nations Development Programme
WB	World Bank
WFP	World Food Programme
WUAs	Water Users' Associations

CHAPTER 1

INTRODUCTION

1.1 Background

Irrigated agriculture contributes 40 percent of the world food supplies (FAO, 2007). Irrigation also contributes to increasing agricultural production, a dominant sector of the gross domestic product in developing countries (Herath, 2002). According to the Food and Agriculture Organisation, on average, crop yields per hectare produced by irrigated agriculture are 2.3 times higher than those from rain-fed agriculture (FAO, 2007). Due to its importance, governments in the developing countries have invested millions of dollars in irrigation development, either through their national budget or funds provided by donors, e.g. the World Bank or Asian Development Bank (Herath, 2002). However, evaluation showed that these investments did not improve irrigation management in some developing countries (Aluvihare & Kikuchi, 1991; Vaidyanathan, 1999). Rosegrant et al. (1995) found that the failure of the investments in irrigation development was caused by centralised control of irrigation schemes by governments. Other studies (e.g. Brown & Nooter, 1992; Meinzen-Dick, 1997; Vermillion, 1997; Le Gal et al., 2003; Molle, 2007) identified the lack of resources to cover operating and maintenance costs associated with irrigation due to the lack of participation by users.

The need to improve the performance of irrigation through the adoption of the participatory or farmer-managed irrigation management approach is widely recognised in the literature (Marothia, 2002). Initiated in the 1980s, the Participatory Irrigation Management (PIM) approach aims to improve irrigation management to ensure the timely and equitable supply of water to farmers (Marothia, 2001; 2002). This is achieved through the establishment of Water Users' Associations (WUAs) that manage irrigation schemes (World Bank, 1993; Marothia, 2002). A fundamental assumption behind this approach is that local farmers are capable of managing small-scale irrigation because they have local knowledge (though not necessarily an understanding of the technical aspects) of irrigation in their district (Brown & Nooter, 1992; Lam, 1996). As such, changing irrigation management from a government-managed to farmer-managed system should help improve performance while at the same time reducing the costs incurred by governments (Meinzen-Dick et al., 1997). According to literature,

the success of WUAs is influenced by several factors that can be classified as internal and external factors (Meinzen-Dick et al., 1997). The internal factors are those that are under the control of WUAs while external factors are those factors that are outside the control of WUAs.

1.2 The participatory irrigation management approach in Cambodia

The PIM approach was introduced into Cambodia in 2000, which was called Participatory Irrigation Management and Development (PIMD), in recognition of the need for community participation in improving the performance of the nation's irrigation systems (Chem et al., 2008). It was also a response to the limited government and donor resources available for the development of irrigation management (MoWRAM, 2008). The goal of PIMD is to let local farmers take over the management of irrigation schemes in their areas in order to improve their livelihoods through increasing both crop production and income (MoWRAM, 2008). Under this approach, farmers have been organised into Farmer Water User Communities (FWUCs) that comprise committees and members. The committees and members are able to set their own rules, membership characteristics, and resource boundaries (MoWRAM, 2008). The committees have full responsibility and authority to manage, repair, and improve irrigation schemes (MoWRAM, 2008). They are also responsible for the delivery of water services and the collection of Irrigation Service Fees (ISFs) from members to cover the costs of routine operations, maintenance, and emergency repairs to the irrigation schemes (MoWRAM, 2008). The government was required to rehabilitate damaged irrigation schemes before handing them over to the FWUCs and to provide technical and financial support for the first five years of the programme (MoWRAM, 2008).

The implementation of FWUCs has resulted in both failure and success (Kim & Khiev, 2007). Several studies (e.g. Perera, 2006; Kim & Khiev, 2007; Thun, 2008) have identified the factors that influence the failure of FWUCs, but little research has focused on the success of FWUCs. It was found that the failure of FWUCs was caused by the poor institutional building of FWUCs, the lack of capacity building and financial resources, and the lack of legal and political support from the government (Perera, 2006; Thun, 2008). Perera (2006), and Kim and Khiev (2007) identified low participation by farmers in irrigation management and poor physical conditions of irrigation schemes as factors that led to the failure of FWUCs.

1.3 Problem statement, research aim, and objectives

Central to the success of FWUCs under PIMD in Cambodia is the improvement of the livelihoods of local farmers and their self-dependency in irrigation management. In this context, PIMD in Cambodia has faced both failure and success (Kim & Khiev, 2007). Several studies have identified factors that influence the failure of the FWUCs under PIMD, but little research has focused on the successes. Such a focus could provide findings that offer concrete assistance to the government, donors, and non-governmental organisations in improving the performance of less successful FWUCs in Cambodia.

Therefore, the overall aim of this research was to identify factors that influence the success of a Cambodian FWUC in irrigation management under the implementation of the Participatory Irrigation Management and Development. This was achieved by addressing the following objectives:

1. To identify the internal and external factors that influence the success of the FWUC;
2. To determine the mechanisms through which these internal and external factors have contributed to the success of the FWUC;
3. To identify mechanisms that have influenced these internal and external factors; and
4. To determine the relationships among these internal and external factors that influence the success of the FWUC.

1.4 Research approach

In this research, a single embedded case study approach was adopted to identify factors that influenced the success of a Cambodian FWUC in irrigation management. As the first step, an initial literature review was undertaken to develop a theoretical framework and identify criteria for the selection of the case study and the data collection protocol. The second step was data collection. Multiple techniques of data collection were applied, including key informant interviews, household interviews, focus group discussions, participatory mapping and matrix development, participant observation, informal conversational interviews, and documentation and archival records. Data analysis involved the iterative process of summarising the audio-tape

and field notes, classifying or coding the data, identifying connections, and then describing any patterns in these connections (Dey, 1993). Once the final model of the factors that influenced the success of the FWUC was developed, it was compared to the existing literature (Eisenhardt, 1989).

1.5 Organisation of the thesis

The thesis is organised into eight chapters. Chapter 1 provides an introduction to the thesis. In Chapter 2, an overview of irrigation management systems in Cambodia is presented. Chapter 3 reviews the literature on the development of WUAs, with the goal of identifying factors that influence the success of WUAs in irrigation management. Chapter 4 describes the single-case study approach adopted for this study, along with the methods of data collection and analysis used in the study. Chapter 5 contains the case description and Chapter 6 reports the results from the case study. Chapter 7 discusses the case study findings relative to the literature presented in Chapter 3. Conclusions drawn from the study, their implications, an evaluation of the methodology, and recommendations for future research on this topic are presented in Chapter 8.

CHAPTER 2

AN OVERVIEW OF THE IRRIGATION MANAGEMENT SYSTEMS IN CAMBODIA

2.1 Introduction

According to the irrigation inventory of 1993-94, Cambodia had 841 pre-existing irrigation schemes, of which 176 (21%) were fully operational. These irrigation schemes supplemented rainwater for 172,727 hectares in the wet season and irrigated 103,656 hectares in the dry season (HALCROW, 1994). By 1997, the irrigated land (in both the wet and dry seasons) had increased to 473,000 hectares, which accounted for 16.6% of the total cultivated land in Cambodia (MoWRAM, 2003). In 2003, the Ministry of Water Resources and Meteorology made another inventory of irrigation schemes of all types across the country, and found that Cambodia had more than 2000 irrigation schemes with the capability of irrigating approximately 1 million hectares (Thun & Chem, 2007). Of these identified schemes, 328 had been organised into Farmer Water User Communities, 114 of which were registered with MoWRAM (Thun, 2008).

Irrigation schemes in Cambodia are classified into three types: 1) small, covering less than 200 hectares, 2) medium, covering from 200 hectares to 5,000 hectares, and 3) large, covering greater than 5,000 hectares (MoWRAM, 2000). In addition, there are four means by which irrigation schemes in Cambodia source water: 1) water is diverted from rivers, lakes, or streams by gravity, 2) water is diverted from rivers or streams through pumping stations, 3) water is sourced from reservoirs supplied by rivers or streams, and 4) water is sourced from reservoirs that store flood water or tributary runoff (FAO, 2008).

Approximately 85% of the Cambodian population consists of farmers who live in rural areas and rely on rainfall to grow rice as a staple food (Thun & Chem, 2007). Irrigation is important as a supplement to rainfall during dry spells in the wet season, helping ensure high rice yields and maintain food security. Farmers in some areas can even cultivate another crop (dry season rice, or a commercial crop such as maize, soybeans, peanuts, or watermelon) in the dry season using irrigation water, and thus earn revenue (MoWRAM, 2003). In 2006, the Ministry of Agriculture, Forestry and Fisheries

identified the total rice production at 6.3 million tonnes, an increase of 5% over 2005. The reason for this increase was due in part to the expansion of irrigated land in Cambodia (Thun, 2008).

Cambodia has gone through a number of different periods during its history, and the position of irrigation management systems in Cambodia during those various historical periods is highlighted in this chapter. The Participatory Irrigation Management and Development (PIMD) programme that led to the establishment of Farmer Water User Communities in the country is also described in more detail below.

2.2 Pre-Angkor, Angkor, and Post-Angkor Periods

The Pre-Angkor, or Funan, period began in the second century when the Cambodian economy relied on agricultural trade and exchange along rivers (Chandler, 1992). According to inscriptions found on Hindu temples, Cambodian farmers grew wet season and dry season rice, and root crops for family consumption, with surplus production used for trade (Chandler, 1992). Chinese records speak of advanced techniques for water management and the presence of man-made canals and reservoirs used by the Funanese to store water for irrigation purposes (Chandler, 1992).

During the Angkor period, from A.D. 802 to 1431, the use of irrigation for rice farming increased (Chandler, 1992). Additional irrigation infrastructure, such as reservoirs, was built by the kings of this period to collect and store rainwater and surplus flood water from the Mekong River (Chandler, 1992). The West Barai reservoir is an example of the type of water management infrastructure built during the Angkor period that still remains in use today (Chandler, 1992). Rice production during the Angkor period was also high. According to the diary of a Chinese diplomat Chou Ta-Kuan, farmers in Cambodia could farm three or four crops per year due to fertile soil, good water storage, and abundant manpower (Chandler, 1992). There is also evidence that the kings of this period engaged in water management from the palace (Nguyen, 1999).

During the Post-Angkor period from 1431 to 1863, there was a decline in agricultural production. Farmers of this period often used ponds to store water for rice farming and reservoirs and canal systems were no longer used (Chandler, 1992). According to the writing of Minh Mang in 1834, the production of rice over and above consumption

requirements rarely occurred during this period and little new technology was applied to diversify crop farming (Chandler, 1992).

2.3 French Colonial Period

Cambodia was colonised by the French for 90 years from 1863 to 1953. The French introduced Colmatage irrigation systems that used dikes and sluices to help control water intake and drainage while retaining fertile soil on the rice fields (Perera, 2006). A few modern irrigation schemes with proper reservoirs and dams were also built during this period (Perera, 2006). However, only a small amount of success was achieved in water management during this period because the colonial state undertook limited development and had little contact with the local people. As such, the new irrigation schemes were often in disrepair and inefficiently used (Nguyen, 1999). However, it is worth noting that this period held the potential for Cambodia to develop export markets for rice to both France and China (Chandler, 1992).

2.4 Prince Norodom Sihanouk Period (1953-1970)

Cambodia obtained independence from the French in 1953. The country was led by Prince Norodom Sihanouk who had helped gain independence. The Prince named his period Sangkum Reastr Niyum which literally translates as Popular Socialist Community. Irrigation management at this time was found to be reasonably successful. The Prince introduced the idea of self-help programmes to upgrade and expand the country's irrigation schemes. The Prince said in 1958, "The people must have enough water to drink and for their fields and rice paddies, even during the dry season" (Than, 1982, p. 24 as cited in Ojendal, 2000, p.180). Farmers were encouraged to participate in irrigation management and dam construction under the direction of local authorities and monks. The government helped employ gate operators (dike keepers) and provided financial resources to farmers. The government also worked with the Mekong Committee (established in 1957) on a few large projects for hydropower and irrigation purposes (Ojendal, 2000). During this period, Cambodia was able to produce high rice yields and become a major exporter of rice (ADB & MoWRAM, 2001).

2.5 Khmer Republic and Pol Pot (Khmer Rouge) Period

Prince Norodom Sihanouk's period ended in 1970, followed by the Khmer Republic from 1970 to 1975. The Khmer Republic was run by Lon Nol who deposed the Prince in a coup. There is no documentation on the operation of irrigation management during this period.

Following the Khmer Republic period came the Pol Pot regime. The Pol Pot, or Democratic Kampuchea regime lasted from 1975 to 1979. It was a tragic time, as the Cambodian people throughout the country were evacuated from their homes to rural areas where they had to live as groups and share food. Farmers were forced to construct irrigation schemes for rice farming by hand, using spades, and 15-25% of the total population (an estimated 1.5 million people) died due to overwork, starvation, illness, and torture (Ojendal, 2000).

As a prime minister, Pol Pot had an ambitious plan to achieve rice yields of more than seven tonnes per hectare. On 10 October, 1978 in Phnom Penh, Pol Pot said "Democratic Kampuchea must...as the first priority...attain rice yields more than those of Japan...who can attain 7 tonnes per hectare" (Martin, 1983, p.1, as cited in Ojendal, 2000). As a result, a large number of irrigation systems were built across the country during this period and still remain in use today (Chandler, 1992). However, most of these schemes were poorly designed, as they were constructed by local farmers without support from technical experts. This created problems in terms of incorrect or mismatched capacities between reservoirs, canal structures, and farmland, and inadequate control capacity for floods (Perera, 2006).

Irrigation management during the Pol Pot regime was directly managed by village and commune chiefs. Farmers were forced to construct irrigation schemes, but they had no input into decision making and they were not paid for their labour. Rice grown by individual farmers was taken by the ruling government, and as a result, farmers stole rice for their own survival and there was no trust between farmers and the government (Chandler, 1992).

2.6 From 1980 onwards

After the fall of the Pol Pot regime in January 1979, a new government called the Khmer People's Revolutionary Party was formed. However, the country was still in disarray with a high level of poverty and a lack of internal security. A large proportion of the population began moving back to their home settlements after the fall of the Pol Pot regime. From 1980 to 1985, local irrigation systems were managed by groups of farmers who were organised into *Krom Samaki* (Solidarity Groups). These groups managed the irrigation schemes developed by the Pol Pot regime, which had typically been left in poor condition. Some new irrigation schemes were also constructed during this period, but once again, they were poorly designed (Chem & Craig, 2008).

After 1985, irrigation management was placed under the control of the government (the Department of Hydrology, Ministry of Agriculture, Forestry and Fisheries). However, the government also encouraged farmers to participate in irrigation maintenance, using rice, oil, or diesel as incentives for local participation. Commune and village chiefs helped mobilise and direct farmers in this work (Perera, 2006). The government's administrative structure introduced by the French in 1908 comprises five levels: national, provincial, district, commune, and village (Perera, 2006). The village is the lowest level of administration, usually having one chief and one deputy in charge. A commune has multiple villages under its administration and it is controlled by a chief and a number of deputies.

During the early 1990s, a range of international non-governmental organisations (NGOs) and donors assisted the government with drafting policies in relation to irrigation management and introduced participatory irrigation management approaches by launching the PIMD programme in 2000. Through this programme, farmers have been encouraged to get involved in operating and maintaining their local irrigation schemes. In 1999, after the establishment of the Ministry of Water Resources and Meteorology (MoWRAM), the government embarked on devolving responsibility for all aspects of irrigation scheme maintenance to farmers (Perera, 2006).

2.7 PIMD and Farmer Water User Communities (FWUCs)

In Cambodia, the current PIMD programme aims to improve irrigation management by allowing local farmers to take over primary responsibility and authority for managing,

repairing, and improving existing irrigation schemes for the purpose of increasing the community's productivity, income, and living conditions (MoWRAM, 2008). The government is taking responsibility for regulating policies, facilitating processes, and providing support to farmers (MoWRAM, 2008). Farmers do not have to pay all the costs of irrigation management and development; rather, they receive financial or technical assistance from the government. The government also helped rehabilitate irrigation schemes before turning them over to farmers and shared with farmers the costs associated with scheme operations in the first five years of the changeover (MoWRAM, 2008). In the first year, the farmers received assistance from the government to cover 80% of their costs, but by year five, this was reduced to 0% (MoWRAM, 2003).

MoWRAM implemented the PIMD programme in 2000. It piloted the programme in 13 irrigation schemes with financial support from the Asian Development Bank (No 1445-CAM). Another 328 other schemes across the country were also involved in PIMD implementation, but they received no shared fund support (MoWRAM, 2008). The main impact of the PIMD programme in the 13 irrigation schemes was focused on two key components – institution building and system rehabilitation, including the construction of community offices and the repair of village roads.

The PIMD programme establishes Farmer Water User Communities (FWUCs) by holding local elections to select local leaders. The FWUCs are then given responsibility for the everyday management of the irrigation schemes. FWUCs are responsible for the enforcement of their own rules, the preparation of work plans, collection of Irrigation Service Fees (ISFs), the operation and maintenance of irrigation schemes, and the resolution of irrigation problems or conflicts (MoWRAM, 2000).

The decision-making structure of FWUCs often comprises an apex committee, groups, and sub-groups. The apex committee is responsible for the management of the whole irrigation scheme, while the groups manage the main canals, and the sub-groups the sub-canals. The committee, groups, and sub-groups consist of a chairperson in charge of general work, a first vice chairperson in charge of system maintenance and repairs, a second vice chairperson in charge of water supply and record keeping, and a treasurer in charge of financial management. All leaders in the committee, groups, and sub-groups obtain training on irrigation management, administrative work, and financial affairs from the government (MoWRAM, 2000).

2.8 Summary

Approximately 85% of the Cambodian population are farmers who grow rice for food security. Irrigation schemes play an important role by supplementing rainfall in the wet season to ensure high rice yields. In some areas, farmers also use irrigation water to grow additional rice or commercial crops for revenue during the dry season. Irrigation has been used for cropping since the second century A.D. in Cambodia. More recently, irrigation schemes were built during the French Colonial (1863-1953), Prince Norodom Sihanouk (1953-1970), and Pol Pot periods (1975-1979). Some of these schemes are still in use today, but are in poor condition and need rehabilitation to achieve effectiveness and efficiency in supplying water to farmers.

The idea of promoting local participation in irrigation management began in the Prince Norodom Sihanouk period. A similar idea was introduced into Cambodia again in 2000 by NGOs and donors under the implementation of the PIMD programme which organises groups of local farmers into FWUCs to take on primary responsibility for local irrigation management. The government recognises the need to rehabilitate irrigation schemes before turning them over to the local farmers, shares the operational costs of irrigation management for the first five years of a changeover, and continues to provide technical support if it is asked for.

CHAPTER 3

FACTORS THAT INFLUENCE THE SUCCESS OF WATER USERS' ASSOCIATIONS UNDER THE PIM APPROACH

3.1 Introduction

The contemporary literature on common pool resources has identified the role of local-level solutions derived from community initiatives as critical in promoting sustainable and equitable natural resource management in developing countries (Agrawal & Gibson, 1999). Theory suggests that local communities are able to improve resource management more effectively than distant actors because they have their own traditional knowledge, combined with existing skills and resources, and a deep understanding of the local context (Korten, 1986; Li, 2002; Child & Lyman, 2005).

The Community-Based Natural Resource Management (CBNRM) approach that emerged in the late twentieth century (Adams & Hulme, 2001) was a response to the need for the involvement of local communities in resource management. CBNRM has been applied to a range of natural resources across a number of continents. In Africa, CBNRM is often known as community-based wildlife conservation, which aims to improve the livelihoods of local people as a means of achieving wildlife conservation (Kangwana, 2001). In forestry and fishery sectors, CBNRM is known as community-based forestry and community-based fisheries, which aim to achieve both resource conservation and livelihood improvement. CBNRM is also increasingly used in the field of nature-focused tourism, known as community-based ecotourism, to help reduce the negative impact of inappropriate tourism development on natural resources and to enhance the quality of life and the natural and cultural resources associated with specific tourist destinations (WWF International, 2001).

In irrigation management, the Participatory Irrigation Management (PIM) approach is used. PIM seeks to ensure the involvement of all irrigation users in all aspects and levels of irrigation management (World Bank, 1998). It is considered part of CBNRM because it deals with the management of irrigation systems which are part of an area's common pool resources, and it works to empower local communities and improve their livelihoods (Naik & Kalro, 1998).

PIM was initiated in the 1980s to organise communities into 'water users' associations' (WUAs) for irrigation management (Meinzen-Dick et al., 1997; Marothia, 2001). A water users' association is an organised group of farmers who manage an irrigation scheme through a committee or council using established rules and regulations (Meinzen-Dick et al., 1997). Such groups may be defined as formal, i.e. recognised in government policies, or informal, i.e. not recognised in government policies. WUAs aim to improve water distribution to farmers and enhance the effective operation and maintenance of irrigation schemes. However, in reality, some WUAs are successful at achieving these goals while others are not (Gandhi & Namboodiri, 2002). The purpose of this chapter is to review the literature on collective action, common pool resource management, and PIM to develop a theoretical framework for analysing the factors and mechanisms that influence the success of WUAs in irrigation management. This chapter begins with a discussion about what is meant by success in relation to WUAs, and then progresses to a review of factors that influence such success. The theoretical framework used to guide this research is presented at the end and is illustrated in Figure 3.1.

3.2 WUAs and the definition of success

Irrigation schemes can be considered as Common Pool Resources (CPRs), and thus the literature on CPRs provides a theoretical basis for discussing the factors that influence the success of WUAs in irrigation management. Irrigation schemes have shared two characteristics with other CPRs (Ostrom, 1990). First, they are jointly used by individuals and as such, the actions of an individual can affect the net benefits obtained by other members of the group. Second, they are large, so it is costly to exclude relevant beneficiaries from access to such schemes.

The "Tragedy of the commons" by Hardin (1968), the prisoners' dilemma game theory by Dawes (1973), and the logic of collective action by Olson (1965) each led to the view that the successful governance and management of CPRs requires cooperation by individuals who depend on the CPRs. Ostrom (1990) also supported this view, stating that when individuals cooperate to govern and manage resources, the returns they receive are higher than those they are capable of realising without cooperation. When they cooperate, individuals can manage the use of resources by others and this helps enhance the ongoing quality of the resources (Ostrom, 1990). Drawing from the views of Hardin (1968), Dawes (1973), Olson (1968), and Ostrom (1990), it can be

concluded that the success of WUAs requires cooperation between those individuals who depend on the irrigation schemes.

There is limited literature about what the success of WUAs means from the perspectives of various irrigation stakeholders. More often, WUA success has been evaluated by scholars relative to implementation goals set for the programme or community involved. For example, Marothia (2002) evaluated the success of WUAs in India using two criteria: 1) the effectiveness of the operation and maintenance of the irrigation scheme, and 2) the timeliness and adequacy of the water supplied to farmers. In the Institutional Analysis and Development framework for CPRs, success is defined as the outcome of the interactions of stakeholders, and it could be evaluated in terms of performance, that is, how well the governance objectives of the WUA are met (Ostrom et al., 1994). Normally, three criteria are used to assess this: efficiency, equity, and sustainability (Ostrom et al., 1994). Ostrom (1990) used the term "robust" to refer to successful community-based organisations (of both irrigation schemes and other CPRs) and selected two criteria for assessing the robustness of community-based organisations: 1) the ability of resource users to devise, apply, and monitor their own rules to control the use of their CPR, and 2) the longevity of the resource system (as well as its the associated institutions). Several studies have identified factors that influence the success of community-based organisations and WUAs, and the following sections draw on these findings to develop a framework for studying such success.

3.3 Factors that influence the success of WUAs

Drawing on several studies and theoretical papers (Olson, 1965; Wade, 1988a; Ostrom, 1990; Baland & Platteau, 1996; Meinzen-Dick et al., 2002) on collective action, governance of common pool resources and Participatory Irrigation Management, as well as the literature on governance and management in general (Pierre and Peters, 2000; Bene & Neiland, 2006), it can be ascertained that the success of WUAs is influenced by seven factors: 1) the level of local participation, 2) the governance and management of irrigation schemes, 3) benefits that flow from irrigation schemes, 4) physical attributes of irrigation schemes, 5) characteristics of farmer members who depend on the schemes, 6) external support, and 7) market access. These factors can be separated into internal and external factors, as suggested by Meizen-Dick et al. (1997). For this study, the internal factors have been defined as those that are under

the control of the WUAs, while the external factors are those factors that exist outside of, and therefore are not under, the control of the WUAs.

3.3.1 Internal factors

Five internal factors found to influence the success of WUAs are: 1) the level of local participation, 2) the governance and management of irrigation schemes, 3) benefits that flow from irrigation schemes, 4) physical attributes of irrigation schemes, and 5) characteristics of farmer members who depend on the schemes. The following sections draw on the relevant literature to describe each internal factor in detail, the mechanisms through which they influence the success of WUAs and the factors that in turn influence them.

3.3.1.1 The level of local participation

Olson (1965) highlighted the importance of member participation as a driver for group success and such participation has been widely defined by several authors. The best known and earliest normative typology of participation was developed by Arnstein (1969), and was named the 'ladder of citizen participation'. This typology specified three levels of citizen participation. The first level was non-participation, where the local people played no role in the planning and operation of programmes. The second level was termed 'tokenism', and described the local people as being allowed to have a voice, but lacking the power to make sure their voices were taken on board by the individuals who actually held the power and made decisions. The third and highest level of participation was called 'citizen power' and at this level, the people were able to negotiate with the individuals who held power and obtain the authority to make decisions.

Another normative typology of participation is based on the work of Adnan et al. (1992), Hart (1992), Pretty (1994), and Satterthwaite et al. (1995). This typology sets out seven types of local participation in development programmes. Moving from the lowest to the highest level of participation, these include: 1) manipulative participation which refers to "participation as a pretence", 2) passive participation that consists of local people being told what has been decided, 3) consultative participation, where local people are consulted but not involved in decision making, 4) participation for material incentives where local people agree to contribute resources to a programme but have no

involvement in the programme activities, 5) functional participation that involves shared decision making, but these decisions are minor choices that the locals are allowed to make after the major decisions have been settled, 6) interactive participation, where local people participate along with outsiders in joint analysis, the development of action plans, and the formation or strengthening of local institutions, and 7) self-mobilisation, where local people take the initiative independently of external agencies, resources, and technical advice (Pretty, 1995).

The typologies of Arnstein (1969) and Pretty (1995), in particular, described the level of participation relative to decision making. The greater the decision making power local people obtained, the higher the level of participation they could achieve. However, these two typologies provided little information about who was participating, in what ways they participated, and for whose benefit (Cornwall, 2008). In the rural development literature, Cohen and Uphoff (1980) developed a participation framework for describing and analysing rural development participation. They suggested analysing participation relative to three dimensions: what, who, and how. The what and who dimensions were used to assess the amount, distribution, and trends of participation while the how dimension analysed the basis, form, extent, and effect of participation. Cohen and Uphoff (1980) also suggested analysing the what dimension in accordance with the stages of the project cycle: decision making, implementation, benefits, and evaluation. Although there was little information about participation in the last stage, Cohen and Uphoff (1980) clearly described the nature of participation in the other three stages. For decision making, participation centred on generating ideas, formulating and assessing options, making choices about the options, and formulating plans to implement those options. In implementation, participation was undertaken in several forms: resource contributions, administration and coordination, and programme enlistment activities. Participation in benefits focused on the involvement of members in obtaining three kinds of benefits: material, social, and personal. Material benefits comprised an increase in consumption, income, or assets while social benefits involved services relative to better roads or housing. Personal benefit was defined as the power obtained by members from being a part of the community (Cohen & Uphoff, 1980).

In the context of irrigation management, participation has been defined relative to the involvement of local farmers (both leaders and members) in a variety of irrigation management activities: planning, design, operations, maintenance, rehabilitation, resource mobilisation, and conflict resolution (Svendsen et al., 1997). Meinzen-Dick (1997) highlighted three modes of participation: through financial contributions, through

direct involvement in the operation and maintenance of irrigation schemes, and through involvement in decision making regarding the operation and maintenance of the schemes. This last, participation in the operation and maintenance of irrigation schemes, also included local involvement in actions involved in monitoring and modification of operation rules (Ostrom, 1990).

Local participation is considered as a primary basis for success in many rural development projects (Narayan, 1993; Nian, 2001; Bowen, 2007). In the rural development literature, participation is seen not only as the means by which efficiency of development can be improved, but also as a fundamental right for collective action, empowerment, institution building, and social change (Pretty, 1995). In Participatory Irrigation Management, participation is considered a key factor contributing to the long-term sustainability of WUAs. Meinzen-Dick and Reidinger (1995) believed that participation is important in improving water distribution between upstream and downstream users, and reducing the operational and maintenance costs of irrigation to governments. Korten (1993) found that the involvement of farmers in all aspects of irrigation management helped achieve farmer satisfaction with the scheme infrastructure in the Philippines.

The prescriptive literature on public participation by Beierle (1999) and Creighton (2005) highlighted the importance of community meetings in improving decision making, breaking down its contribution into five factors: 1) through incorporating local knowledge, interests, values, and assumptions into the decision-making process; 2) through building consensus and long-term agreements among resource users to provide legitimacy for the decisions and maintain a low level of controversy; 3) through increasing the ease of implementation and a sense of ownership for the decision among local users that results in local enthusiasm for participating in the work; 4) through improving local knowledge; and 5) through developing trust with face-to-face deliberation and ensuring local understanding of the reasoning behind the decision.

A wide range of PIM and common pool resource management studies have identified a multitude of reasons why local farmers have participated or not participated in irrigation management. These reasons include: 1) livelihood dependency on irrigation schemes (Korten, 1986; Ostrom, 1999; Kim & Khiev, 2007), 2) the presence of an efficient and reliable supply of water (Maleza & Nishimura, 2007), 3) the level of benefits that flowed from irrigation schemes (Maleza & Nishimura, 2007), 4) rule enforcement (Ostrom, 1990), 5) peer pressure (Levi, 1988; Ostrom, 1994), 6) trust in the leadership (Wade,

1988b; Meinzen-Dick et al., 1997; Lopez-Gunn, 2003), 7) local awareness of rules, rights and the importance of participation relative to livelihood and irrigation status (Tewari & Khanna, 2005), 8) the improvement in scheme infrastructure (Meinzen-Dick et al., 1997), and 9) the community's sense of ownership of the scheme (Ostrom, 1990; Meinzen-Dick et al., 1997; Hirschmann, 2003).

Livelihood dependency has been highlighted as an important motivation for participation in both prescriptive and empirical studies of CBNRM and PIM. In the CBNRM literature, Korten (1986) wrote that local people whose livelihoods depended upon resources would be motivated to manage and use them more sustainably than would distant actors. This view was supported by Pinkerton and Weistein (1995) in their study on the co-management of fisheries. Likewise, in the PIM literature, Kim and Khiev (2007) found that the lack of local participation in irrigation management in some Cambodian WUAs stemmed from the farmers' lower levels of dependency upon irrigation during the dry season. Water supply for irrigation was often unreliable in Cambodia during the dry season, and because of this farmers had diversified into non-agricultural activities (Kim & Khiev, 2007). Since the benefits from irrigation were dependent upon a water supply that was often unreliable, these farmers were also reluctant to participate in irrigation management (Chem & Craig, 2008).

This brings into focus the second reason for farmer participation in irrigation schemes - the presence of an efficient and reliable water supply. Although not many studies have highlighted this, recent research by Maleza and Nishimura (2007) found that water inadequacy led farmers in Bohol, Philippines to refuse to pay water irrigation service fees to their leaders. Several causes for the failure of local leaders to provide an efficient and reliable water supply to farmers have been specified in the literature. For example, McKay and Keremane (2006) reported that the leadership of the Mula irrigation scheme in India could not distribute sufficient water to farmers when there were droughts. Maleza and Nishimura (2007) discovered that the efficiency and reliability of the water supply they studied was influenced by the quality of the irrigation infrastructure, and an imbalance between the level of demand for water on the part of the users and the capacity of the scheme.

A third factor shown to influence the level of local participation was the level of benefits that flowed from irrigation schemes (Maleza & Nishimura, 2007). McKay and Keremane (2006) found that benefits from irrigation could be in the form of enhancing food security and/or providing additional revenue to farmers through crop production.

Benefits need to be sufficient in order to ensure local participation. Meinzen-Dick et al. (1997) asserted that farmers would not participate in irrigation management when the costs of their participation exceeded the benefits they derived from the scheme. Further, Maleza and Nishimura (2007) based on a study in the Philippines discovered that farmers would not pay fees unless the net income from cropping was enough to cover expenses for family consumption.

A fourth factor that impacted on local participation was the degree to which the rules of the scheme could be enforced. Ostrom (1990) argued that rule enforcement helped restrict illegal access to the resource and discouraged local users from exploiting it by drawing on it in excess of their requirements. A study on WUAs in Cambodia by Thun (2008) found that where leaders had authority to enforce the rules, they were able to collect irrigation service fees. The same results were also reported by Maleza and Nishimura (2007) in Bohol, Philippines in the case of fee payment. Maleza and Nishimura (2007) suggested that local leaders should collaborate with outsiders, such as local authorities or governmental agencies, to be able to enforce rules effectively.

Peer pressure was the fifth factor associated with local participation, as asserted by Levi (1988) and Ostrom (1990). Peer pressure occurred when local resource users (rather than outsiders or leaders) actively got involved in monitoring and sanctioning members' use of the resource. Ostrom (1990) believed that when most of the members agreed to contribute to the work, the rest would not be able to free-ride because their lack of action would be detected and they would typically suffer loss of favour and social disgrace among others in the community. According to Ostrom (1990), individual members chose to monitor each other's contributions under three conditions: firstly, when the costs to individuals of such monitoring were low, which can occur partly as a result of having appropriate 'rules in use' in the community; secondly, when individuals receive personal rewards for monitoring; and thirdly, farmers were more willing to enforce the rules when they were the ones who designed those rules. This means that allowing farmers to craft their own rules can lead to greater local participation in peer monitoring, rule enforcement, and rule compliance.

A sixth factor that influenced the level of local participation was trust in the local leadership (Wade, 1988b; Lopez-Gunn, 2003). Wade (1988b) found that when local farmers trusted that the leadership would distribute sufficient water, they would stop stealing it, making it easier for irrigation leaders to enforce the rules. Pomeroy et al. (2001) and Pretty (2003) observed that trust takes time and effort to build, and is easily

broken. Trust can be established through several means. Meinzen-Dick et al. (1997) believed that as farmers gained in successful collaborating with leaders, their trust in them grew. Pomeroy et al. (2001) commented that trust requires good communication and open and ongoing dialogues between leaders and members in order to help clarify the needs and expectations of the farmers. A study by Wade (1988b) found that farmers' trust in their leaders was dependent upon the performance of those leaders. Trust occurred when farmers could get sufficient water, or at least, if the water supply was inadequate farmers received good reasons from their leaders as to why this was so. In addition, farmers trusted the leaders when they could see their use of power was not for self-interest, but for the welfare of all the people in the community. Another empirical study on Irrigation Management Transfer (IMT) by Tewari and Khanna (2005) demonstrated that trust was built when leaders shared decision making with the farmers, respected their concerns, needs, and knowledge, and were transparent in their management of the scheme.

Local awareness of rules, rights, and the importance of participation was also a major determinant of the level of local participation. Tewari and Khanna (2005) observed that most of farmer members in successful irrigation schemes were aware of their rights and of the importance of participation. As a consequence of this, they made an effort to maintain the irrigation scheme and engage in activities with the leaders. Tewari and Khanna (2005) also found that when farmers were well informed about the rules, they were less likely to break them because they were afraid of paying the imposed penalties as punishment. Similarly, Maleza and Nishimura (2007) found that farmers in Bohol, Philippines did not pay fees to leaders because they did not understand the purpose of the fee collection or were unaware of the collection rules and changes in fee rates. Although not reported in previous PIM studies, awareness of the effects of overusing a resource on one's livelihood was determined to be a critical factor in the locals' cooperation with their leaders, as reported by Altrichter (2008) who conducted research on community-based wildlife conservation in Argentina.

Meinzen-Dick et al. (1997) believed that improvements to scheme infrastructure also led to greater farmer participation in the payment of irrigation service fees. This view was supported by the work of Perera (2006) and Thun (2008), who found that the improvement of scheme infrastructure had to be an on-going focus for the leadership, otherwise farmers would withdraw their participation in the scheme. Ostrom and Gardner (1993) also supported this finding. However, they claimed that lack of resources for regular maintenance was often a challenge for leaders of WUAs because

maintaining irrigation schemes for the long term often required immediate and costly contributions from farmer members.

Finally, Meinzen-Dick et al. (1997) reported that a sense of ownership was another underlying reason for high participation in irrigation management as it served as an incentive for local leaders and farmers to contribute resources and labour to scheme maintenance. Hirschmann (2003), drawing on findings of other studies, stressed the importance of initiatives in developing a sense of ownership. In other words, a sense of ownership occurred when local leaders and farmers were made responsible for at least part of the capital and recurrent costs for scheme rehabilitation or maintenance (Meinzen-Dick et al., 1997). Nakashima (2000), in a study on WUAs in Pakistan, observed that farmers could gain a sense of ownership spiritually, through their own commitment and efforts to manage the irrigation scheme, and legally, through property rights that were delegated to them from government.

3.3.1.2 The governance and management of irrigation schemes

The governance and management of irrigation schemes was also identified as a factor that influenced the success of WUAs. According to Bene and Neiland (2006), governance and management are related terms, involving subtle differences, with governance being defined as the process of setting the rules and sharing responsibility, power, or decision making among different actors, and in contrast, management being defined as the implementation of decisions in accordance with the rules – i.e., determining how, when, or where resources are used (Bene & Neiland, 2006).

Bene and Neiland (2006) analysed the definitions of governance given by various organisations (e.g., European Commission, 1995; UNDP, 1997; World Humanity Action Trust, 2000; OECD, 2003) and found that most of these encompassed two components: 1) a multi-action dimension, i.e. the belief that government should not be the only actor involved in the governance process, and 2) the accommodative nature of the process, i.e., the belief that governance should accommodate the interests and expectations of the majority. However, Pierre and Peters (2000) and CBNRM (2007) suggested separating governance into “structure” and “processes” when considering the governance and management of irrigation schemes. The following sections discuss governance and management in terms of first structure, and then process.

3.3.1.2.1 The governance and management structure

In the literature on governance and management, Pierre and Peters (2000) suggested categorising the governance and management structure into the decision-making structure, organisations, and actors. In PIM, Meinzen-Dick et al. (2002) emphasised leadership capacity as part of governance structure. Drawing on Pierre and Peters (2000) and Meinzen-Dick et al. (2002), the governance and management structure for the study of WUAs is likely to encompass two attributes: 1) the decision-making structure and 2) leadership capacity. These attributes impact on the governance and management process and influence how local leaders, together with local farmers, make decisions in managing an irrigation scheme. The following sections describe each of the attributes of the governance and management structure, the mechanisms through which each attribute impacts on success, and then the factors that influence the attribute.

The decision-making structure

Uphoff (1986) and Tang (1991) believed that in large or complex irrigation schemes, the decision-making process needs to be structured in multiple layers. Ostrom (1990) supported this claim and called it "nested enterprises". A multiple-layer structure helps divide farmers into small groups so that the leaders and farmers can have frequent interactions; and this reduces the transaction costs involved in making collective decisions (Agrawal & Gibson, 1999). Similarly, Olson (1965 as cited in Ostrom, 1990, p.5-6) pointed out that "unless the number of individuals is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, rational self-interested individuals will not act to achieve their common or group interests."

Leadership capacity

A wide range of literature has discussed the meaning of leadership capacity. The dialogue began with the early work of Ross and Lappin (1967) who described leadership capacity relative to the attitudes and behaviour of individuals who performed as leaders. Ross and Lappin (1967) believed that leaders needed to possess a positive identification with their people and outsiders, and a hard-working disposition. Tewari and Khanna (2005), in a study on irrigation management transfer in Gujarat, supported this view. They found that good leaders were able to get on well with their people, to

speak for them, to have frank and honest discussions with them, and to spend time or make the extra effort to solve problems in their communities.

According to Ross and Lappin (1967), leadership also includes two other attributes: education level and social status. This view was confirmed by Meinzen-Dick et al. (2002) in a study on canal irrigation systems in India. They found that educated people were able to develop useful innovations and had the skills required for managing the irrigation schemes. Rather than mentioning social status, Meinzen-Dick et al. (2002) stressed the importance of external recognition. They reported that leaders who obtained external recognition often had networks of contacts both within and outside communities which they used to obtain support for their activities. In addition, Thun (2008) found that farmers often preferred men over women for leadership positions because they believed that men were able to handle heavy work in irrigation management and travel away from home more frequently.

Cemea and Meinzen-Dick (1992) described leadership capacity relative to skills and knowledge and divided these into two types: those required in an organisational role and those required in a technical role. They pointed out that leaders might take on either of these roles. Organisational roles required skills that were useful in the operation of the WUAs, including financial management, participatory decision making, conflict resolution, record keeping, resource mobilisation, communication, and coordination. A technical role, on the other hand, required skills specific to the operation of the irrigation system, such as water allocation, system operation and maintenance (Cemea & Meinzen-Dick, 1992).

The skills and knowledge required for leadership can be built through training (Ostrom & Gardner 1993; Musa, 1994; Tewari & Khanna, 2005). Fabricius (2004), Tewari and Khanna (2005), Altrichter (2008), and Johnson III and Stoutjesdijk (2008) all reported that local leaders often had limited experience in administration, record keeping, or financial management because they rarely engaged in this work and often depended on local authorities to do it. These scholars suggested that local leaders should be provided with training, workshops, and field visits, so that they could learn and apply good practices in their communities. Meinzen-Dick et al. (1997) believed that training was required when leaders took on increasing level of responsibility for irrigation management. Ribot (2003) supported this claim, but he believed that capacity building had to be done after authority was devolved to local leaders. Local leaders need

authority to work in order to gain the practical experience necessary for capacity building (Ribot, 2003).

Coates (1997) mentioned authority or power as part of leadership capacity. Power or authority is defined as the ability of leaders to make decisions and to ask their local people to implement them (Sinha, 1988). Leaders obtain authority through their attitudes and behaviour (Coates, 1997; Weber, 1947). Good attitudes and behaviour help build personalised relationships, including trust and sharing, between the leaders and their local people, which as a result provide the leaders with the power or authority to make decisions (Katz & Kahn, 1978).

Pinkerton and Weistein (1995) further extended the definition of authority as suggested by Sinha (1988). Based on their multiple-case studies of co-management fisheries, the authors found that aside from authority for asking members to implement the decisions of the community, local leaders also needed authority to exclude outsiders from access to the fishery resource.

Numerous studies (e.g., Commons, 1968; Schlager & Ostrom, 1992; Vermillion, 1998; Meinzen-Dick & Knox, 2001) related authority in leadership capacity to property rights. The theoretical paper by Commons defined property rights as "the authority to undertake particular actions related to a specific domain" (1968, p. 48), while studies by Schlager and Ostrom (1992), Vermillion (1998), and Meinzen-Dick and Knox (2001) claimed that community leaders obtained authority when they held property rights. According to Schlager and Ostrom (1992), property rights comprise 1) the right to use the resource (e.g., getting access to and withdrawing the resource), 2) the right to manage the resource (e.g., modifying or transforming the resource), 3) the right to exclude (e.g., determining who else may use the resource), and 4) the rights to alienate (e.g., transferring the resource either by inheritance, sale, or gift). Each property right provides a different level of authority to local leaders.

Property rights can also be separated into legal rights and customary rights (Schlager & Ostrom, 1992). Legal rights are defined as formal, official, *de jure*, or written rights that are transferred from the governments and backed up by policies or laws (Meinzen-Dick et al., 1997). On the other hand, customary rights or *de facto* rights refer to rights that originated among resource users guided by customs, tradition, religion, or social norms (Warren & McCarthy, 2002). Some user communities hold both kinds of rights

while others do not. Local communities who hold only de facto rights have to enforce these rights among their own members (Schager & Ostrom, 1992).

A few studies (e.g. Schager & Ostrom, 1992; Vermillion, 2001; Ribot, 2003) stressed the importance of authority gained through property rights in resource management and governance. Ribot (2003) maintained that local leaders needed authority to gain experience for capacity building. In the context of PIM, Vermillion (2001) believed that local leaders need rights to earn revenue (rights to use), either from irrigation service fees or other sources, for cost recovery. These leaders also need exclusion rights so that, in the case of encroachment, illegal activities such as water theft can be prevented (Vermillion, 2001).

While leadership capacity is critical for irrigation management, Hunt's (1989) writings, based on an empirical study of WUAs in India, pointed out incentives as another factor of influence on leadership. Incentives can be separated into the tangible and intangible (Uphoff, 1985; Hunt, 1989), and Ross and Lappin (1967) suggested that local leaders might be motivated to work because of tangible benefits such as cash, water, land, labour, or some combination of these. However, they also argued that such tangible incentives were not always the reason why local leaders kept working for their community. Leaders were also motivated to work for the community when it satisfied their need for prestige or yielded moral benefits from improving the existing conditions in their community; rewards such as these are called intangible incentives. Motivation to work due to intangible incentives was thought to be important for sustainable community organisations, because leaders in this context might be willing to work to improve their communities regardless of the tangible benefits they received (Ross & Lappin, 1967). In addition, intangible rewards may strengthen leaders enough to be able to withstand conflict or criticism from their members (Ross & Lappin, 1967).

3.3.1.2.2 The governance and management processes

Governance and management processes are defined as the processes of forming a community (including the determination of who is eligible to manage the scheme and the process of designing rules) (Bene & Neiland, 2006). These also include the processes used to implement, enforce (Menzies, 2004), and adapt the rules on the ground (Ostrom, 1994; Imperial, 1999). The following sections describe the literature about the formation, rule implementation, enforcement, and adaptation processes, the

mechanisms through which they influence the success of WUAs, and then the factors that influence them.

The formation process

The process used to form a WUA must address two tasks: 1) determine who is eligible to manage the scheme, and 2) design the rules by which the WUA will operate. Ostrom (1999) observed that the community-based organisations of CPRs (including irrigation schemes) can be either self-organised or formed by outsiders. More self-organised groups are often sustained over time because members in those groups are able to make and adapt their own rules effectively. Ostrom (2000) also believed that in self-organised groups, social capital in terms of mutual trust and cooperation is high, allowing the local people to come together easily for collective action.

While some communities are self-organised, other communities are initiated by outsiders such as governments, donors, or non-governmental organisations. Dasgupta and Beard (2007) found that externally initiated organisations are still able to function effectively when they are formed using the principles of broad-based participation, democratic decision making, and transparency.

The formation process of a community involves several activities. Ross and Lappin (1967) and Perera (2006) suggested two important steps in forming a community: 1) organising meetings with farmers, and 2) having proper elections to determine who is eligible to manage the irrigation scheme. The first step in the formation process should be the organisation of a meeting to identify common problems in relation to irrigation and the group interests. Once local people have agreed to be involved and to take over an irrigation scheme, the selection of leaders, based on democratic principles, should be organised. Local people should be allowed to select their own leaders through elections, and they should be informed of the leadership qualities required for this kind of leadership position (Perera, 2006). Perera (2006) suggested that in areas where there is a lack of village organisation and local leader presence, the elections should be open to commune or village chiefs, since these individuals were often found to possess the capability to mobilise farmers for institutional building.

Interestingly, it has been documented that elections are not the only way to identify good leadership (Katon et al., 1997; Pomeroy et al., 1996), and elected leaders have not always been accountable to their people (Ribot, 2003). Katon et al. (1997) and

Pomeroy et al. (1996) found that locally recruited leaders were also helpful to the implementation of community-based organisations. Mandondo (2000) found that appointed leaders could be made accountable to local people if accountability mechanisms were put in place.

Apart from elections, Ostrom (1990) suggested also focusing on rule design during the formation process. According to Ostrom (1990), local people should craft their own rules to suit their conditions and needs. Locals may also need resource people to be made available for consultation in order to craft effective rules (Ballabh et al., 2002). Several studies (Tang, 1992; Ostrom 1994; Lam, 1996; Meinzen-Dick et al., 1997; Meinzen-Dick et al., 2002; Shivakoti & Ostrom, 2002; Keremane et al., 2006) confirmed that rules internally crafted by local people often result in better outcomes than those that are externally imposed, because such rules reflect local needs and because local people are more likely to comply with established rules of their own making (Hønneland, 1999).

The implementation, enforcement, and adaptation of rules

The governance and management processes also include the implementation, enforcement, (Menzies, 2004) and adaptation of rules (Ostrom, 1994; Imperial, 1999). In PIM, the implementation of rules is defined as the process of putting rules into practice, including allocating and distributing water to farmers, collecting Irrigation Service Fees, maintaining and monitoring the irrigation infrastructure, conducting community meetings, and resolving community conflicts. On the other hand, rule enforcement is defined as the process of meting out punishment or establishing sanctions against those who violate community rules, such as giving a verbal warning, imposing a fine, or preventing access to irrigation water. Rule adaptation refers to the process of changing the rules.

Little of the literature has expounded upon the criteria used by local leaders to implement and enforce community rules. However, scholars often use such criteria to assess how well rule implementation and enforcement have been carried out in a community. For example, in studying fishery co-management, Pinkerton and Weistein (1995) highlighted three criteria for assessing rule implementation and enforcement, namely accountability, representativeness, and effectiveness. They conceived of accountability as involving local access to information on the status of the resource, the ability to engage in public discussion to debate and scope out what the real problems

were, the ability to reach agreement on what the most basic problem was and what the basic strategy should be, and the ability to gain timely feedback on the outcome of management actions. Representativeness was defined by Pinkerton and Weistein (1995) as the ability to involve different relevant groups from various locations in the community, and effectiveness was defined as the ability to make appropriate rules, monitor compliance, enforce the rules, censure non-compliances and mobilise members to participate in management activities.

Further, Tanaka and Sato (2005) suggested fairness as another criterion for assessing rule implementation and enforcement. Fairness can be separated into two types: distributive fairness and procedural fairness (Thibaut & Walker, 1975). Thibaut and Walker (1975) believed that local people perceive the performance of leaders as fair when the outcome was worth the input that was paid for it, and this was called distributive fairness. Farmers were found to also consider the procedure used by the leaders in their decision-making process as part of reaching an outcome, and this was called procedural fairness (Thibaut & Walker, 1975).

Wade (1988b) believed that fairness is critical to the success of WUAs because it influences individuals' choices concerning free-riding. Similarly, Tanaka and Sato (2005) found that farmers' perceptions of fairness were critical for the success of WUAs, because such perceptions influenced local participation in irrigation management. Based on the study of a successful case of PIM in Japan, Tanaka and Sato (2005) found that farmers placed a high priority on fairness as applied to rule compliance and equality in water volume. Tana and Sato also found that farmers' perceptions of fairness were mainly influenced by customary rules.

The literature highlighted several factors that influenced rule implementation and enforcement. An empirical study by Meinzen-Dick et al. (2002) on PIM stressed the importance of leadership capacity, while Ostrom (1990), speaking in the context of both CPRs and irrigation schemes, contented that the effective implementation and enforcement of rules requires local members to participate in monitoring and sanctioning each other's performance. Vermillion (1994; 2001) placed emphasis on the rights, authority, and financial resources necessary for effective rule implementation and enforcement in irrigation management. According to Vermillion (1994), local leaders need the right to collect fees and the authority to effectively prevent water theft. Leaders also need sufficient financial resources to ensure the effective operation and maintenance of irrigation schemes (Vermillion, 1994) as well as to pay administrative

costs such as staff remuneration, office facilities, stationery, travel costs, and other expenses (Jaujay, 1990; Pomeroy et al., 2001).

Unlike community forestry or fishery, leaders in WUAs can generate financial resources because they are authorised to collect irrigation service fees from their members (Johnson, 1993; Meinzen-Dick et al., 1997). Concerning this, leaders are also advised to use a proper fee collection system to keep track of how many farmers have not paid for water fees or how much each farmer owes (Tewari & Khanna, 2005). Besides collecting fees from their members, committees are also allowed to apply for loans, subsidies, or donations from external agencies (World Bank, 1998) and to look for alternative revenue sources, such as fish or trees, in the community (Meinzen-Dick et al., 1997; Tewari & Khanna, 2005).

Thun (2008) found that despite the fact that WUAs have the authority to raise financial resources in theory, they often struggle to accomplish this with local members and other sources. In Cambodia, Thun (2008) found that the failure of some WUAs was driven by the fact that local leaders could not collect irrigation service fees from users, in addition to the absence of the government agencies and non-governmental organisations who could provide the WUAs with needed support during emergencies. Having established only limited financial resources, the leaders of these WUAs were unable to undertake adequate maintenance on the schemes, and as a consequence the infrastructure deteriorated over a short period of time (Perera, 2006).

Rather than focusing purely on rule implementation and enforcement, Ostrom (1994) and Imperial (1999) looked at the need for rules to be changed over time so that they stay compatible with changes in the physical and biological setting of the resource. Pinkerton and Weistein (1995) used their findings from fishery co-management to argue that the success of community-based organisations is partly reliant upon the ability of the leaders to change rules in response to new problems, and to accumulate knowledge and learning about the local resource. In PIM, McKay and Keremene (2006) found that the success of a WUA in India was determined by the fact that the leaders were able to adapt the irrigation service fee payment rules to meet local needs in the light of changing circumstances. Farmers who lacked money due to crop failure and droughts were allowed to default on the payment of their irrigation service fees. In addition to this, the leaders occasionally increased the annual irrigation service fees substantially to obtain sufficient revenue to pay for major scheme maintenance. These

adjustments resulted in increased local participation in the scheme and a reduced level of conflict over water in the community.

3.3.1.3 Benefits from irrigation schemes

Benefits were another critical factor shown to influence the success of WUAs. Benefits impact on local members' levels of participation in a group, according to Olson (1965). In PIM, several studies (e.g., Uphoff et al., 1990; Meinzen-Dick & Reidinger, 1995; Meinzen-Dick, 1997; Meinzen-Dick et al., 1997; Subramanian et al., 1997; Regmi, 2008) found that the benefits that flowed from irrigation schemes served as powerful incentive for local farmers to participate in irrigation management. McKay and Keremane (2006) found that benefits from irrigation enhanced food security or provided additional revenue from crop production.

Thus, benefits need to be sufficient in order to ensure local participation. Meinzen-Dick et al. (1997) asserted that farmers would not participate in irrigation management if the cost of their participation exceeded the benefits they derived from the scheme. Likewise, three recent empirical studies by McKay and Keremeny (2006) in India, Maleza and Nishimura (2007) in the Philippines, and Thun (2008) in Cambodia found that farmers often refused to pay fees if they obtained low production resulting from inadequate water supply or as a consequence of droughts.

Poffenberger (1990) believed the benefits that flowed from irrigation schemes should be shared equally among members to ensure local participation in the management of them. However, Quiggin (1993) observed that in some successful communities, the benefits were shared unequally among members. Jain (2002) and Kerr (2002), in their studies on community forestry and watershed development in India, reported that the benefits received by members from local participation depended on their socioeconomic conditions. For example, Kerr (2002) found that of all members, large landholders benefited most from a watershed project in India. Adhikari et al. (2004) reported that poor families had less access to forest products than did well-off families in the hills of Nepal. However, Jain (2002) argued that unequal benefit sharing did not prevent local people from participating in the management of the resource. He found that farmers still participated in resource management, despite the inequality of benefit sharing, when community gains were distributed among all the members and they found they were better off than when the resource was not managed by the community.

Oakerson (1990) highlighted the importance of reciprocity in ensuring cooperation within a group despite the unequal benefit sharing. Reciprocity means that members learned to expect future positive performance from others.

3.3.1.4 The attributes of irrigation infrastructure

The attributes of irrigation infrastructure were another factor found to influence the success of WUAs. Several studies have identified those attributes that impact on WUA success. Three comprehensive studies, by Wade (1988a), Ostrom (1990), and Meinzen-Dick et al. (2002), identified two important attributes of irrigation infrastructure: size of command area and boundary definition. Other empirical studies (e.g., Uphoff et al., 1990; Perry, 1995; Maleza & Nishimura, 2007; Regmi, 2008) emphasised the importance of the quality of the irrigation infrastructure. Thus, the combined literature identifies three main attributes of irrigation infrastructure that influence the success of WUAs: size of command area, boundary definition, and the quality of the irrigation infrastructure.

Although Meinzen-Dick et al. (2002) asserted that a smaller-sized command area is less attractive to outsiders and thus not as helpful in winning support for a WUA, Wade (1988a) argued that the smaller the size of the command area and the more clearly defined the boundaries of irrigation, the greater the chance of success. Ostrom (1990) believed that when the boundary definition of resources was clear, it was easier for local leaders to govern and manage the schemes.

In addition to command area size and boundary definition, the quality of the irrigation infrastructure was also identified as a key factor influencing the successful management of WUAs. Regmi (2008) reported that poor irrigation infrastructure made it difficult for leaders to distribute water to their members equitably and on time. As such, it often led to water anarchy in communities (Perry, 1995). When farmers could not access water because of the state of the irrigation infrastructure, they would decide to adjust the infrastructure on their own, e.g., by enlarging outlets or canals, destroying control structures, or constructing barriers to keep water on their farmland (Perry, 1995). Furthermore, according to the findings of Perera (2006), poor irrigation infrastructure limits institution building because farmers are unlikely to work together to manage the irrigation scheme if they anticipate few benefits due to the poor quality of the irrigation infrastructure.

Poor irrigation infrastructure is usually a consequence of either poor irrigation design and construction, the unfavourable location of a scheme, or a lack of regular maintenance (Meinzen-Dick et al., 1997) due to high costs, high labour requirements or the difficulty of the work (Hunt, 1989). Perera (2006) and Chem and Craig (2008) found that the majority of irrigation systems in Cambodia were not in good condition because they were built during the Pol Pot regime (1975-1979) without proper design and were often damaged due to annual floods. However, Perera (2006) believed that the operation and maintenance costs incurred by local farmers could be reduced if the government took responsibility for scheme construction or rehabilitation prior to turning the scheme over to communities. When the rehabilitation or construction of irrigation schemes by the government is undertaken properly, it can ensure a long-lasting reduction in maintenance costs for the communities (Meinzen-Dick et al., 1997).

3.3.1.5 The characteristics of farmer members

Another factor that influenced the success of WUAs is the characteristics of farmer members. Drawing from the work of Olson (1965), Wade (1988a), Ostrom (1990), Baland and Platteau (1996), and Meinzen-Dick et al. (2002), four group characteristics were identified as important namely: 1) group size, 2) homogeneity of farmer members, 3) livelihood dependency, and 4) past experience.

First, Olson (1965), Wade (1988a), Ostrom (1990), and Baland and Platteau (1996) all suggested that members cooperate well when their group is small and they live close to each other. It was noted that members of small groups living in a small area were able to interact with each other more frequently, thereby reducing the transaction costs involved in making collective decisions (Agrawal & Gibson, 1999). The closeness of members within the community also allowed them to be well-informed about each other's actions and preferences (Baland & Platteau, 1996). These views were supported by the work of Tang (1992) who found that successful irrigation systems usually operated in relatively small communities. Weissing and Ostrom (1991) suggested subdividing larger irrigation schemes into small units, so that the actual number of farmers whose actions affected one another was kept small and so that it was less difficult for farmers to monitor each other.

Second, the degree of homogeneity of farmer members has been shown to influence the level of cooperation in a community (Baland & Platteau, 1996; Lowdemilk et al., 1978). Communities with a high degree of homogeneity among members (concerning factors such as culture, norms, ethnicity, socioeconomic level, and interest level) were more likely to share beliefs, views, and perceptions, helping to facilitate cooperation and collective action (Baland & Platteau, 1996). For example, Freudenberger and Mathieu (1993) found that the lack of cooperation among villagers in southern Burkina Faso was due to the community's mix of host farmers and new arrivals. The host farmers did not want to cooperate with the new arrivals (migrants) who they believed did not respect their traditional authority. Similarly, in the case of a fishery community in Japan, there was a conflict of interest between small-scale fishermen and industrial fishing companies (Baland & Platteau, 1996). The former had been taught that catching young fish was an unacceptable practice, while the latter caught all fish regardless of size, resulting in low levels of fish stock for small-scale fishermen in the area (Baland & Platteau, 1996).

However, this does not mean that community-based organisations cannot be successful in a culturally or socio-economically heterogeneous community (Khan & Apu, 1998). Pinkerton and Weistein (1995) found that if members were willing to work together, heterogeneous groups could still cooperate, but needed to build multiple checks and balances into their processes along with constant monitoring to make sure that leaders and members were accountable to the sustainability principles of participatory resource management. Baland and Platteau (1996) argued that heterogeneity of endowments in terms of skills, knowledge, assets, and so on could lead to unequal access and contributions to resource management by local people, but that this was not an obstacle to local cooperation. Although unequal economically, local people can still show an interest in working collaboratively on resource regulation and collective action (Khan & Apu, 1998). Wade (1988a) studied the irrigation schemes of South Indian villages and found that all landowners (both small and large) who held land scattered about the village area had a common interest in establishing and enforcing water access in their community.

The third farmer characteristic found to influence local co-operation is livelihood dependency. Empirical studies have confirmed that local farmers are likely to cooperate to manage the resources if they rely on them heavily for their livelihood, and when the number of alternative livelihoods available in the community is low (Pinkerton & Weistein, 1995; Baland & Platteau, 1996; Meinzen-Dick & Knox, 2001; Perera, 2006).

For example, Baland and Platteau (1996) found that small-scale fishermen in Japan who were critically dependent upon fishing for subsistence and had no alternative income opportunities were more concerned about fish conservation than were industrial fishing companies. Perera (2006) found that some Cambodian farmer households were not interested in irrigation management because their livelihood strategies were not entirely dependant on irrigation. The main sources of livelihood security for these families came from other activities such as small businesses or paid employment. As such, they preferred to spend their time working on these activities, rather than farming (Perera, 2006).

Finally, past organisational experience also has an influence on the quality of local cooperation within a community (Balland & Platteau, 1996; Wade, 1988a). Ostrom (1999) believed that in areas where they had experience in organising themselves or being organised to perform community activities (e.g., self-help groups or women's groups), members might have learned at least the minimal skills of organisation through participation which would allow them to engage in a high level of mutual dependency. The presence of temple or religious institutions has also been found to be a reliable indicator of the existence of a high level of interdependence in many rural communities (Meinzen-Dick et al., 2002). Moreover, having organisational experience leads to the emergence of local leaders (Perera, 2006). As such, people who used to hold positions as group leaders tend to possess leadership capacity, which is necessary for the run of a community (Ostrom, 1999).

3.3.2 External factors

Apart from internal factors, the success of WUAs is also influenced by external factors. External factors are defined as those that exist outside the community and are not under the control of the WUAs. Two main external factors that have been documented in the literature as influencing the success of WUAs are the presence of external support and market access. The following sections describe each factor in detail.

3.3.2.1 External support

External support is defined as assistance or aid provided by outsiders to WUAs, and it can come in many forms. Meinzen-Dick et al. (1997) highlighted the importance of external support from the government relative to the establishment and adjudication of

water rights, legal framework, rule design, technical and organisational training, occasional financial support, and major construction of irrigation infrastructure. Besides support from the government, Maleza and Nishimura (2007) suggested securing support from local NGOs for the development and extension of crop production technology, soil quality enrichment, water management, provision of farm credit and marketing assistance, or the construction and maintenance of farm-to-market roads. Assistance in these areas can help farmers deal with shocks resulting from infertile soil, insects, or drought, and provide access to markets for crops and produce. Further, according to a national study by the Technical Working Group on Agriculture and Water (TWGAW) (2006) in Cambodia, it was found that external support from local authorities regarding rule enforcement was also important in ensuring the efficiency of a created organisation.

Balint and Mashinya (2006), studying the case of a community-based conservation project in Zimbabwe, found that the influence of outsiders, especially the central government, could undermine the autonomy of local communities in the long run. However, several empirical studies of CPRs (e.g., Subramanian et al., 1997; Kolavalli & Brewer, 1999; Kellert et al. 2000; Ballabh et al., 2002; Bwayal, 2002; Keremane et al., 2006; Opare, 2007) argued that local leaders could perform well if they obtained support from the central government, local authorities, non-governmental organisations, or other community-based organisations. In PIM, Meinzen-Dick et al. (1997) suggested that efforts to implement WUAs successfully should not go so far as to insist the WUAs function without any external support at all. Jain (2002) supported this stand, and claimed that in successful WUAs in Udaipur, India, local irrigation leaders and farmers still obtained external support. Jain (2002) further reported that the success of these WUAs in Udaipur occurred in part because the support from external agencies did not create dependency, but rather helped improve and build the capacity of local leaders for self-reliance.

Subramanian et al. (1997) believed that external support (especially from central governments) for WUAs should be seen as an ongoing practice despite communities being given complete control over irrigation management. This is because of the catalytic role outsiders can play in promoting cooperation among farmers when leaders fail to accomplish this on their own (Meinzen-Dick, 1997). Further, based on forestry and fishery co-management research, Klooster (2000) and Pomeroy et al. (2001) similarly found that in communities where committees generated a high level of revenue from their operations, it was important to have external actors who could

advise community leaders on financial management, and to monitor and evaluate the management process to ensure accountability and transparency within the communities.

3.3.2.2 Market access

Market access is the second factor observed to influence the success of WUAs (Meinzen-Dick et al., 2002). Meinzen-Dick et al. (2002) suggested two important aspects associated with market access: 1) distance to markets, and 2) transportation costs. According to Meinzen-Dick et al. (1997), WUAs that were close to markets had lower transaction costs between farmers and retailers than WUAs that were further from markets. This made irrigated agriculture more profitable for farmers who were close to markets. In a Tanzanian study, Rweyemamu (2003) found that when farmers were located a considerable distance from markets, private traders were not interested in travelling to buy produce from them. As such, those farmers had to sell their produce at the farm gate at much lower prices than they could have obtained at a market.

Meinzen-Dick et al. (1997) argued that market access helped increase the economic returns that flowed from irrigation and this led to greater participation by farmers. Based on an empirical study on groundwater irrigation management, Jackson (1991) found that farmers in Western Madura, Indonesia were more interested in irrigation management activities when they had markets for their dry season fruits and vegetables. Similarly, Tubpun (1986), who studied small tank irrigation in Northeast Thailand found that successful WUAs were more likely to be found in areas where local farmers could access markets for their production.

According to Rweyemamu (2003), market access is also dependent upon the amount of crops the farmers produce and the poverty level of farmer households. He reported that farmers who grew a limited amount of produce often preferred to sell their crops at the farm gate rather than at markets because the returns from smaller crop sales tend not to cover the cost of transportation if taken to the market. Moreover, rich farmers who could afford the cost of transportation or had their own transportation were more often able to sell their produce at markets.

3.4 Conceptual framework

The Participatory Irrigation Management approach has been applied in several developing countries as a response to the need for local participation in irrigation management. Water Users' Associations have been established with farmers so they might take responsibility for the operation and maintenance of irrigation schemes on behalf of the government. However, in practice, some WUAs have been successful in irrigation management while others have not. The review in this chapter has provided a framework for understanding the factors that influence the success of WUAs in irrigation management.

Drawing from the literature on collective action, the governance of Common Pool Resources, Participatory Irrigation Management, and general literature on governance and management, it was found that the success of WUAs is influenced by five internal factors and two external factors, as illustrated in Figure 3.1 below. The five internal factors include: 1) the level of local participation, 2) the governance and management of irrigation schemes, 3) benefits that flow from irrigation schemes, 4) physical attributes of irrigation schemes, and 5) characteristics of farmer members who depend on the schemes. The two external factors include: 1) external support, and 2) market access.

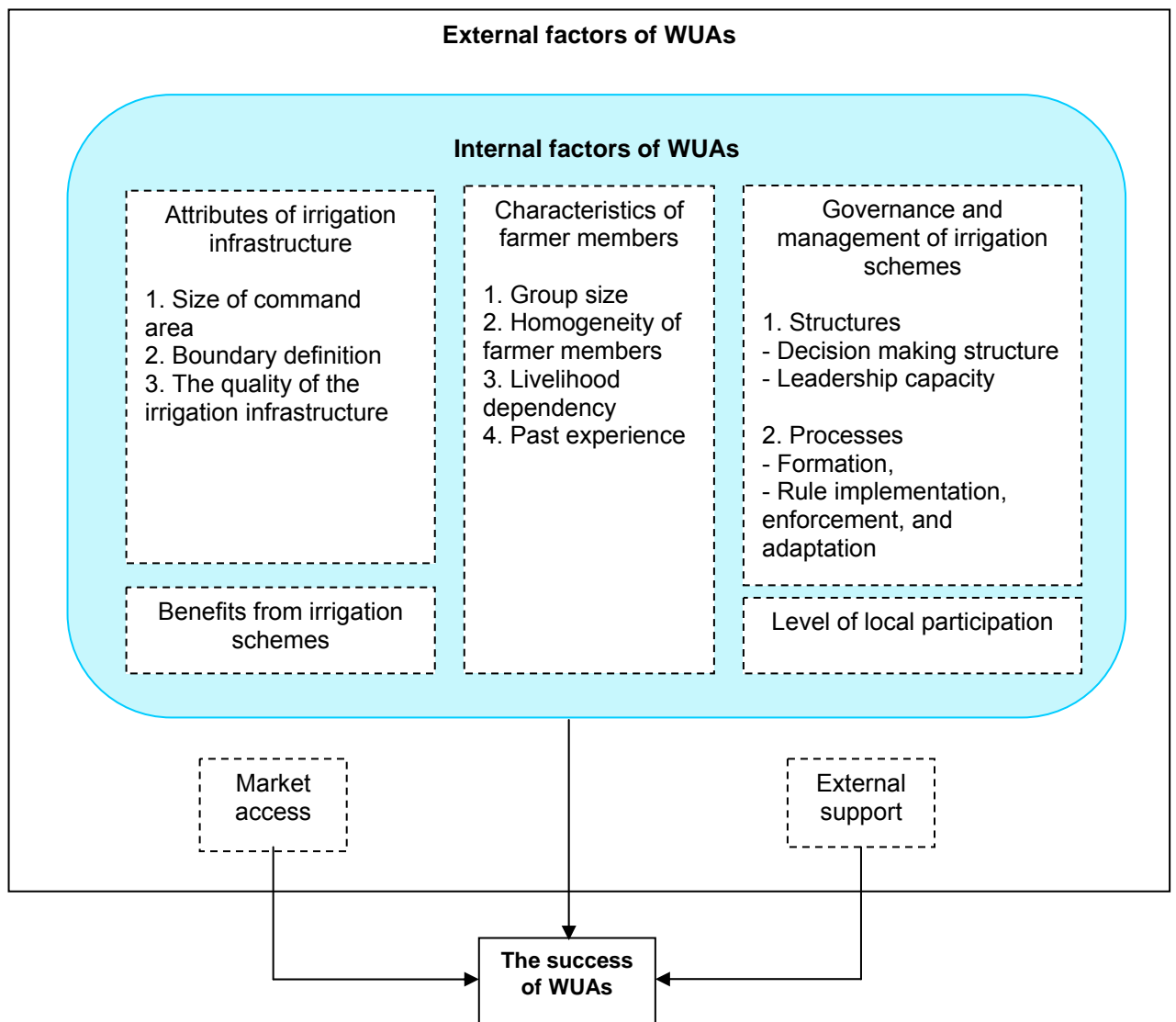


Figure 3.1. A diagram of the conceptual framework for the relationship between internal and external factors impacting on the success of WUAs

CHAPTER 4

RESEARCH METHODS

The aim of this research is to identify factors that influence the success of a Cambodian Farmer Water User Community involved in irrigation management. In this chapter, the choice of research strategy, case study methods, and an overview of a single embedded case study are discussed. The sampling method for case selection and within-case selection, and the design of data collection protocol are outlined. The data collection and data analysis processes used by the researcher are then described. In the final section of the chapter, the ethical considerations that were applied by the researcher in this study are discussed.

4.1 Choice of research strategy

Yin (2003) identified five different research strategies that can be used by researchers according to the focus of the research and the type of research question involved. These five strategies include experiment, survey, archival analysis, history, and case study. According to Yin, case study methods are suitable when a researcher seeks to address “how” or “why” research questions, when a researcher wants to investigate situations that require no control over behavioural events, and when the research focus is on contemporary events within a real-life context. For the current study, a case study methodology was applied because 1) the focus of the investigation is about how and why a Cambodian Farmer Water User Community is successful in irrigation management, 2) control over behavioural events is not required, and 3) contemporary events are the subject of this research.

4.2 Choice of case study design

Case study methods can involve either qualitative approaches alone or a mix of both qualitative and quantitative approaches (Hakim, 1987; Merriam, 1998; Yin, 2003). Qualitative case study methods comprise five types: descriptive, explorative, theory building, theory exploring and refining, and theory testing (Kaarbo & Beasley, 1999). A descriptive case study, which Eckstein (1975) called “configurative-idiographic”, is the type that provides a holistic picture or understanding of the event or phenomenon of

the case itself, while an explorative case study uses a particular theory to set hypotheses which serve to direct the examination or interpretation of a particular case (Kaarbo & Beasley, 1999). The theory building type of case study seeks to generate a hypothesis or theory on the basis of the case findings. This is done when minimal theory exists or the existing theory is limited and needs extension. Case study methods that explore and refine theory are selected when researchers want to explore whether certain aspects or variables of theory are consistent with empirical data and phenomena and ascertain whether the theory needs to be refined (Kaarbo & Beasley, 1999). Finally, the theory testing case study is used when there is sufficient theory to develop testable hypotheses and specific cases are chosen to test these hypotheses (Kaarbo & Beasley, 1999).

This research employs the exploring and refining theory type of case study methodology, as there is already an existing body of theory concerning this topic, but it contains some weaknesses. As such, this research further explores empirical phenomena to help refine existing theory.

Yin (2003) also identified four types of case study design (Figure 4.1). A single-case study design is used when the case represents a critical test of existing theory, a rare or unique circumstance, a representative or typical case, a revelatory case, or longitudinal purpose (Yin, 2003), while multiple-case studies involve collecting and analysing more than one case (at least two cases) for replication purposes (Hakim, 1987; Merriam, 1998; de Vaus, 2001; Yin, 2003). Furthermore, an embedded case study design is used when there are multiple units of analysis, and a holistic design applies when the focus is on a single unit (Yin, 2003).

	Single-case designs	Multiple-case designs
Holistic (Single unit of analysis)	Type 1	Type3
Embedded (Multiple units of analysis)	Type2	Type4

Figure 4.1. Basic types of designs for case studies. (Source: Yin, 2003)

For this study, an embedded single-case study design was adopted. This study can be characterised as embedded because the focus of the study is on multiple units of analysis, such as the level of local participation, the governance and management of

the scheme, the benefits that flowed from the irrigation scheme, the quality of the irrigation infrastructure, the characteristics of the farmers, the level of external support, and market access. Moreover, a single-case study approach was used because the selected case represents a rare or relatively unique case (the most successful case) in Cambodia, which is worth documenting and analysing (Yin, 2003).

4.3 Overview of the single embedded case study

The single embedded case study approach for this research was adopted from Merriam (1998) and Yin (2003) comprising three phases: design, single-case data collection, and within-case analysis and interpretation (Figure 4.2). The first step in the design phase was to review the literature to develop a theoretical framework. Once the initial literature review was completed, it was used to develop criteria for the selection of the case study and the design of the data collection protocol.

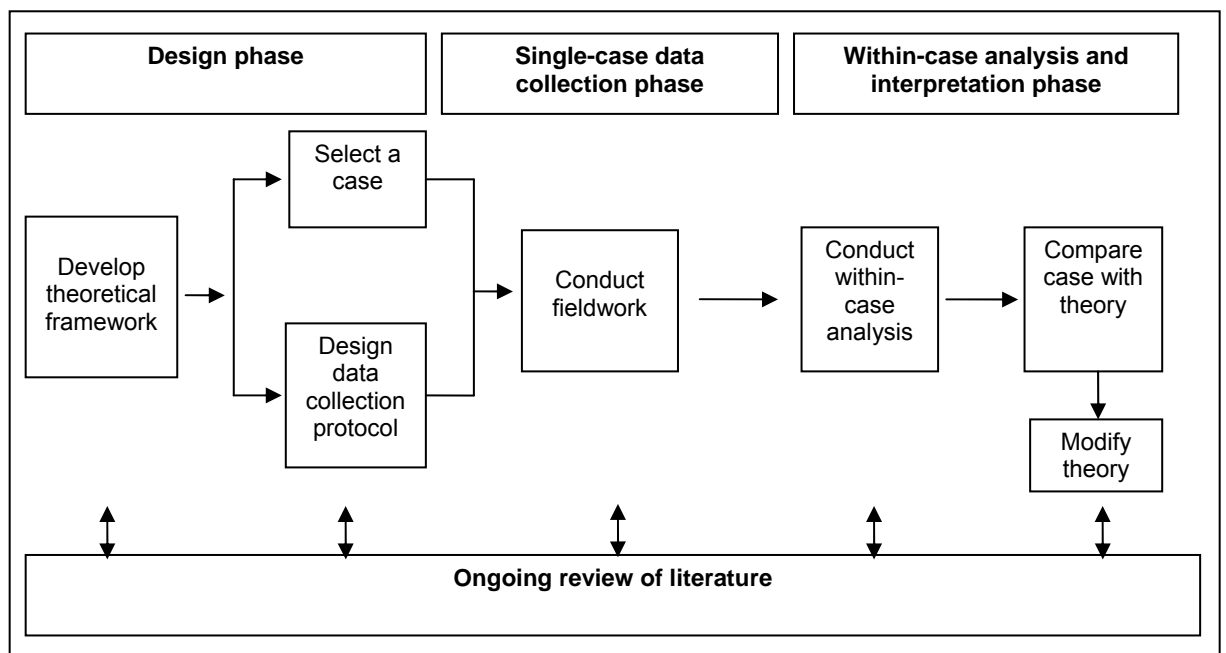


Figure 4.2. A diagram of the single embedded case study method, as adapted from Merriam (1998) and Yin (2003).

In the second phase, data was collected in the form of key informant interviews, household interviews, group discussions, participant observations, informal conversational interviews, and documents and archival records. When the data collection process was finished, the third phase began, involving within-case analysis

and interpretation. The literature was reviewed throughout most of the three phases of the research process because, as the researcher gained a greater understanding of the case study and the phenomena under investigation, other areas of the literature were identified that needed to be explored. The findings were then compared to the extant theory, which was modified accordingly.

In the following sections, the sampling for the case study, the design of the data collection protocol, the data collection process, and within-case analysis and interpretation are discussed in detail.

4.3.1 Sampling

Merriam (1998) mentions two types of sampling, namely probability (statistical sampling) and non-probability sampling (also called purposive or purposeful sampling). The purposive or non-probabilistic sampling is suitable for qualitative case studies because it allows researchers to select cases from which they can learn the most. This research purposively selected the O-treing Farmer Water User Community located at the Prey Gniet and Chung Rouk communes, in Kong Pisei District, Kampong Speu Province, Cambodia as the subject for case study (Figures 4.3 and 4.4).

The O-treing Farmer Water User Community was selected based on two criteria: 1) the FWUC was one of 12 pilot schemes across the country selected by the government for the implementation of Participatory Irrigation Management in 2000 (Chandrapatya et al., 2007); and 2) the FWUC was classified as the most successful scheme in Cambodia by the Ministry of Water Resources and Meteorology in 2008. The Ministry of Water Resources and Meteorology defined the FWUC as successful because of its self-dependency in irrigation management and the degree of improvement in local livelihoods (Personal communication, MoWRAM staff member, 3 October, 2008).



Figure 4.3. Map of Cambodia. (Source: www.worldmapfinder.com)

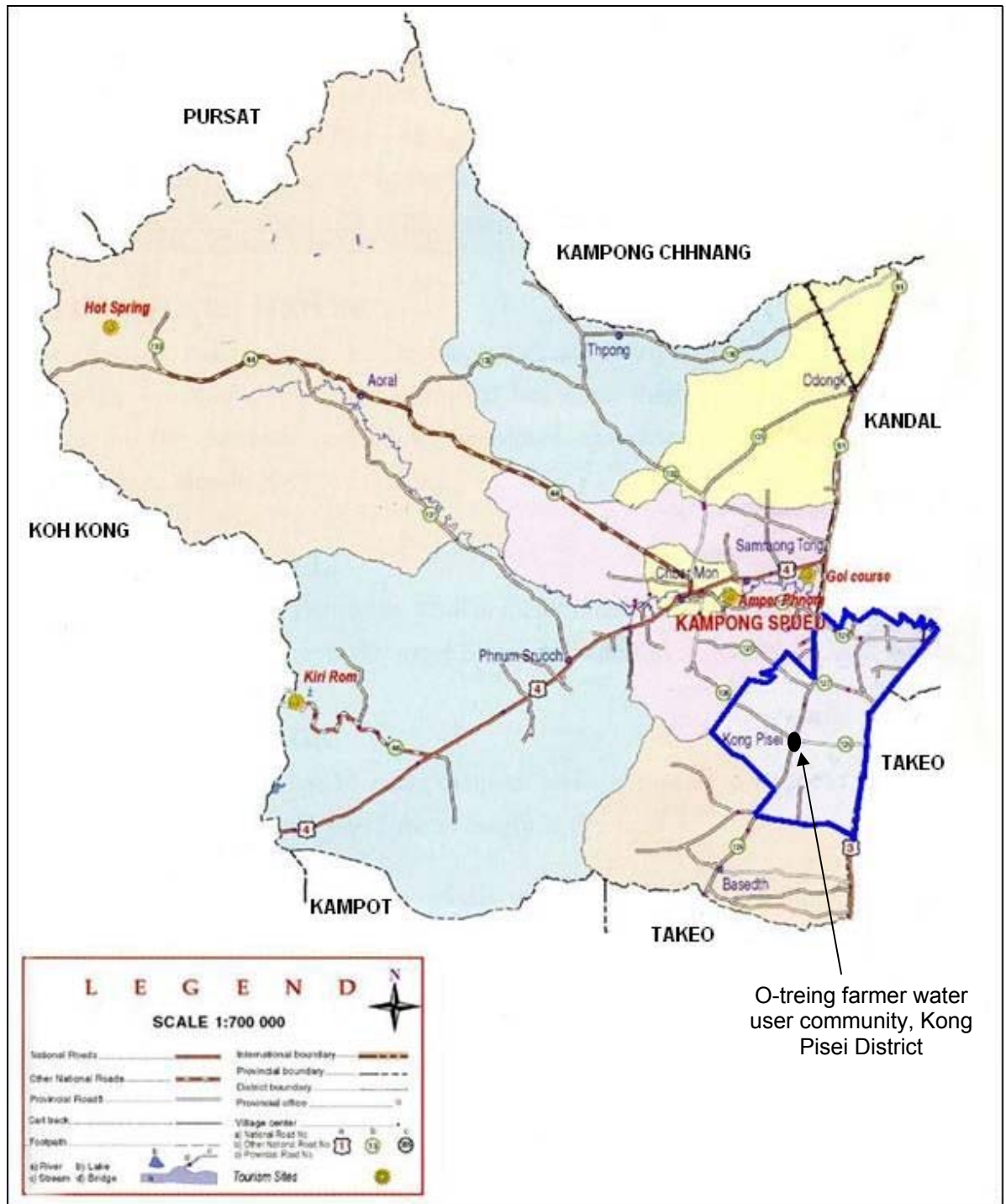


Figure 4.4. Map of Kampong Speu Province.
(Source: <http://www.tourismcambodia.com>)

Within-case sampling was conducted to obtain data from within the identified research subject. Snowball and maximum variation sampling strategies were used to select samples from within the target population for conducting key informant interviews, household interviews, and group discussions (Table 4.1). In the snowball sampling strategy, respondents are asked to identify others who could help provide detailed

information on particular issues (Fossey et al., 2002). Maximum variation sampling was also used to obtain information from a wide range of people in various positions who possessed a variety of livelihood characteristics and came from different farmland locations, namely from above the reservoir, and at the head, middle, and tail of the scheme (Sandelowski, 1995). According to Patton (1990), snowball and maximum variation strategies ensure a richness of information for the research.

Table 4.1. Types of respondents and sample size

	Type of respondents/ participants	Sample size
Key informant interviews	FWUC leaders	27
	Local authorities	6
	MoWRAM and DoWRAM	4
Household interviews	Farmers	23
Focus group discussions	Farmers	7

4.3.2 Design of data collection protocol

The research fieldwork was carried out between early January and late February 2009. Before starting this fieldwork, the researcher arranged a one-day visit to the O-treing Farmer Water User Community with a staff member from the Ministry of Water Resources and Meteorology. The purpose of the field visit was to get to know the FWUC leaders, local authorities, and local farmers, and to become familiar with the geographical location of the area. During this visit, the researcher also asked permission from the committee chairman to stay with his family during the fieldwork period. The researcher provided a copy of the data collection schedule to the local authorities and FWUC chairman, and asked for their cooperation.

Two phases of data collection were organised. The first data-collection phase lasted for one week and its purpose was to collect data on the history and background of the FWUC, the community decision-making structure, and the key factors that influenced the success of the FWUC. The second data-collection phase lasted for two weeks and its purpose was to conduct an in-depth investigation of the key factors identified from the first phase of data collection along with any other new factors. The reason for

conducting the data collection in two phases was to allow the researcher to reflect on the data collected from the first series of interviews before undertaking the second phase.

4.3.3 Data collection process

Multiple techniques of data collection were applied in this research, which, according to Yin (2003), promotes the likelihood of obtaining accurate data. These techniques included: 1) key informant interviews, 2) household interviews, 3) focus group discussions, 4) participatory mapping and matrix development, 5) participant observation, 6) informal conversational interviews, and 7) the collection of documentation and archival records. The following sections describe each technique of data collection in detail, including their aims and processes.

4.3.3.1 Key informant interviews

Key informant interviews are one of the most important sources of case study information (Yin, 2003). In this research, key informant interviews were used with three types of informants: FWUC leaders, local authorities, and government officials (Table 4.2). A semi-structured (Scott et al., 1991) or non-scheduled interview was used (Denzin, 1989) in the current study.

For this research project, the aim of the key informant interviews varied depending upon the type of key informant with different sets of questions. The interviews with government officials and local authorities were designed to collect information about the level of their support for the FWUC, their perspectives on the governance and management of the scheme, and the factors that influenced the success of the FWUC. The researcher also sought to learn the characteristics of local farmers by interviewing the local authorities. The researcher also had a checklist of factors that influenced success drawn from literature and as such she could check these with the answers provided by respondents. The broad set of questions for key informant interviews with the government officials and local authorities is contained in Figure 4.5.

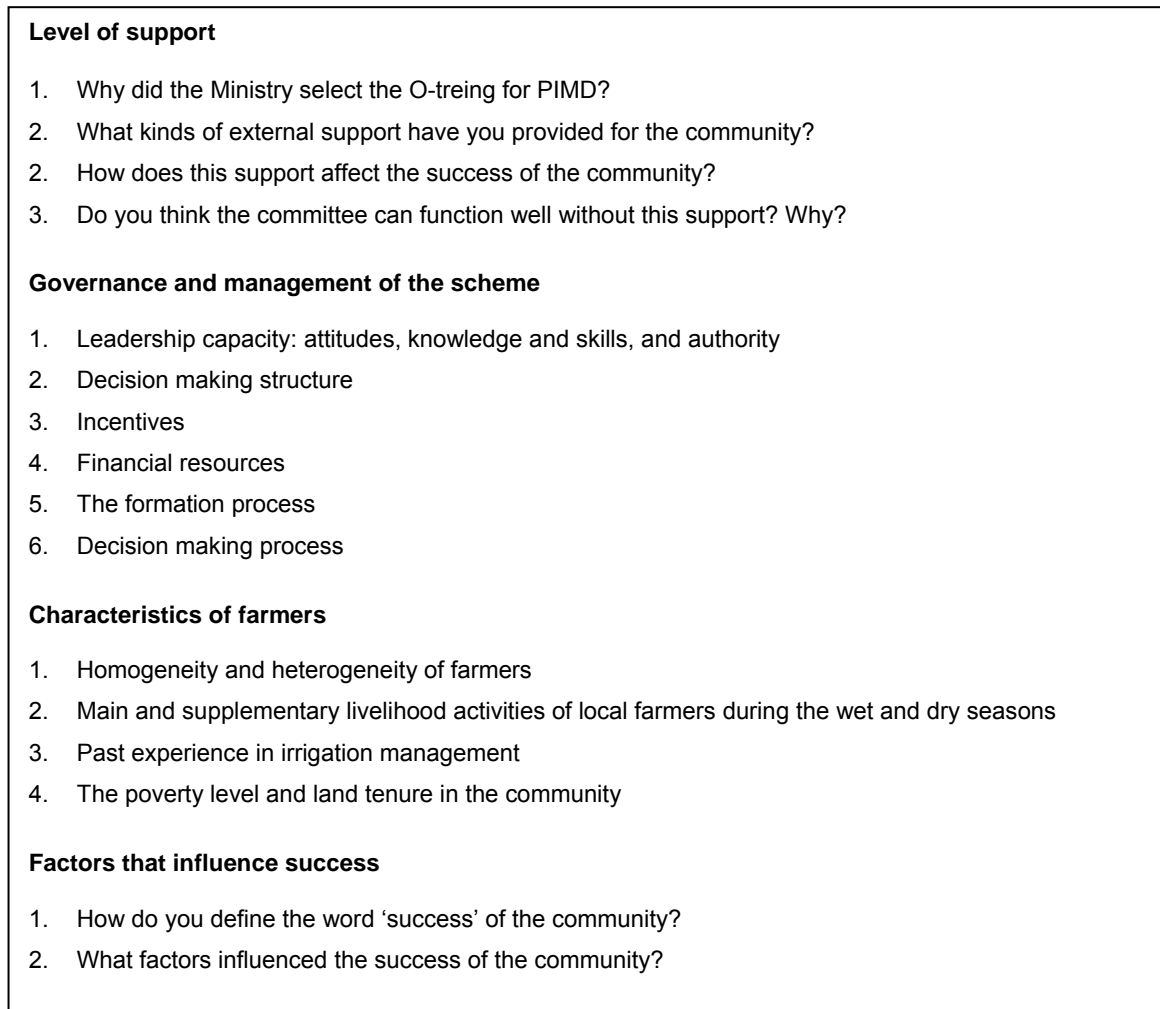


Figure 4.5. Broad question areas for the interviews with the local authorities and government officials.

Interviews were also undertaken with FWUC leaders to obtain information about the level of local participation, the characteristics of farmers, the governance and management of the scheme, the attributes of the irrigation infrastructure, the external support, the availability of water in the reservoir, and the history of the scheme. The broad set of questions for the interviews with FWUC leaders is shown in Figure 4.6.

<p>Local participation</p> <ol style="list-style-type: none"> 1. Types of local participation in the community 2. Reasons for local participation 3. How does the level of local participation influence success? <p>Characteristics of farmers</p> <ol style="list-style-type: none"> 1. Homogeneity and heterogeneity of farmers 2. Main and supplementary livelihood activities of local farmers during the wet and dry seasons 3. Past experience in irrigation management 4. The poverty level and land tenure in the community <p>Governance and management of the scheme</p> <ol style="list-style-type: none"> 1. Leadership capacity: attitudes, knowledge and skills, and authority 2. Decision making structure 3. Incentives 4. Financial resources 5. The formation process 6. Decision making process <p>The scheme infrastructure and availability of water</p> <ol style="list-style-type: none"> 1. Size of command area 2. Boundary definition 3. The quality of the scheme infrastructure? How does this influence success? 2. Water availability in the reservoir over a year 3. Is there any water scarcity or shortage of water supply in the community? Why? <p>Level of external support</p> <ol style="list-style-type: none"> 1. What kinds of external support have you provided for the community? 2. How does this support affect the success of the community? 3. Do you think the committee can function well without this support? Why? <p>History of the scheme</p> <ol style="list-style-type: none"> 1. History of the scheme <p>Factors that influence success</p> <ol style="list-style-type: none"> 1. How do you define the word 'success' of the community? 2. What factors influenced the success of the community?

Figure 4.6. Broad question areas for interviews with FWUC leaders.

The researcher went to meet key informants in person at their houses, farms, or offices to ask for their consent for the interviews and then to make an appointment. These key

informants were briefed on the aim and objectives of the research and the question areas about which they would be asked. A date, time, and place for the interviews were agreed upon by the researcher and informants. These informants were also asked to prepare relevant documents, files or records for the interview. If an informant could not make a time to be interviewed in person, the researcher carried out the interview over the phone.

Several interview techniques were used by the researcher. “Friendly” and/or simple “non-threatening” questions were asked first to relax interviewees (Patton, 1990; Yin, 2003), followed by more detailed open questions. Clarifying and confirmatory questions were applied to develop understanding of important areas (Scott et al., 1991). Decisions were also made about which areas to pursue in depth during the interviews, and as such, active listening was important (Denzin, 1989; Scott et al., 1991). The interviews were taped (Patton, 1990) only when informants had given consent. The researcher also took notes, so that at the end of the interview she could give the participant a brief summary of what had been said. The researcher also asked informants for their permission to come back if further information was needed.

4.3.3.2 Household interviews

Household interviews were used only with farmer members of the Farmer Water User Communities. Similar to the key informant interviews, a semi-structured interview (Scott et al., 1991) technique was applied. The aim of household interviews was to identify their reasons for local participation in the FWUC, especially in light of required payments for irrigation service fees, to discover the reasons why they grew crops, to explore their impressions of the value of the benefits that flowed from the irrigation water, and to identify their accessibility to markets. Another broad set of questions was developed for this technique (Figure 4.7).

The researcher went to meet farmers at their households to ask for their consent for the interviews and to make an appointment with them. Similar to the key informants who were interviewed, farmers were briefed on the research aim and objectives and the question areas about which they would be asked. The date, time, and place were agreed upon by the researcher and farmers. Some farmers preferred to have an interview after lunch, while others preferred before lunch or in the late afternoon at their homes or on their farmland. Most of the time the interviewees were husbands, but

there were a few cases when the husbands or parents were busy working, and the wives or children (above 18 years of age) – who also engaged in cultivation activities – were chosen for the interview. The interviews were taped (Patton, 1990), but this was done only when informants had given consent. The researcher also took notes of important areas for clarifying or confirmatory purposes and to provide a summary to participants at the end of the interviews.

<p>Personal information</p> <ol style="list-style-type: none"> 1. Sex, age, education, and family members 2. Main and supplementary livelihood activities 3. Total farmland and irrigated farmland <p>Local participation</p> <ol style="list-style-type: none"> 1. Types of local participation in the community 2. Reasons for local participation <p>Value of benefits and market access</p> <ol style="list-style-type: none"> 1. How much production did you get from irrigated land in both the dry and wet season? How much did you spend for inputs, water fees and other costs? 2. Where did you sell your production? Who bought it? How much did you earn from it? 3. How important are the dry season and wet season crops for your livelihood?
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Figure 4.7. Broad question areas for household interviews.

4.3.3.3 Focus group discussions

Focus group discussions were used to supplement key informant and household interviews (Morgan, 1997). According to Krueger (1988), focus group discussions are a powerful means of gaining insight into the opinions and beliefs of a particular group of people. Morgan (1997) commented that the main advantage of focus group discussions is to let the researcher observe a large amount of interaction on a topic within a limited amount of time.

In this research, seven focus group discussions were organised with farmers in seven different villages. Two group discussions were conducted in two villages above the reservoir, one in a village at the head of the scheme, two in two villages in the middle of

the scheme, and two in two villages in the tail of the scheme. The purpose for conducting focus group discussions was to identify the characteristics of farmers in the FWUC (especially the level of local dependency on irrigation), their cultivation practices, the value of benefits and markets access, the level of local participation, their access to water, and local perceptions of the leadership capacity of the FWUC leaders. Questions about the definition of success and factors that influence it were also asked during the focus group discussions. The broad set of questions for the focus group discussions is contained in Figure 4.8.

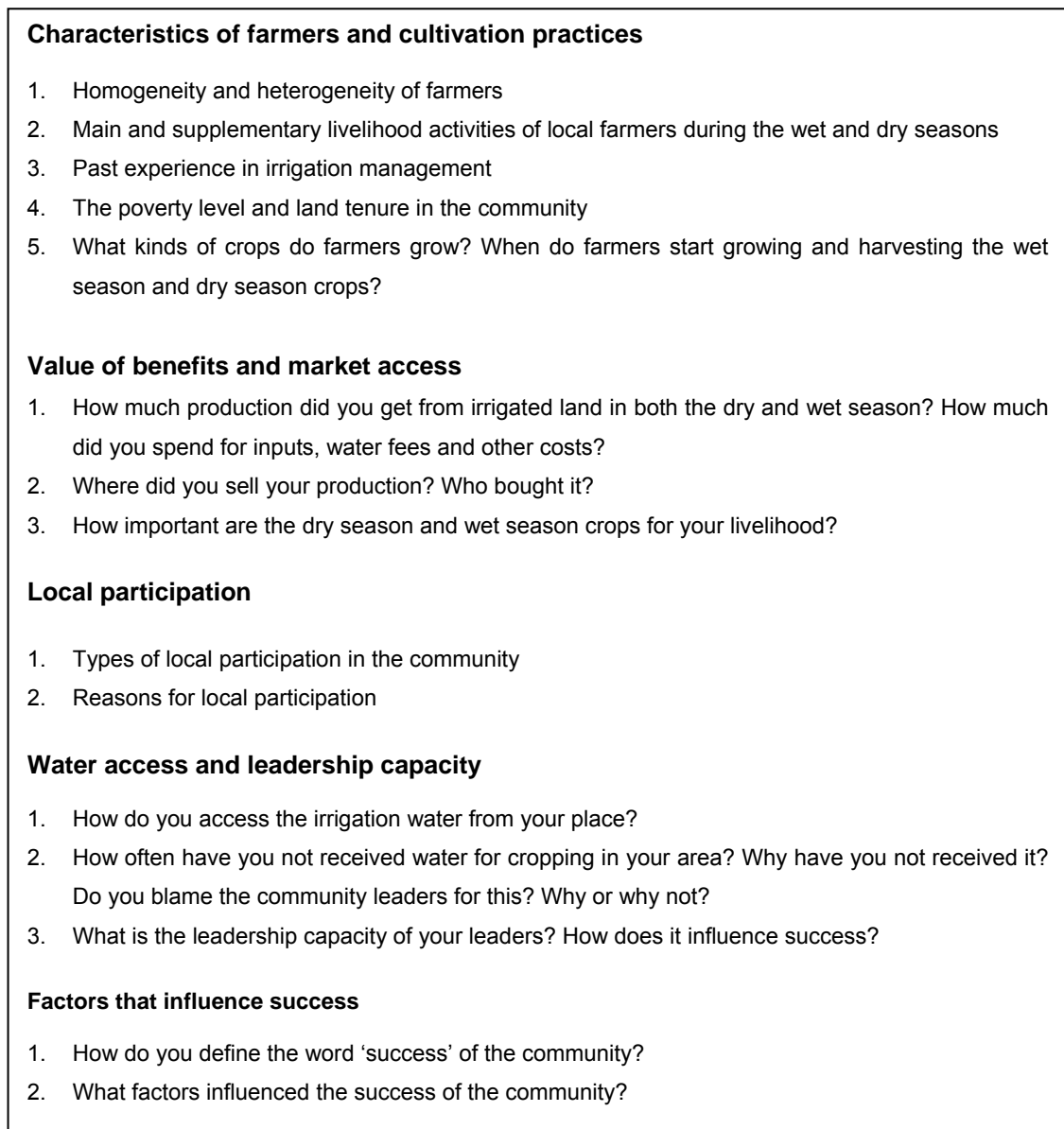


Figure 4.8. Broad question areas for focus group discussions.

The researcher went to meet group and sub-group leaders in the identified villages to schedule a day for the focus group discussions and asked for their help with mobilising farmers. The number of participants ranged from 5-12 people, and the focus group discussions usually took place at the house of one of the group or sub-group leaders. The group discussions were often conducted after lunch, between 1-2pm.

The researcher facilitated the focus group discussions which began with a brief introduction to the research, its aims and objectives, followed by simple non-threatening questions, i.e., queries concerning livelihood activities (Patton, 1990). The researcher asked a question and then let participants answer it. Quiet participants were asked to present their opinions. The researcher took note of important areas needing clarification or confirmation and offered a summary of the focus group discussion at the end. The discussions were also taped with the consent of all participants (Patton, 1990).

4.3.3.4 Participatory mapping and matrix development

The participatory mapping activity was conducted with three committee leaders. The aim of the participatory mapping was to create a map of the FWUC that included the water scheme infrastructure, main canals and sub-canals, and villages. Clarifying and confirmatory questions were asked during the mapping activity to identify items on the map. The participants were also asked how farmers in each village obtained water from the scheme and if there were any problems associated with a particular village. The map can be found in Chapter 5, Figure 5.1.

A matrix was developed after the participatory mapping activity. The researcher asked the committee leaders to draw up rows and columns. In each row, the leaders were instructed to state the types of authority required in irrigation management and in the columns, to name all relevant stakeholders. The leaders were then required to work out what kinds of authority they had or did not have. A sample of the matrix is shown in Figure 4.9.

Activity		Stakeholders that had authority over the activity			
		FWUC leaders	MoWRAM and DoWRAM	Commune Office	District Office
Mobilising farmers					
Planning	Small repair or maintenance works				
	Large repair or maintenance works				
Distributing water					
Maintaining the scheme					
Financing	Collecting fees				
	Withdrawing money from the bank				
	Spending budget for administrative work and small-scale maintenance				
	Spending budget for large-scale repairs or maintenance				
Punishing offenders (verbal warning and cutting off water supply)					
Punishing offenders (arresting and imposing a fine)					
Resolving serious conflicts					

Figure 4.9. A sample of the matrix created with committee leaders.

4.3.3.5 Participant observation

The use of the participant-observation technique allowed the researcher to gain access to information that was inaccessible through interviews and offered an opportunity to perceive reality through the viewpoint of someone “inside” the case rather than “external” to it (Yin, 1993). According to Morgan (1997), participant observation is important because it lets the researcher observe naturalistic interactions among farmers related to a specific topic.

In this research, participant observation was conducted during many activities. The researcher attended two FWUC meetings in Svay and Ang Sangkream villages. Both meetings were large, with 30 and 50 participants, respectively. These meetings provided the researcher with an opportunity to observe local attendants and the roles of group and sub-group leaders in mobilising farmers to join the meetings, local participation, and the nature of decision making.

The researcher also went to visit a local market (Tram Kna) where a majority of the farmers in the FWUC often go to buy and sell their crop produce. During this visit the

researcher was able to observe how local farmers accessed local markets and the activities in the markets. In addition, because the researcher stayed at the house of the committee chairman, she also was able to observe the decisions of the committee chairman when farmers came to request water with or without permits, along with his attitude toward and interactions with farmers.

All the information from participant observations was noted and this was used in combination with the data received from key informant interviews, household interviews, and focus group discussions to complete the data analyses for this study.

4.3.3.6 Informal conversational interviews

According to Patton (1990), informal conversational interviews are one of three basic approaches to collecting qualitative data. This technique is the most open-ended approach to interviewing, requiring the researcher to maintain maximum flexibility while pursuing information in whatever direction it is taken by the conversation, and to develop questions through the immediate context (Patton, 1990). In this research project, the researcher had numerous opportunities during her three-week stay in the FWUC to converse with a wide range of people about the irrigation scheme. For example, the researcher had discussions with the committee chairman during lunch and dinner, with local farmers in the fields, with middlemen while they were buying produce, and with local taxi drivers. Informal conversations were also held with villagers in Paing Na at a food store because the researcher was not able to organise a formal group discussion in this village. The data from these informal discussions were written down after the conversation by the researcher and used for analysis.

4.3.3.7 Documentation and archival records

Documents and archival records are also useful for case study research (Yin, 1993). Documents are helpful for (i) verifying the correct spelling, titles, or names of organisations that might be mentioned during interviews; (ii) providing specific details to corroborate information from other sources; and (iii) providing inference to help researchers for a further investigation (Yin, 1993). In addition, archival records can be useful for extensive retrieval in quantitative analysis (Yin, 1993).

In this research, copies of all documents and archival records relevant to the irrigation management work of the O-treing Farmer Water User Community were collected by the researcher. These documents included receipts for ISFs, water requests, membership application forms, the list of farmer members, and formal letters issued by MoWRAM, DoWRAM, and district and provincial governors. Archival records that were collected included the FWUC's constitution, commune statistics, legal documents, policies of the government on the implementation of PIMD programmes, and a Participatory Rural Appraisal report on the O-treing Farmer Water User Community.

The aim of collecting documentation and archival records in this research was to verify the title and spelling of the communes and villages. They were also used to provide specific details on the number of households, the size of the farms in each village in the FWUC, and the history of the scheme.

4.3.4 Within-case analysis and interpretation

Once the data collection phases were completed, the within-case analysis and interpretation were undertaken. This involved two steps: (i) a within case analysis that produced the result chapter in this thesis, and (ii) a comparison of the case results to relevant theory that is the discussion chapter in this thesis.

4.3.4.1 Within-case analysis

The within-case analysis process is the most important part of carrying out case studies (Eisenhardt, 1989), but it is also one of the least developed and most difficult parts (Yin, 2003). Dey (1993) separated the qualitative analysis process into an iterative process of classifying, connecting, and describing. According to Dey, the data should be transcribed and then summarised to provide a thorough and comprehensive account of the phenomenon of interest and the context in which it occurred. In this research, 37 key informant interviews, 23 household interviews, and 7 focus group discussions (plus participant observations, informal conversational interviews, documentation and archival records) were conducted in the Khmer language, of which 35 were audio taped and the rest were written up as field notes. Each interview or group discussion had 30-90 minutes of taped data. Due to a lack of time and resources, together with the large volume of collected data, the researcher did not transcribe all the interviews. Rather, the researcher decided to listen to the audio tapes and

summarise in English the key points under individual question headings (Table 4.2). When a particularly interesting or powerful statement was made, direct quotes were used in the summary. For those interviews that were documented in field notes, the summary was done on the basis of the written notes.

To begin the process, 15 interviews and 6 group discussions that were identified as particularly information rich were chosen for the initial analysis. These interviews and group discussions were analysed in depth to develop a preliminary model of the research results.

Table 4.2. Example of a summary of the data

No.	Sources	Data-bits	Summary
1	Chief of Chung Ruk commune	1 2 3 4 5 6 7 8 9 10 164 165 166 167 168	<p>Q1. Do you think O-treing is successful or not? He thought that O-treing had achieved a lot of things at the present time. The community did not have external support as before; just the local authorities (commune and village chiefs) and the people worked together to run the scheme ...</p> <p>The community is successful because (i) the irrigation infrastructure is in better condition although it is not yet complete, (ii) famers have a better understanding of irrigation management, and (iii) local authorities, district...</p> <p>Q16. What do you think about the leadership of the recent FWUC? <i>"The recent leaders do not have a good education from school, but they are honest and creative. They can pick up new things quickly. The good thing about the recent leaders is that they do not just talk about things, they are also involved in doing the work."</i></p>
2	Irrigation engineer, Department of Irrigated Agriculture	183 184 185 186 187 188 189 190 191	<p>Q1. Why did the Ministry select the O-treing for PIMD? The Ministry of Water Resources and Meteorology piloted PIMD in 12 irrigation schemes. Kampong Speu was one of 11 provinces that have been selected for the work because it has large production areas and plenty of old irrigation schemes left from Pol Pot...</p> <p>The Ministry chose O-treing for the pilot because (i) 40-50% of its structure is still in good condition; (ii) the scheme has large catchment areas; and (iii) the available irrigated lands are big...</p>

Classification

Classification refers to the process by which data is classified into well-defined categories, sub-categories and supra-categories (Dey, 1993). The data from the audio tape summaries was manually coded and read to identify concepts. The literature review was reviewed to ensure the researcher was sensitised to the theory. A form of

comparative analysis (Dey, 1993; Strauss & Corbin, 1990) was used to code the data according to where the text in the audio tape summaries was broken up into “units of meanings” (Maykut & Morehouse, 1994) or data-bits (Dey, 1993); these units of meaning were then compared to category definitions in the literature. Similar data-bits were grouped under category headings. Category definitions were obtained predominantly from the literature; however, where data-bits differed from definitions found in the literature, new categories were named and defined.

Once relevant categories were identified, the structure of the category hierarchy was determined by logic (Dey, 1993). The researcher also split or spliced some categories if they could be further sub-divided or could be combined for theoretical usefulness (Dey, 1993; Strauss & Corbin, 1990). For example, the leadership capacity category was split into attitudes, knowledge and skills, and authority. The classification was an iterative process between the data and the category name, definition, and location in the category hierarchy (Dey, 1993).

Connection

Connection is another step in the qualitative analysis process (Dey, 1993). During connection, the relationships between categories in the data are identified and defined. These connections between categories may occur in three forms: explanatory, causal relationships, or chronological relationships (Dey, 1993). The data collection protocol made it simple for the researcher to identify the connection types between categories and develop a model of the factors that influenced the success of the Farmer Water User Community. These connections were identified through linking words or conjunctions (Dey, 1993) such as “because”, “as a result”, “as a consequence”, and so on, in combination with inferences from the context. Flow diagrams were often used to show the causal relationships in the analysis (Miles & Huberman, 1994).

Description

Once the data had been classified and the important connections identified, these results were described (Description) in text and diagrammatic form. The findings were separated out into key headings. Within these key headings, concepts and key processes or sub-processes were separated out as sub-headings. Diagrams were used to describe important relationships, processes and sub-processes, and important concepts. The description phase was useful in that it forced the researcher to reflect on

the findings and as a consequence, new insights were obtained that led to the refinement of the classification and connection tables.

Following Dey's (1993) advice, the researcher iterated between description, classification, and connection (Figure 4.10). Once the initial analysis of the 15 interviews and 6 group discussions was completed, the other audio tapes and field notes were analysed using the model structure as a guide. During this phase of the analysis, the aim was to identify data-bits that were: (i) consistent with the model, (ii) in contrast to the model, i.e., contradicted other findings, and (iii) new and not previously found in the data. As each new interview was added to the analysis, the researcher used the process of summarising the audio tape or field notes, classifying or coding the data, identifying connections, and then describing the data. The description process at this point was used to refine, extend, or change the initial model on the basis of the findings from each specific interview. As a greater number of interviews were added, the analysis reached saturation point with little new information being identified from the interviews that were analysed later in the process. In the end, the final model of the factors that influenced the success of the Farmer Water User Community was developed.

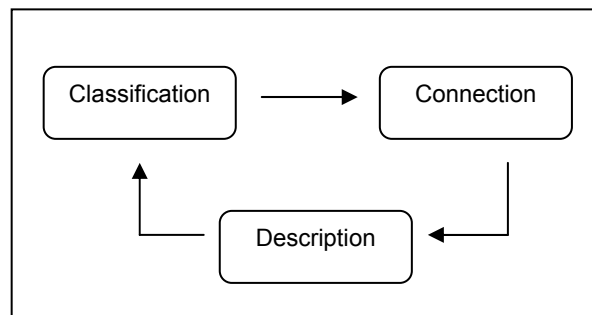


Figure 4.10. An illustration of the interaction between the description, classification, and connection phases in within- case data analysis.

4.3.4.2 Comparison of the case results to the literature

Once the final model of the factors that influenced the success of the Farmer Water User Community was developed, it was compared to the existing literature (Eisenhardt, 1989). Similarities and differences between the results and the literature were identified

and the nature of the differences was documented. The reasons behind these differences were explored, and the theory was modified or extended accordingly.

4.4 Ethical considerations

Ethical issues in this research were analysed thoroughly and considered to be very important in helping to provide protection for individual participants, groups, the researcher, and Massey University. A number of ethical principles were applied during this research. The researcher informed the local authorities of her presence in the area, and requested their permission to undertake the study prior to data collection. The researcher introduced herself and her work to the participants, and asked for their informed consent before she interviewed any of them. Minimisation of the risk of harm to participants was considered carefully to prevent participants from being exposed to pain, stress, intimidation, or embarrassment. As such, the participants were given the prerogative to stipulate the time and place for the interviews. Audio recording was used in key informant interviews, focus group discussions, and individual interviews, but only with the participants' consent. In addition, it was explained to the farmers, local leaders, and local authorities that they could withdraw from the process at any time and that they could refuse to respond to any of the interview questions if they were not comfortable answering them.

Concerning distributive justice, all participants were encouraged to express their ideas equally, and there was no deception or discrimination based on race, age, disability, religious affiliation, gender, employment status, or family status. No monetary incentive was provided for participation in this research. Participation was considered to be voluntary and participants were provided adequate and appropriate information about their rights and participation. Furthermore, respect for privacy and confidentiality was applied in this research. Names and addresses of the individual participants were kept confidential throughout, including in all reporting.

4.5 Summary

To identify the factors that influenced the success of the Farmer Water User Community, a single embedded case study was chosen. This research employed an exploring and refining theory type of case study to investigate the empirical phenomena to fill existing gaps in the current literature and refine theory. The single embedded case study methodology in this research comprised three phases: design, single-case

data collection, and within-case analysis and interpretation. The first step in the design phase was to review the literature to develop a theoretical framework, select criteria for the selection of the case study, and create the data collection protocol. Within-case sampling techniques such as snowball and maximum variation sampling strategies were also applied to select samples from within the target population for interviews. In the second phase, data was collected through key informant interviews, household interviews, group discussions, participant observations, informal conversational interviews, and the collection of documents and archival records. Once the data collection process was finished, the third phase was carried out to produce the within-case analysis and interpretation. The within-case analysis was an iterative process that comprised: classifying, connecting, and describing to develop a model of factors that influenced the success of the Farmer Water User Community. Once the final model was developed, it was compared to the existing literature.

CHAPTER 5

CASE DESCRIPTION

5.1 Introduction

In this case description, the history of the irrigation scheme, its physical infrastructure, the Farmer Water User Community's characteristics, the formation process, and the decision-making structure of the FWUC are presented. The O-treing Farmer Water User Community was initially established in 1998, but not officially recognised until 2000 when the Ministry of Water Resources and Meteorology came to reform it. This FWUC is situated in Kong Pisei District, Kampong Speu Province, Cambodia. The FWUC is managed by a group of local leaders with farmer members from 13 villages in two communes.

5.2 The history of the O-treing irrigation scheme

The O-treing irrigation scheme was built between 1973 and 1976 during the Pol Pot period (1975-1979) and local farmers played a major role in its construction. The area, which was previously in farmland, was considered ideal for an irrigation scheme because it had a suitable site for water storage. The area was also often flooded due to rainwater runoff and as such, the scheme provided a means of reducing runoff – hence flooding – in the wet season.

The reservoir for the irrigation scheme lies in the Prey Gniet commune, but borders the Chung Rouk commune to the east (Figure 6.1). The scheme was constructed to distribute water to the Chung Rouk commune because the farmland there is flat and situated below the reservoir. The Chung Rouk commune was an agricultural centre during the Pol Pot period and people from other communes and districts were sent there to cultivate rice.

After the end of the Pol Pot regime in 1979, the O-treing irrigation scheme was still in operation. Farmers who lived in the Prey Gniet and Chung Rouk communes were organised into solidarity groups to manage the scheme under the direction of their commune chiefs. The groups used irrigation water to supplement rainwater for both wet

season and dry season rice. At that time, farmers from the Prey Gniet commune reportedly had access to less water than farmers from Chung Rouk commune, due to topographical difficulties. Farmers in the solidarity groups shared the rice after they harvested their crops. The rice produced on the farms was split on the basis of individual household size. Parents and children aged 18 and above were considered to be the priority group, or first labourers, who were believed to contribute the most to the cultivation work; therefore, they received 20 kg/person. Children under 18 were considered to be second labourers, so they received only 10kg/person.

In 1985, land ownership was privatised and farmers were then able to own land. Through the late 1980s, the irrigation scheme started to deteriorate because of a lack of maintenance and increased local competition for water. Farmers were only interested in sourcing water, and took no part in the maintenance of the scheme. In 1995, a local leader and his villagers (from Ang Sangkream village) who lived close to the reservoir began to rehabilitate the scheme. They tried to convince farmers in other villages such as Paing Na, Chum Srok, and Prek Kdei to participate in this work. Their efforts were recognised by farmers in those villages and they agreed to contribute labour and/or resources to maintaining the scheme. At that time, the scheme could irrigate only 15-20 hectares in the dry season.

In 1998, the Japanese government provided funds for the rehabilitation of the O-treing irrigation scheme. The District Office and Department of Agriculture in Kampong Speu decided to organise a temporary Farmer Water User Community (FWUC) with farmers from six villages (Chhouk Sor, Svay, Chum Srok, Ang Sangkream, Prey Tamean, and Paing Na). The commune chiefs from both Prey Gniet and Chung Rouk communes were chosen to take responsibility for irrigation management. The chief of Prey Gniet commune was in charge of water distribution and maintenance work, and the chief of Chung Rouk was responsible for fee collection. Farmers were asked to pay irrigation service fees (ISFs) and these were set on the basis of what local farmers were willing to pay. The chiefs from the two communes held meetings with farmers to identify the fees local people were willing to pay in individual villages, and then added up the suggestions to calculate an average fee that would be paid by all farmers. This was 10,000 riels/ha (USD 2.5/ha, at the exchange rate of 3800 riels to USD 1 in 1999). The ISFs were set at the same level for all farmers, regardless of their ability to drain water either by pumps or gravity.

At the time, there were no group or sub-group leaders who could help collect ISFs or assist with the distribution of water to farmer members. The commune chiefs called on local farmers with experience in irrigation to help manage the main gates of the irrigation scheme. Farmers who needed water asked the “gate keepers” for access to water and they had to be responsible for draining water to their own farmland. The commune chiefs also asked the village chiefs to help collect ISFs from their local users. Village chiefs and farmers were reported to have been so cooperative during this period that the majority paid their ISFs. The FWUC earned 599,600 riels in 1999 and 450,000 riels in 2000 (USD 150 and USD 112.50, respectively, at the exchange rate of 4,000 riels to USD 1).

In 2000, the O-treing irrigation scheme was selected by the Ministry of Water Resources and Meteorology as a pilot scheme for the implementation of the Participatory Irrigation Management and Development (PIMD) programme. The O-treing irrigation scheme was chosen because (i) 40-50% of its infrastructure was still in good condition; (ii) the scheme had large catchment areas; and (iii) the area of available irrigated land was large.

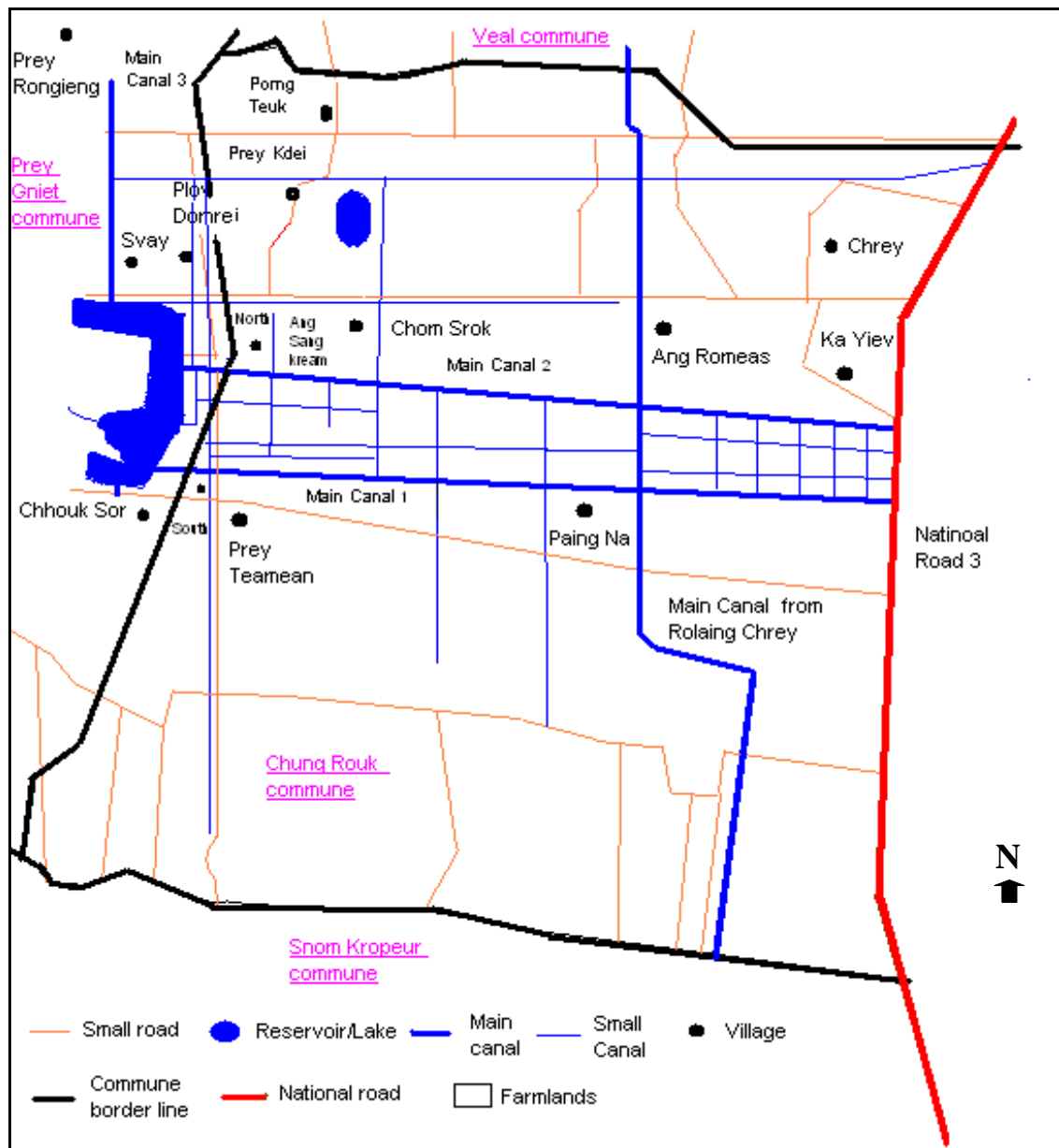
5.3 The physical infrastructure of the scheme

The O-treing irrigation scheme comprises a reservoir and dam, four main gates, three main canals, six secondary canals, and twelve tertiary canals. The scheme is expected to irrigate 1,500 hectares in the wet season (supplementing rainwater) and 300 hectares in the dry season. The first main canal has 11 control gates, the second main canal has 8 control gates, and the third main canal has 4 control gates. In addition to this, there are numerous small canals and ditches dug by farmers across farmland to convey water throughout the Farmer Water User Community (Figure 5.1). The FWUC has a good physical infrastructure in place for the scheme because it has undergone numerous rehabilitation work projects provided by the government and non-governmental organisations (Table 5.1).

Table 5.1. Timeline of Scheme Rehabilitation

Year	Rehabilitation Activities
1998	Rehabilitating canals with support from WFP, Japanese government, and Department of Agriculture
2001	Repairing one main gate and buying water pipes using the FWUC budget and support funds from the provincial Department of Water Resources and Meteorology
2002	Rehabilitating the dam using the FWUC budget
2003	Sowing grasses using the FWUC budget
2004	-Rehabilitating 21 main, secondary, and tertiary canals using rice-for-work from the World Food Programme -Planting 1,400 trees on the dam, using the FWUC budget
2005	Constructing 21 control gates with support funds from the World Food Programme and Social Foundation
2006	Repairing eroded dam using the FWUC budget
2007	Rehabilitating the reservoir and the dam, and constructing main gates using support funds from the Ministry of Water Resources and Meteorology
2008	Buying gate locks

The first main canal conveys water to five villages (Ang Sangkream, Prey Tamean, Paing Na, Chrey, and Ka Yiev). The second main canal brings water to five villages (Ang Sangkream, Chum Srok, Ang Romeas, Chrey, and Ka Yiev). The third main canal irrigates four villages (Prey Rongieng, Svay, Plov Domrei, and Pornng Teuk). Chhouk Sor is located south of the reservoir and must access water by pumping it, because the farmland of this village is above the reservoir. A fourth main canal brings water in from Rolaing Chrey lake (outside the FWUC). This canal was rehabilitated in 2008 to help provide water to farmers in four villages (Paing Na, Ang Romeas, Chrey, and Ka Yiev) in the wet season (Figure 5.1).



(Source: Participatory mapping activity with the committee leaders of the O-treing Farmer Water User Community, 2009)

Figure 5.1. A map of the O-treing irrigation scheme.

5.4 Characteristics of the Farmer Water User Community

Thirteen villages belong to the O-treing Farmer Water User Community. These include four villages from the Prey Gniet commune (Chhouk Sor, Prey Rongieng, Sway, and Plov Domrei) and nine villages from the Chung Rouk commune (Ang Sangkream, Chom Srok, Prey Tamean, Pong Teuk, Prek Kdei, Paing Na, Ang Romeas, Chrey, and Ka Yiev) (Figure 5.1). This section discusses the location of these villages relative to

the reservoir and main canals. Local livelihoods, poverty and land tenure, and cultivation practices are also described in this section.

5.4.1 Villages, topography of farmland, and water routes

Prey Gniet and Chung Rouk communes are topographically different and source water through different routes. Prey Gniet commune is located above the reservoir to the west and faces more difficulties in accessing the irrigation water than does Chung Rouk commune which is below the reservoir to the east. As such, the scheme serves more members and irrigates more land in the Chung Rouk commune than it does for Prey Gniet commune, in both the wet and dry seasons (Table 5.2 and Table 5.3). Below is the description of each village in each commune, relative to household numbers, irrigated land, water routes, and topography.

Table 5.2: Data on households and irrigated farmland in Prey Gniet Commune

Villages	Chhouk Sor	Svay	Plov Domrei	Prey Rongieng
No. of households	126	127	35	109
Location in the scheme	AR	AR	AR	AR
Wet season area cultivated (hectares)	48	59	30	76
Dry season area irrigated (hectares)	25	8	6	6
Percentage of the dry season area irrigated	52%	14%	20%	8%
<u>Note:</u> AR: Above the reservoir				

Source: RGC (2008a)

Table 5.3: Data on households and irrigated farmland in Chung Rouk Commune

Villages	Ang Sangkream	Prey Tamean	Porng Teuk	Paing Na	Ang Romeas	Chum Srok	Prey Kdei	Chrey	Ka Yiev
No. of households	135	61	25	308	199	205	65	77	59
Location in the scheme	H	M	M	M	M	M	M	T	T
Wet season area cultivated (hectares)	66	48	28	144	126	76	69	61	52
Dry season area irrigated (hectares)	66	25	6	50	63	42	7	8	5
Percentage of the dry season area irrigated	100%	52%	21%	35%	50%	55%	10%	13%	10%
<u>Note:</u> H: Head, M: Middle, T: Tail									

Source: RGC (2008b)

Chhouk Sor is positioned to the south of the reservoir and comprises 126 households. This village have 48 hectares of cultivated land in the wet season, of which only 25 hectares were irrigated in the dry season. Farmers obtain irrigation water in the dry season through pumping because their farmland is above the reservoir. However, about 5 hectares could be irrigated by gravity because there was a pipe that connected the reservoir to a pond and then to the farmland.

According to the village chief, 70 households unofficially occupy 20 hectares of land inside the reservoir. These farmers usually grow two crops a year on this land. They start the first crop (watermelons, wax gourds, or pumpkins) soon after the water level drops to the point that the land inside the reservoir is cultivatable (February or March) and the second crop (wet season rice) in June before the land is submerged as the reservoir fills during the wet season. The farmers with land outside the reservoir usually pump the water that remains in the canals, ponds or paddy fields inside the reservoir to their crops in February or March, but they depend on rainwater to grow rice in June.

Chhouk Sor does not have a canal that connects the reservoir to their farmland; rather, it has a feeder canal built inside the reservoir in 2004 as part of the World Food Programme's rice-for-work support. This feeder canal was constructed to help retain water in the reservoir when it is being used to irrigate the Chung Rouk commune. However, at present this canal is too shallow to retain sufficient water for all the villagers.

Prey Rongieng, Svay and Plove Domrei are situated to the north above the reservoir and comprise 109, 127, and 35 households, respectively. Svay and Plove Domrei sit beside the dam of the reservoir while Prey Rongieng is about one kilometre from it. The villagers of Prey Rongieng, Svay, and Plov Domrei farm 76 hectares, 59 hectares, and 30 hectares of cultivated land in the wet season, respectively. However, only 6 hectares in Prey Rongieng, 8 hectares in Svay, and 6 hectares in Plov Domrei were irrigated in the dry season. Similar to Chhouk Sor, the farmers in these three villages must access water from the reservoir by pumping because their farmland is located above the reservoir.

There is a main canal built by the Ministry of Water Resources and Meteorology to bring water from the reservoir to farmland in the three villages. However, this canal stores limited supplies of water because it is too shallow. Moreover, during the dry

season, the water level in the reservoir often drops below that of the canal, reducing its effectiveness. This canal can only provide water to farmers at the tail (Prey Rongieng village) of the scheme during the wet season, when water is plentiful.

The villagers of Svay and Plov Domrei have better access to irrigation water than those of Prey Rongieng, because these two villages are situated closer to the reservoir. As such, the villagers can pump water directly from either the reservoir or the canal. Moreover, the villagers of Svay and Plov Domrei have some land located below the reservoir and this land can be irrigated by gravity.

According to the interviews with village chiefs, almost all the households from Svay and about 3 households from Plov Domrei unofficially occupy over 20 hectares of the reservoir. Similar to Chhouk Sor, these farmers often grow two crops a year, one in February or March after the water level of the reservoir drops, and a second in June before the land is flooded by rainfall. According to the village chief in Svay, some farmers are reluctant to grow wet season rice in June because of the risk of the crop being flooded.

Ang Sangkream is located east of the reservoir and comprises 135 households. This village is divided into two parts: southern Ang Sangkream, which is located along the first main canal, and northern Ang Sangkream, which is located along the second main canal (Figure 5.1). Ang Sangkream is considered the head village of the two main canals because its villagers always obtain water first. Water is gravity fed to the farmland of these villagers because their land is below the reservoir. Ang Sangkream has 66 hectares of farmland that grows wet season rice, and all of this land could be irrigated in the dry season.

Prey Tamean and Chum Srok are positioned along the first and second main canals after Ang Sangkream and comprise 61 and 205 households, respectively. These two villages are considered 'middle water users' because they cannot access water unless the farmers of Ang Sangkream release it. Prey Tamean and Chum Srok have 48 hectares and 76 hectares of wet season farmland, respectively, of which 25 hectares in Prey Tamean and 42 hectares in Chum Srok could be irrigated in the dry season. The rest of farmland in these two villages is not irrigated because it is above the level of the reservoir, or lies too far away from the scheme.

Paing Na lies along the first and second main canals. The village borders Prey Tamean and Ang Sangkream to the west, Chum Srok and Ang Romeas to the north, Rolaing Chrey canal to the east, and Thmor Kda village to the south. Paing Na has 308 households and is the largest of the 13 villages involved in the scheme. The villagers cultivate 144 hectares in the wet season, of which 50 could be irrigated in the dry season. Like other villages, the rest of the farmland in Paing Na is not irrigated because it is either above the level of the reservoir or too far away from the scheme. Paing Na is also considered 'a middle user' because it relies on other villages, such as Ang Sangkream, Prey Tamean, and/or Chum Srok, to release water. However, Paing Na can also access water from the Rolaing Chrey canal, particularly in the wet season.

Prey Kdei is located north of the second main canal and comprises 65 households. Farmers in this village access irrigation water from secondary canals that are connected to the second main canal. Prey Kdei is also considered 'a middle user' because it gets water after Ang Sangkream. Sometimes, farmers in Prey Kdei can get water from the same route as Chum Srok. The farmers of Prey Kdei cultivate 69 hectares in the wet season, of which only 7 could be irrigated in the dry season. The reason this area of irrigated farmland is so small is the village's high altitude relative to the reservoir, and its location relative to the main canals. Because it is high and far away, it is more difficult for farmers in Prey Kdei to access water.

Pong Teuk is sited north of Prey Kdei and comprises only 25 households. Farmers in this village access water from secondary canals connected to the third main canal. The farmers cultivate 28 hectares in the wet season, of which 6 were irrigated in the dry season. As in Prey Kdei, the farmers here have difficulty accessing water due to the altitude and location of their farmland. Since it obtains water after Svay and Plov Domrei, Pong Teuk is also considered a 'middle user'.

Ang Romeas is located along the second main canal and comprises 199 households. This village is also considered a 'middle user' because it gets water from Chum Srok. The farmers cultivate 126 hectares in the wet season, of which 63 could be irrigated in the dry season. Like other villages, the rest of the farmland is not irrigated because of altitude or distance from the irrigation canals. However, some farmers can obtain water from the Rolaing Chrey canal.

Chrey and Ka Yiev lie at the tail end of the first and second main canals and comprise 77 and 59 households, respectively. These two villages are the last recipients of

irrigation water, after Paing Na and Ang Romeas, and their irrigation infrastructure, especially in Chrey, is still incomplete. Some farmers in Chrey have complained that recent rehabilitation work by the Ministry of Water Resources and Meteorology made the canals too deep, further limiting their access to water. Chrey and Ka Yiev often receive less water in the dry season than other villages, and this limits the area of cultivatable farmland. The farmers in Chrey and Ka Yiev cultivate 61 hectares and 52 hectares, respectively, in the wet season, of which only 8 hectares in Chrey and 5 hectares in Ka Yiev could be irrigated in the dry season. However, these two villages can access additional water from the Rolaing Chrey canal.

5.4.2 Local livelihoods

Villagers in these 13 villages grow rice and other crops as their main livelihood source. They grow rice in the wet season, and during the dry season other crops such as watermelons, wax gourds, pumpkins, or additional rice are grown on the same paddy fields. Some farmers also own other plots of land beside their houses where they can grow vegetables, corn, sugar cane or kumara during the wet season, for consumption or sale.

Farmers here also engage in supplementary activities, such as raising pigs and/or chickens, running home businesses, selling goods at local markets, driving taxis inside or outside the communes, working as construction workers, collecting palm juice, working at garment factories, and buying and selling cattle, dishes, salt, or oil door-to-door. These activities are usually undertaken only when farmers are free from cultivation work or soon after they have finished harvesting their crops. However, in large families, parents often stay at home to carry out the farming with one or two children while the other children go out to work in Phnom Penh or other places. Women typically go to work at garment factories while men go to work at construction sites; these workers often send their remittances back to their families.

5.4.3 Poverty and land tenure

According to the Participatory Rural Appraisal results conducted by the Ministry of Water Resources and Meteorology in 2007 and interviews with village and commune chiefs, individual villages comprised three levels of wealth: (i) the poor – those who did not have houses or land and always bought rice for consumption; (ii) the middle class–

those who had land, houses, and motorbikes, and generated income from non-agriculture work; and (iii) the rich – those who owned land, houses, and motorbikes plus rice mills, cell phones, cars, and vans; the rich people also generated income from non-agricultural work and lent money to other villagers.

Among the 13 villages, the majority of the rich lived in Paing Na, followed by Ang Romeas, and Chum Srok. In other villages, the middle class makes up the majority. The poor accounts for only 10% or less in each village. The middle class often give priority to cultivation work during the wet and dry seasons. Aside from the cultivation work, the middle class often go out to find jobs.

Farmers in the O-treing Farmer Water User Community hold legal title over both their residential land and their farmland. These titles were granted by the local authorities (commune and village chiefs) after the fall of the Pol Pot regime in 1979. The local authorities allocated land to individual families on the basis of family size. Farmers who have a legal title have the right to sell the land or pass it on to other family members. However, the land title does not cover the right to use irrigation water or the right to cultivate crops. Tenants are allowed to grow crops or obtain irrigation water as long as they have consents from their landlords, the local authorities, and irrigation leaders. Farmers can lease land from other farmers to grow crops and obtain access to the irrigation water that way. Some farmers in Chouk Sor, Svay, and Plov Domrey grow crops on land inside the reservoir even though they do not hold a legal title.

5.4.4 Cultivation practices

The wet season extends from May to October, with the highest rainfall occurring between September and October. Farmers often grow rice in the wet season, and two types are grown: (i) heavy rice¹ is usually grown between mid-May and July and harvested between mid-November and January, and (ii) light rice², which is grown at the same time as the heavy rice, but is harvested between mid-October and the end of November. Farmers depend on rainfall to grow wet season rice. If the rainfall is not sufficient, farmers use irrigation water to supplement it. Irrigation may be used in the early, middle, or end parts of the wet season.

¹ The heavy rice includes several types of rice and takes at least six months to harvest.

² The light rice includes several types of rice and takes less than six months to harvest. However, it yields less than the heavy rice per hectare of land.

Once the wet season rice is harvested, farmers start growing either dry season rice or other crops such as watermelons, wax gourds, or pumpkins. Farmers can grow one or two crops within the dry season period, depending upon the availability of irrigation water and the types of crops they grow. Watermelons usually take two months to grow, while wax gourds and pumpkins take three months, and dry season rice takes four months. Some farmers begin growing crops earlier than others and this is dependent upon the date at which they finish harvesting the wet season rice. Some farmers choose to grow light rice in the wet season, particularly those who farm inside the reservoir (Chhouk Sor, Svay, and Plov Domrei), so that the rice crop is harvested early and they can start growing crops in early January. However, those farmers who grow heavy rice must harvest this crop in December and as such, they cannot grow more crops until late January.

The majority of farmers prefer to grow watermelons, wax gourds, or pumpkins rather than rice as their first crop during the dry season for several reasons. First, some farmers believe rice grown at this time of year produces lower yields due to the hot weather and the rats, insects, and diseases that can become problems during the early months of the dry season. Other farmers want to change crops to enhance soil quality, and believe that by doing so they can obtain high yields. Those who farm land above the reservoir do not want to grow dry season rice because this crop requires considerably more irrigation water than the alternative crops and at that time of year they find it difficult to access irrigation water.

After the first dry season crop is harvested, the farmers typically grow a second crop which is often dry season rice. Although irrigation water is extremely limited at this time of the year, the farmers have found that dry season rice can remain alive until the rains come sometime in April or May. The farmers also believe that rice grown during this period can provide high yields because the soil is rich with retained fertiliser from previous crops.

5.5 Formation of the O-treing Farmer Water User Community

The O-treing Farmer Water User Community was established by the Ministry of Water Resources and Meteorology in 2000. The formation began with a visit to the FWUC by the field-level staff from the Ministry. These field-level staff and the local authorities organised multiple meetings with farmers to talk about the FWUC's formation, its

purpose, and the benefits to be derived from it. Then farmers were asked to select their own leaders through elections. Over 100 farmers from 9 villages voted in the elections and all were aware of the leadership requirements as explained by commune and village chiefs, along with field-level staff, before the start of the elections.

Elections were held to select leaders at the committee and group levels, followed by the selection of farmer members on the same day. Village chiefs were required to nominate themselves (if they were interested in doing the work) and a few other candidates from their villages to stand in the elections. The votes were conducted separately for the chairman, the deputies, and the treasurer. The first vote was to select a chairman. The candidate who received the highest number of votes became the chairman whilst those who were not elected to this position were kept in the running for the next round which selected the deputies. The position of treasure was granted to the candidate who received the highest number of votes after the deputies.

The FWUC constitution was crafted once the FWUC was formed. The constitution crafting process was supported by the field-level staff from the Ministry, the district governor, the commune chiefs, and the elected farmer water user committee. All farmers were invited to participate in the process to define the membership, design water distribution processes, and set irrigation service fees, punishments, and incentives.

The farmers participated in the process of crafting the rules and were encouraged to share their ideas. They were asked to decide how much they were willing to pay for irrigation service fees and to determine the penalties to be imposed on individuals who broke the rules of the FWUC. The field-level staff would propose a price or fine, and let the farmers decide if it was adequate; or alternatively, farmers were asked to make the proposals. If the irrigation service fee or the fine proposed by the farmers was too little, the committee, group, and ministerial staff proposed another, higher value. This negotiation process continued until the majority of farmers reached agreement.

Capacity building through training was provided to the elected leaders of the FWUC by the Ministry soon after the elections. Training was provided in the areas of irrigation operation and maintenance, administrative management, report writing, financial management, and the roles and responsibilities of leaders and farmers. Both the leaders and the farmers were trained in irrigation management and made aware of relevant government policies.

Sub-group elections were organised two years later (in 2002) in each village. Committee and group leaders, Ministerial staff, the district governor, and the commune chief were present during the elections. The sub-group election process was similar to the committee and group elections. All farmers who were members of each sub-group were invited to vote for their own sub-group leaders. Candidates were required to be farmers living in the villages. Village chiefs were also encouraged to stand in the elections. Between six and ten candidates were nominated at each election and the winners of the elections filled four positions in each sub-group (sub-group chairman, first deputy, second deputy, and treasurer).

5.6 Decision-making structure of the O-treing Farmer Water User Community

The decision-making structure of the O-treing Farmer Water User Community includes a committee at the highest level (Figure 5.2). Beneath the committee are four groups to represent the farmers associated with each of the four main irrigation canals. These four groups are separated into 15 sub-groups based in 13 villages on the basis of the amount of farmland, number of farmer members, and number of sub-canals. Villages with a large area of irrigated land, a large number of farmer members, and several sub-canals contain several sub-groups, whereas a village with a small area of irrigated land, a small number of farmer members and only one (or a few) sub-canals will have only one sub-group.

Several external organisations influence the operation of the O-treing Farmer Water User Community (Figure 5.2). These include the Ministry and Department of Water Resources and Meteorology, the district, the communes, and the villages. The Ministry of Water Resources and Meteorology (MoWRAM) is the line ministry of the Department of Water Resources and Meteorology (DoWRAM) based in Kompong Speu Province, and it has often provided support to the FWUC directly or through DoWRAM. MoWRAM and DoWRAM have no official roles, responsibilities, or authority in the decision-making structure of the FWUC.

Similar to MoWRAM and DoWRAM, the district, commune, and village play no role in the decision-making structure of the FWUC. However, it was found that village chiefs and deputies were allowed to be elected as leaders of the committee, groups, and sub-groups of the FWUC; the chief of Chung Rouk commune and the district governor of

Kong Pisei were also nominated as advisors to the FWUC. The commune chief of Prey Gniet was not selected because the commune had a small number of farmers who use irrigation water; however, he was often invited to FWUC meetings.

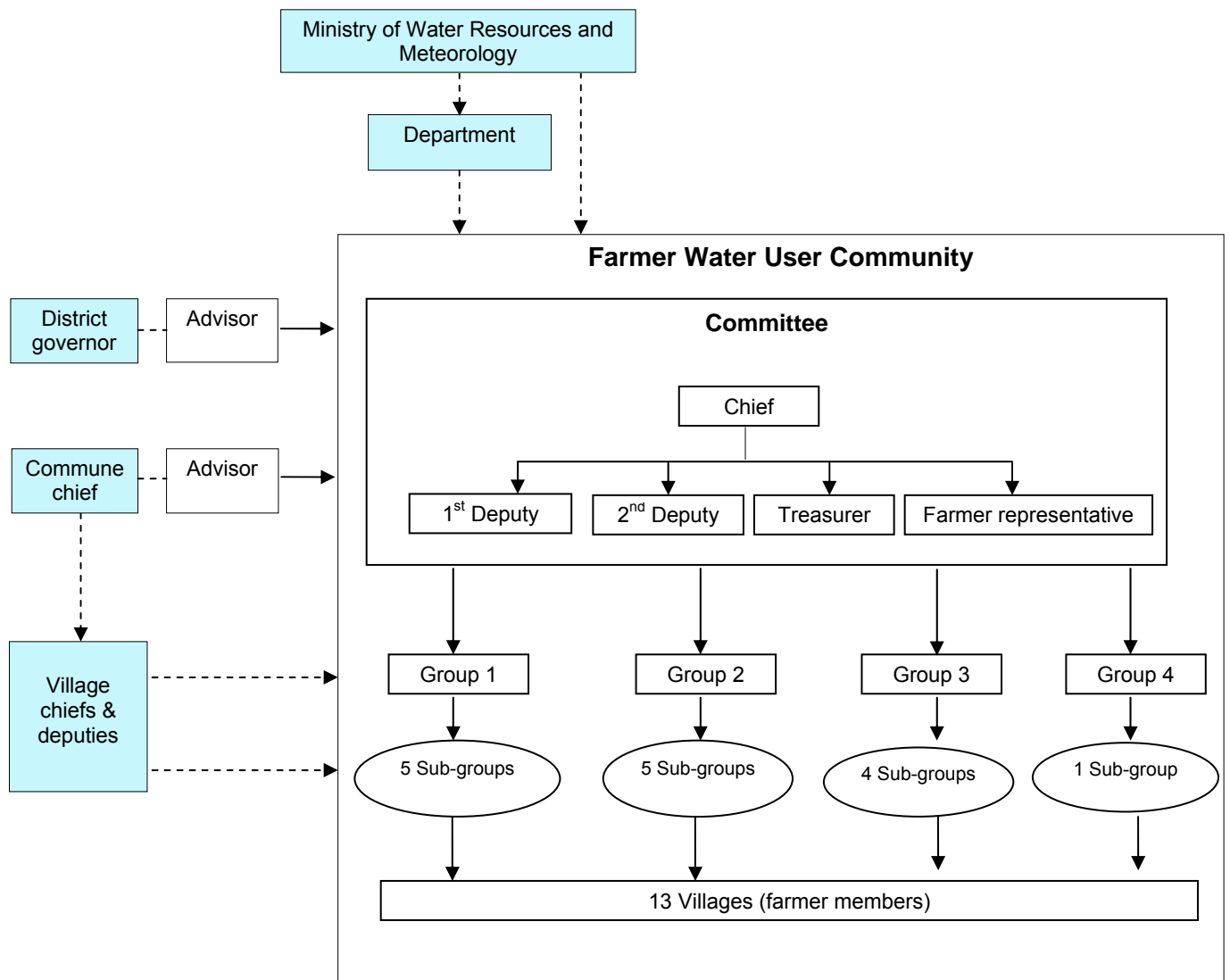


Figure 5.2. The organisational hierarchy of the O-treing Farmer Water User Community.

5.7 Summary

This chapter provides a thorough description of the case study used for this research. The O-trieng Farmer Water User Community is managed by a group of local leaders with farmer members from 13 villages in 2 communes. The FWUC had experience with self-organisation and was also reorganised by the Ministry of Water Resources and Meteorology, the district and the communes in 2000. The infrastructure of the FWUC's scheme is of a high quality. Most of the irrigated farmland in the FWUC lies in Chung Rouk commune which is below the reservoir, while a small proportion is located in Prey Gniet commune where the altitude of the farmland makes it more difficult for farmers to access the water. Farmers in the FWUC grow rice and crops as their main source of livelihood. The majority of the farmers hold legal title over their farmland and employ similar cultivation practices. The decision-making structure of the FWUC includes a committee at the highest level, overseeing four groups and fifteen sub-groups.

CHAPTER 6

CASE STUDY RESULTS

6.1 Introduction

The purpose of this study was to identify the key factors that influenced the success of a Cambodian Farmer Water User Community in irrigation management. The FWUC was organised by the government under the implementation of the Participatory Irrigation Management and Development (PIMD) programme. This chapter presents the empirical results describing the key factors that influenced the success of the O-treing Farmer Water User Community. The first section of this chapter will describe how the various stakeholders associated with the scheme defined “success”. Then, an overview of the high level factors - both internal and external - that have influenced the success of the FWUC will be described. This will be followed by a detailed review of each of the factors that have influenced the success of the FWUC, including a description of each factor, and the mechanisms through which it contributed to the success of the FWUC, and also a discussion of the mechanisms that have influenced that factor in turn where relevant.

6.2 Definition of success

It was found that different groups used different criteria to define the success of the O-treing Farmer Water User Community (Table 6.1). For example, the criteria used by government officials (Ministry and Department of Water Resources and Meteorology) were: 1) the degree to which the scheme had improved the livelihood (income and living conditions) of local farmers, 2) the level of local participation in the payment of irrigation service fees, 3) the level of self-dependency developed by the local leaders and farmers, and 4) the level of ownership local leaders and farmers had for the scheme. A ministerial staff member gave his perspective on the FWUC:

The O-treing Farmer Water User Community performs better than the 11 other PIMD schemes... because the livelihood of local farmers has been improved from their crop production...The good thing about the O-treing Farmer Water User Community is that the leaders are able to collect fees from members. With the money, these leaders can provide regular maintenance. The money was not

much if compared to the other PIMD schemes, but the O-treing Farmer Water User Community shows...the ability of leaders to work on their own.

Table 6.1. The criteria used by different stakeholders to assess the success of the O-treing Farmer Water User Community

	Government	Local leaders and local authorities	Local farmers
The level of local farmers' awareness of irrigation management	---	X	---
The level of conflict over water in the FWUC (low)	---	X	---
The quality of the irrigation infrastructure	---	X	X
The efficiency of water distribution	---	X	X
The degree to which the scheme had improved the livelihood of local farmers	X	X	X
The level of local participation	X	X	---
The level of self-dependency	X	---	---
The level of ownership	X	---	---

At the next level (Table 6.1), the local leaders (committee, groups, and sub-groups) and local authorities (district, commune, and village chiefs) defined the success of the O-treing FWUC using five criteria. The criteria were: 1) the level of local farmers' awareness of irrigation management, 2) the level of conflict over water in the FWUC (ideally low), 3) the quality of the irrigation infrastructure, 4) the efficiency of water distribution, 5) the degree to which the scheme had improved the livelihood (income and living conditions) of local farmers, and 6) the level of participation by local farmers. One leader commented:

The O-treing Farmer Water User Community is successful in the way that leaders can collect fees...maintain and repair the scheme... [and] distribute and save water effectively...The success is also related to the improvement in local livelihoods and better local awareness.

and another remarked, "The FWUC is successful because the scheme has [many] canals, [the FWUC has] people who help maintain the scheme, farmers participate in

maintaining the scheme, and water is better distributed to farmers, resulting in fewer conflicts.”

Finally, the local farmers judged the success of the FWUC using three criteria (Table 6.1). These criteria were: 1) the quality of the irrigation infrastructure, 2) the efficiency of water distribution, and 3) the degree to which the scheme had improved the livelihood (income and living conditions) of local farmers. The farmers also noted that the scheme enhanced their livelihoods in two ways. First, it improved their food security by ensuring adequate water for wet season rice production. Second, it allowed them to grow dry season crops to generate additional revenue. “I think the FWUC is successful because of sufficient water supply and a good irrigation scheme as a result of regular and proper maintenance” a farmer in Ang Sangkream said. During a group discussion in Chum Srok, farmers offered:

The FWUC is successful because we get water for wet season rice. Farmers in other areas may face crop failure during droughts, but people in this area have never had this problem...We use irrigation water to supplement rainwater almost every year

From these three views, the success of the O-treing Farmer Water User Community was likely to be centred on two features. First, the success of the FWUC referred to the self-dependency of local leaders and farmers in taking over the management of the irrigation system. This was reflected in the high level of participation by local leaders and farmers in irrigation management, their ability to maintain the quality of the irrigation infrastructure and distribute water with a low level of conflict, a stronger local awareness of irrigation management, and a clear sense of ownership. Second, success was reflected in the improvement of local livelihoods in terms of food security and household revenue from crop production. The following section describes the key factors that influenced the success of the O-treing Farmer Water User Community in greater detail. An explanation of how each factor impacted on their success and which mechanisms influenced each factor is also provided.

6.3 Factors that influenced success

It was found that the success of the O-treing Farmer Water User Community was underpinned by five internal and two external factors. The internal factors are the

factors that are under the control of the FWUC while the external factors refer to those factors that existed outside the FWUC and are not under the control of the FWUC. The five internal factors included: 1) the level of local participation, 2) the governance and management of the scheme, 3) the value of the benefits that flowed from the irrigation scheme, 4) the quality of the irrigation infrastructure, and 5) the characteristics of the farmer members within the scheme. The two external factors that influenced the success of the FWUC included: 1) the level of external support provided to the scheme, and 2) market access.

The interactions between the seven factors are complex with a range of feedback loops (Figure 6.1). This research found that the level of local participation by farmers, the governance and management of the scheme by local leaders, and the level of external support by the local authorities, the Ministry of Water Resources and Meteorology, and non-governmental organisations were the three main factors underlying the success of the FWUC.

These three factors (the level of local participation by farmers, the governance and management of the scheme by local leaders, and the level of external support by the local authorities, the Ministry of Water Resources and Meteorology, and non-governmental organisations) were influenced by many other factors. The level of local participation was influenced by the value of the benefits that flowed from the irrigation scheme, the characteristics of the farmers, the governance and management of the scheme, and the quality of the irrigation infrastructure. On the other hand, the governance and management of the scheme were determined by the level of local participation, the characteristics of the farmers, the quality of the irrigation infrastructure, and the level of external support. The level of external support was partly the product of the governance and management of the scheme through good leadership and the willingness of the government and local authorities to provide assistance to help strengthen the FWUC. These interactions are discussed in more detail in the following sections.

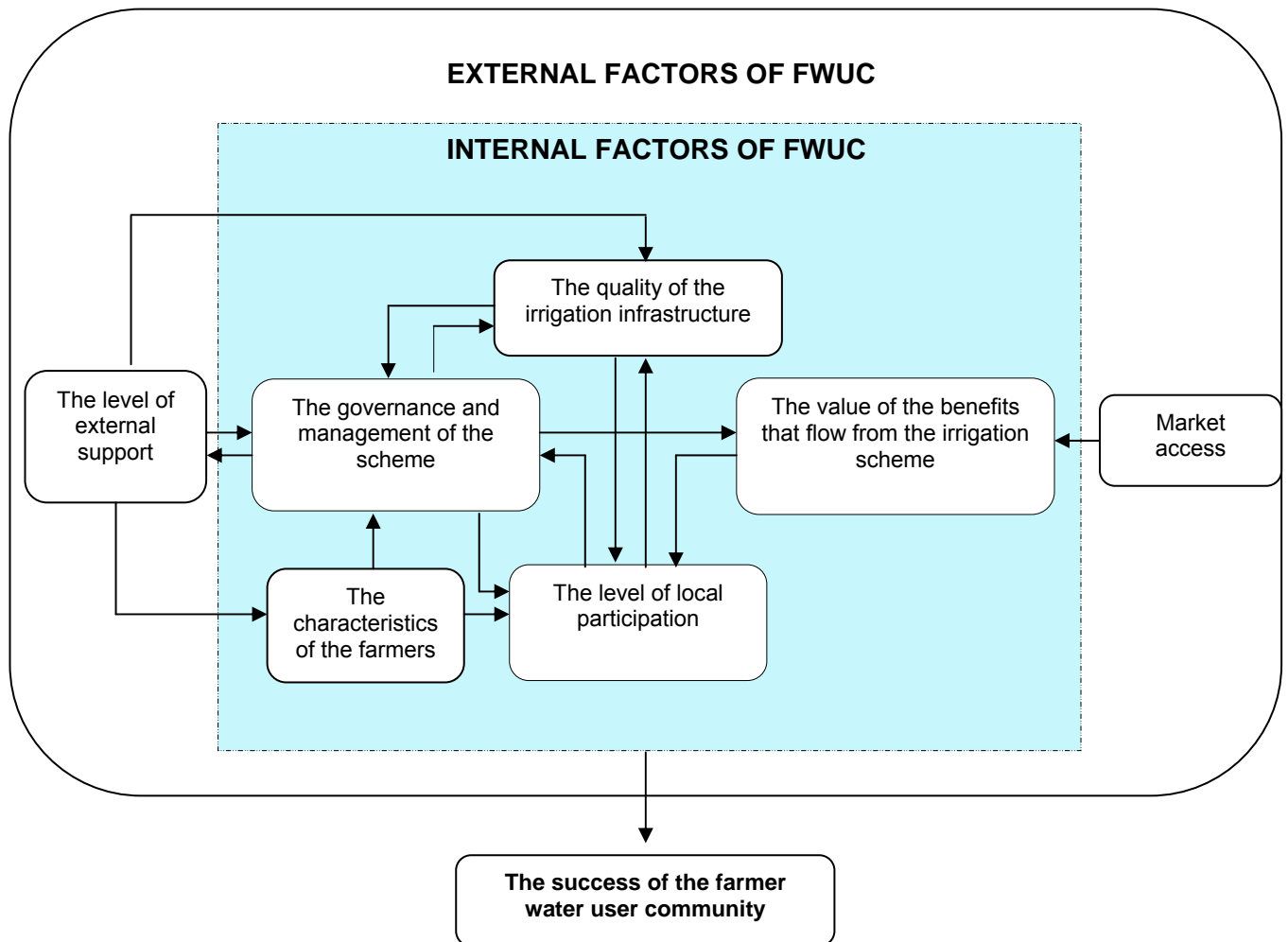


Figure 6.1. A diagram of factors that contributed to the success of the O-treing Farmer Water User Community.

6.3.1 The level of local participation

The level of local participation by farmers in irrigation management was one of the important internal factors that influenced the success of the O-treing Farmer Water User Community. The level of local participation was high because the proportion of the farmers who participated in irrigation management was large and their participation ranged from the provision of resources to engaging in decision making with the local leaders. The local farmers contributed resources to the FWUC in three different modes: 1) through the payment of irrigation service fees, 2) through the distribution of water, and 3) through scheme maintenance (Figure 6.2). Participation in decision making

occurred through FWUC meetings about the management of the scheme. The following sections describe in more detail the level of local participation in each of these areas, explain how the participation influenced the success of the FWUC, and identify the factors that in turn influenced the level of participation.

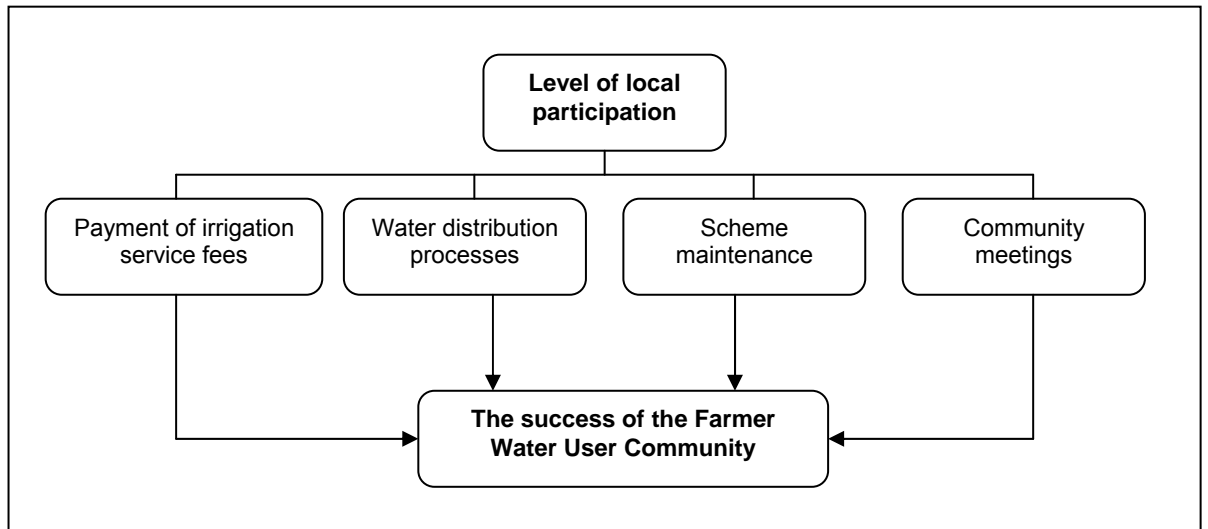


Figure 6.2. A diagram of the mechanisms through which the level of local participation impacted on the success of the FWUC.

6.3.1.1 Participation in the payment of irrigation service fees

The level of local participation in the payment of irrigation service fees at the O-treing Farmer Water User Community was reported to be high. In most years, almost all the farmers who used irrigation water were reported to have paid the irrigation service fees. The exceptions were farmers who had suffered full or partial crop failure. They were reluctant to pay the full irrigation service fees and often requested that fee payment be postponed until the next harvest. Because these farmers were in financial difficulty, the committee often agreed that they could pay a portion (one-third to one-half) of the full irrigation service fee and/or delay payment until the following season.

The high level of compliance with the payment of irrigation service fees contributed to the success of the FWUC through ensuring the availability of financial resources for the operation of the scheme (Figure 6.3). The availability of financial resources helped ensure regular repair and maintenance of the scheme which then impacted on the

quality of the irrigation infrastructure and the timely and adequate supply of water to farmers. This in turn improved the benefits to farmers through higher crop yields which resulted in an improvement in local livelihoods. The availability of financial resources also meant that the FWUC was less reliant on external support and then more self-dependent. In addition, a portion of the fees was used to pay the leaders for their input into the scheme. This payment served as an incentive for the FWUC leaders to remain involved in the governance and management of the scheme, which enhanced the self-dependency of the FWUC.

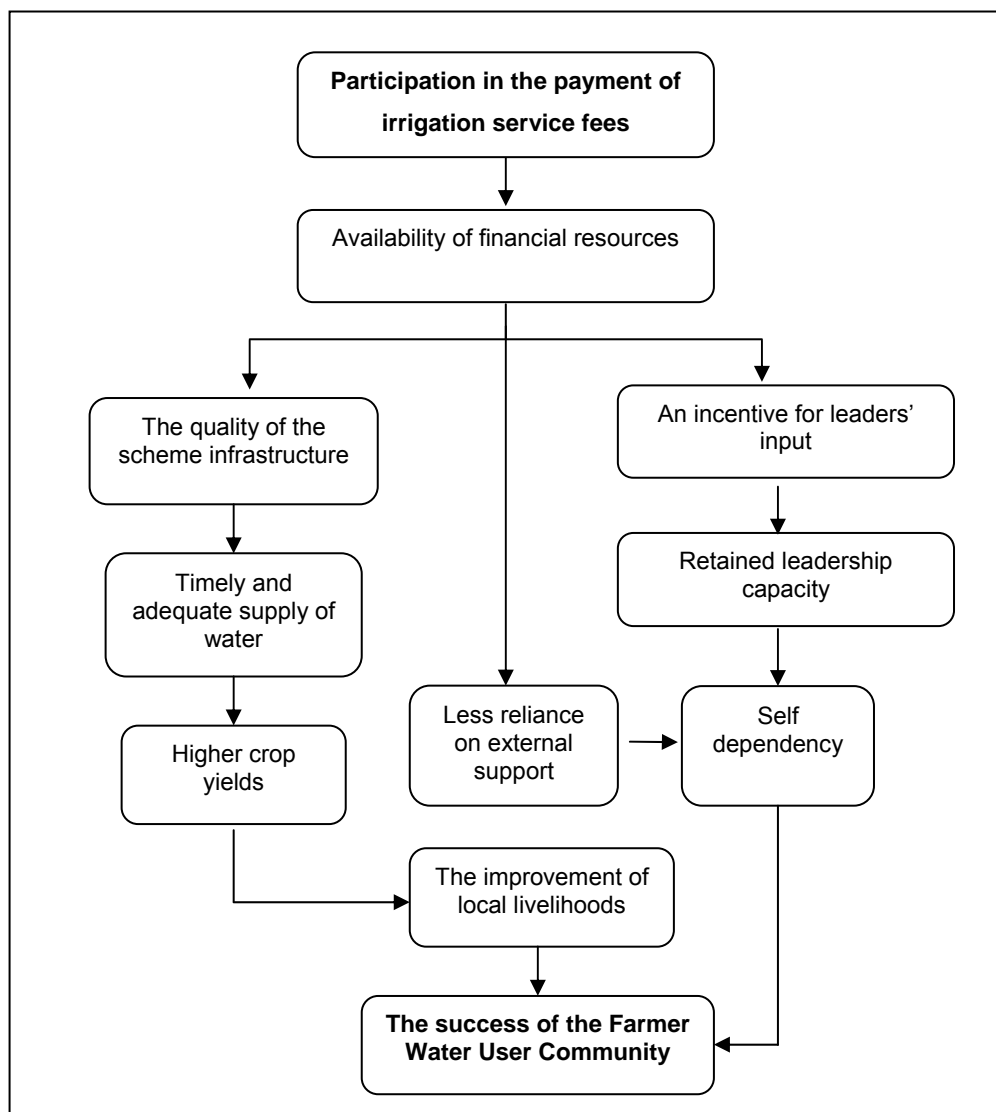


Figure 6.3. A diagram of the mechanisms through which the participation in the payment of irrigation service fees impacted on the success of the FWUC.

This study identified that the high level of participation by farmers in the payment of irrigation service fees could be attributed to six factors: 1) farmers' awareness of the importance of participation in the payment of irrigation service fees, 2) the value of the benefits that flowed from the irrigation scheme, 3) the cost of irrigation service fees relative to the value of the benefits and the costs of alternative sources of water, 4) the quality of the irrigation infrastructure, 5) the effectiveness of the governance and management of the scheme that led to trust in and respect for the leadership and 6) peer pressure (Figure 6.4). First, farmers were more inclined to pay the irrigation service fees because they were aware of the importance of participation in fee payment. Their awareness was determined by their experience in self-organisation and training and capacity building by local leaders and outsiders through external support. Farmers had previously organised their own groups to manage the scheme and fees had been collected from users to cover maintenance costs (see Chapter 5, Section 5.2). Because of this experience, farmers had learned the importance of their participation in fee payment. Farmers also obtained a lot of training and capacity building from their leaders, local authorities, and the Ministry of Water Resources and Meteorology about the importance of fee payment.

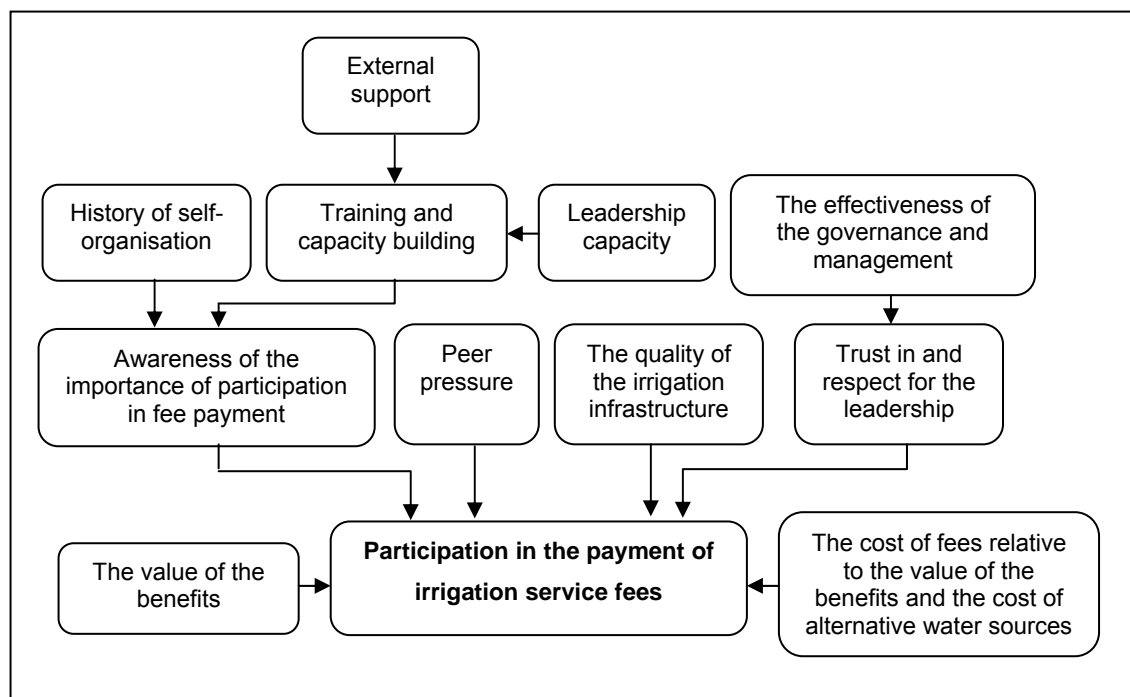


Figure 6.4. A diagram of factors that influenced farmer participation in the payment of irrigation service fees

Second, this study found that the high level of participation in the payment of the irrigation service fees by the farmers was influenced by the level of benefits they obtained from the irrigation water. Farmers often used the irrigation water to supplement rainwater for rice production during the wet season, which ensured optimal yields. Rice is their staple food source and as such, the irrigation scheme ensured food security for their families throughout the year. In the dry season, the farmers used the irrigation water to generate revenue by growing crops such as dry season rice, water melons, wax gourds or pumpkins. Although fertiliser and pesticide were expensive, farmers still made enough profit to be better off using the irrigation water to grow dry season crops.

The third reason that farmers participated in the payment of the irrigation service fees was in part related to the costs of the irrigation service fee, specifically, the amount of the fee they were required to pay was low relative to the benefits. According to a group discussion in Ang Sangkream, farmers could earn up to 2 million riels per hectare from selling crops. In return, farmers needed to pay only 40,000 riels/ha for the irrigation service fee, an amount accounting for only 2% of the gross revenue that was generated. As such, the farmers did not mind paying the irrigation service fee when the returns from the irrigated crops were so high. One farmer explained this during a group discussion in Ang Sangkream:

We do not mind paying water fees because 40,000 riels/ha per hectare is nothing for us. We can earn up to 2 millions as a result of selling produce from an area smaller than one hectare. If we do not pay the fees, we do not have water, and then we will have nothing to do in the dry season.

In addition, this study revealed that the irrigation scheme provided a cheap source of water relative to alternative sources. Digging ponds to store flood water during the wet season for domestic use was popular in the community. However, farmers preferred to access water from the scheme because it was less expensive. In a Chum Srok group discussion, it was commented:

I think that 40,000 riels per hectare is the cheapest price. Imagine if we did not take water from the FWUC and we made our own ponds; I would say we would spend more than this on petrol just to pump water from the pond to our farmland. As a matter of fact, we would not be needing to pump water only once

or twice. So 40,000 riels per hectare to get water by gravity [until crops are ready to be harvested] is a good deal.

The quality of the irrigation infrastructure was the fourth reason for the high level of compliance by farmers in the payment of the irrigation service fee. Farmers believed that the quality of the irrigation infrastructure was critical in obtaining an adequate and timely supply of water. Irrigation service fees were used to ensure that the irrigation infrastructure was well-maintained, and the farmers trusted the leaders to spend the fees on scheme maintenance. A few remarks on this theme include:

We did not disagree when we were told to pay fees because... we knew that we needed people [leaders] who could manage the scheme; we pay fees [to these leaders] to maintain the scheme for us. (Group discussion in Chum Srok)

"Farmers participated in paying fees...because they wanted to get water for the long run and they believed that the committee would be able to maintain and repair the scheme by using the fees. (A local authority)

We have to pay fees because...the committee has control gates and infrastructure to distribute water to us. The committee takes the money to maintain [or repair] that infrastructure. (Group discussion in Ka Yiev)

Another critical factor that influenced the payment of the irrigation service fees was the effectiveness of the governance and management of the scheme. The leaders managed the scheme in a fair and transparent manner and the leadership put the interests of the FWUC first. The leaders also worked hard to distribute water, maintain the scheme, and address farmers' problems effectively. As a consequence of this, the leaders were trusted and respected by their farmer members and this was an important reason why the farmers paid the irrigation service fees. A number of comments illustrating these sentiments follow:

They show transparency in spending money; for example, they have financial records for all the expenses, therefore making local farmers to have trust in them... (A local authority of Chung Rouk commune)

Farmers participate in the FWUC because they want to have leaders who help manage and distribute water to them. When it rains, farmers are not worried

[about who will go to close gates at the reservoir] because they know that someone [from the committee] will take care of it. (A local leader)

Once the FWUC was established and the scheme was rehabilitated, we were asked to pay fees. We did not mind paying the fees because... the fees are used by the leaders to maintain the scheme...we do not suspect the FWUC of embezzling the money because we saw the maintenance work they have done. The leaders also hired members like us to carry soil for dam repairs or to block running water. (Group discussion in Ang Sangkream)

Finally, this research also found that peer pressure was another reason for the high level of local participation in the payment of irrigation service fees at the O-treing Farmer Water User Community. Farmers did not want to be embarrassed in front of their friends or neighbours for not paying the irrigation service fees. According to one leader,

Farmers normally hesitate to spend money. But when they see...other members pay the fees, farmers often agree to pay as well. Those farmers do not want to get embarrassed in front of other members or their neighbours for not paying the fees...

6.3.1.2 Participation in the water distribution process

Irrigation water was distributed to farmers in both the dry and wet seasons. The process of water distribution began with the opening of the main gates and the control gates. Water was discharged into the main canals, secondary canals, tertiary canals, and then onto farmland by gravity. There was a high level of farmer participation in the water distribution activities of the O-treing scheme. Most of the farmers were reported as participating in filing water requests to the committee in order to obtain access to the irrigation water. Farmers also participated in following the water flow to their farmland. For farmers who were located far from the main canals, water releases from their neighbours' property through ditches were often conducted. They also monitored the water distribution process to avoid flooding or overflows that could destroy the crops of other farmers, damage the scheme, or waste water. Some farmers, especially those who were located above the reservoir, were also responsible for pumping water either from canals or from the reservoir to farmland located above the water source.

The participation of farmers in the water distribution process contributed to the success of the FWUC through three mechanisms (Figure 6.5). First, it ensured the timely and adequate supply of water to farmers, leading to the benefits of higher crop yields and thus the improvement of local livelihoods. The local leaders could not effectively distribute water to the farmers without the participation of the farmers. Water distribution not only involved following the water flow and ensuring it reached the farmers' fields, but also required the farmers to dig ditches, block water ways, and adjust control gates as well. Such activities could not be done effectively by the leaders alone; rather it required a large group of farmers working together. Second, the participation of the farmers in the water distribution process also ensured less flooding, overflows and wastage of water, and these conditions then led to the efficient use of water and less damage to the scheme. The efficient use of water contributed to the adequate and timely supply of water, while the minimisation of damage to the scheme contributed to the quality of the scheme infrastructure, which again impacted on the timely and adequate supply of water to farmers. Third, the participation of farmers in the water distribution process also helped reduce the input required from leaders, hence allowing them to remain actively involved in the governance and management of the scheme, which in turn helped enhance the self-dependency of the FWUC.

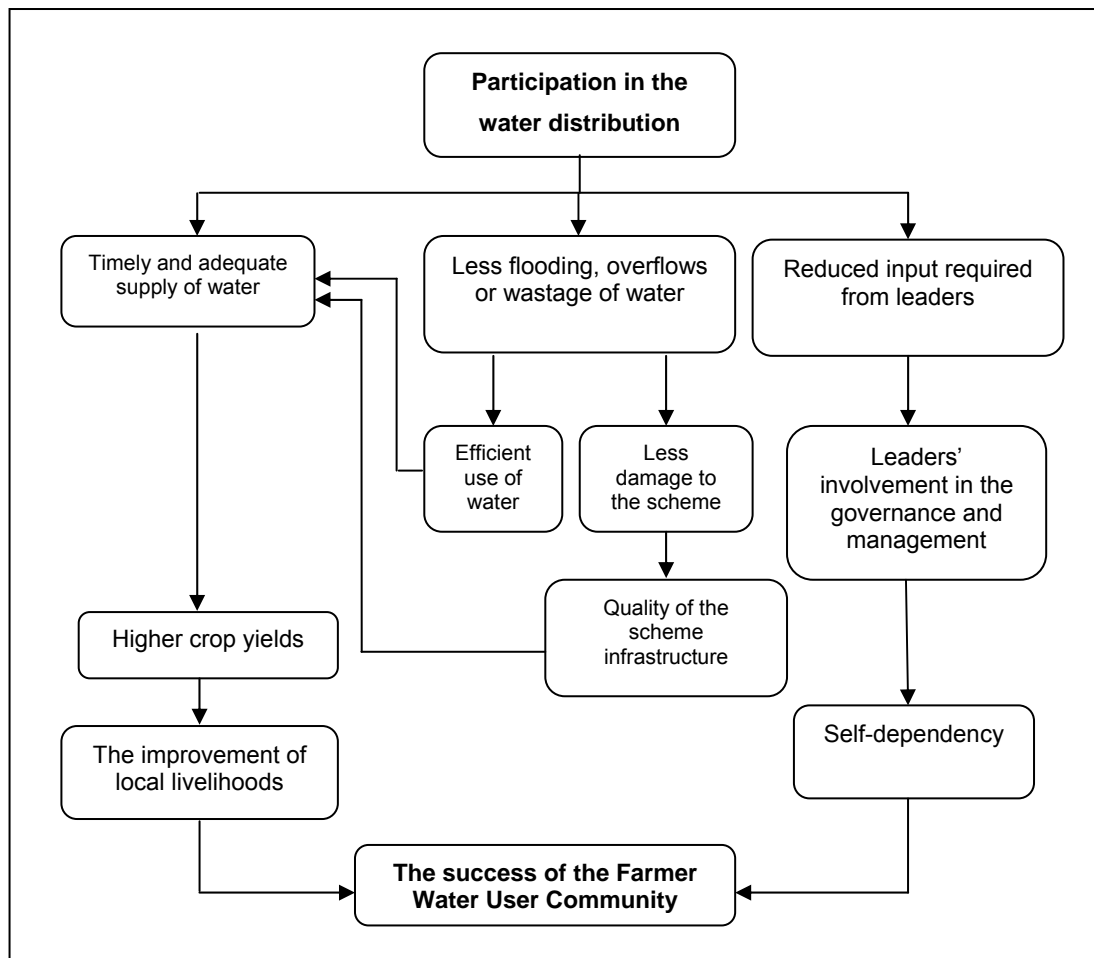


Figure 6.5. A diagram of the mechanisms through which farmer participation in water distribution impacted on the success of the FWUC.

The reasons behind the high level of farmer participation in water distribution were influenced by three factors: 1) local awareness of the rules, 2) rule enforcement and 3) the value of the benefits that flowed from the irrigation scheme (Figure 6.6). First of all, farmers participated in water distribution because they were aware of the rules. According to the rules, farmer members were required to file a water request to obtain irrigation water. Once the water was released, the rules stipulated that the farmers were expected to follow the water flow and ensure that water reached their land. The leaders (committee, group and sub-group leaders) played a supervisory role during this process. The rules also stipulated that the farmers had to ensure the water was not wasted due to flooding or overflow. If there were incidents of overflow or flooding leading to crop failure, the farmers involved would be responsible for the related costs.

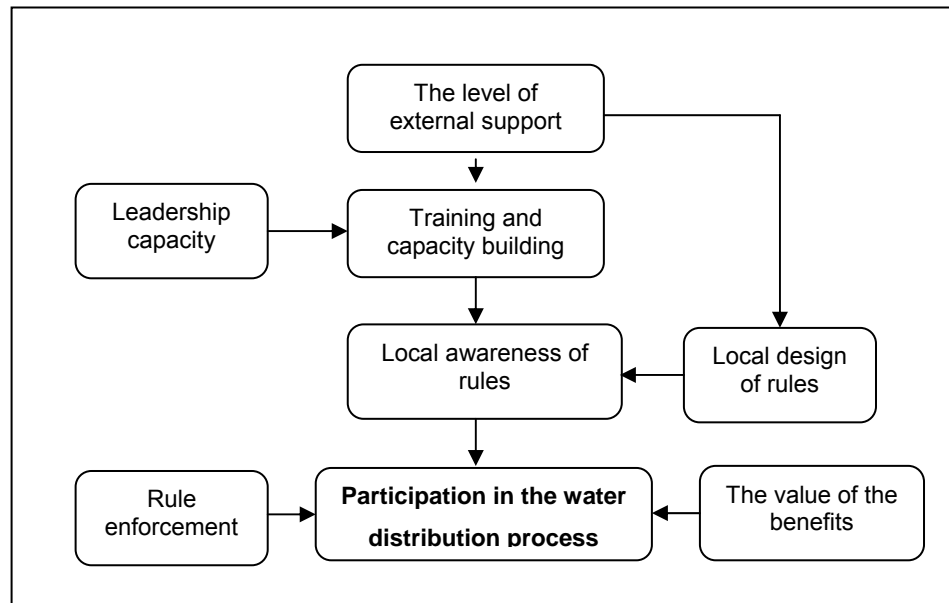


Figure 6.6. A diagram of the factors that influenced farmer participation in the water distribution process

Farmers were aware of the rules firstly because they designed those rules with the help of local leaders and the Ministry of Water Resources and Meteorology (MoWRAM). Secondly, the MoWRAM and local authorities (commune and village chiefs) helped provide training and capacity building to local farmers on the FWUC rules. Finally, the leaders worked hard to raise local awareness of the rules through FWUC meetings.

Rule enforcement was another critical factor impacting on local participation in the water distribution process. The committee would not distribute water unless more than three families filed a water request and they agreed to follow the water flows to their farmland. Farmers who asked for water without filing a water request were often sent back to their sub-groups and told to file a request letter in order to obtain access to the water.

Finally, farmers were willing to participate in the water distribution process because of the value of the benefits they obtained from the water. Farmers wanted water to reach their land as soon as possible to ensure they achieved high crop yields and an early harvest. If they could harvest their crops earlier than other farmers in the commune, they could receive a higher price from the middlemen. It also meant that the farmers could sow their next crops earlier than other farmers, providing them with further advantages.

6.3.1.3 Participation in scheme maintenance

A third area of local participation in irrigation management identified by the study was scheme maintenance. Participation in scheme maintenance required the farmers to report damage to the leaders and contribute labour and/or resources (cash and/or materials) to help maintain the scheme's infrastructure at an adequate level. Most of the farmers in the FWUC participated in reporting damage to the scheme. They also contributed labour to maintain both the headwork of the scheme (the reservoir, dam, and main gates) and the canals through which they sourced water from. The local leaders reported that farmers usually participated in maintaining their own canals more often than in maintaining the headwork of the scheme. Moreover, the participation of farmers in the maintenance activities depended upon the extent the needed work. Farmers were required to fully participate in small scale activities that required limited skills, such as sowing grass or planting trees, filling holes, digging small ditches, clearing sub-canals, or installing small water pipes. For such activities, a meeting was often organised beforehand between the leaders and the farmers in order to set aside days for the work. Each family was asked to provide at least one member along with tools such as hoes or spades. Sometimes some families provided an ox-cart for heavy work. For more specialised maintenance work, the leaders paid farmers with specialist skills. Farmers were also paid to undertake maintenance work when labour was in short supply, during the periods when farmers were busy planting or harvesting their crops.

Apart from labour, this study found that farmers were also willing to contribute their own money on top of the irrigation service fees to the maintenance of the canal or infrastructure in their area. According to group discussions in Chrey and Ka Yiev, participants said that they used to contribute 5,000 riels per household in Chrey and 15,000 riels per household in Ka Yiev to the FWUC for water pipes.

Local participation in scheme maintenance contributed to the success of the FWUC through enhancing the governance and management of the scheme (Figure 6.7). The participation of farmers in scheme maintenance helped reduce the input required from leaders in scheme monitoring and patrolling, hence allowing those leaders to remain actively involved in scheme management for the self-dependency of the FWUC. Furthermore, the involvement of local farmers in reporting damage to the leaders and contributing labour and/or cash led to the effective scheme maintenance, and thereby contributed to the improved quality of the irrigation infrastructure and a reduction in

damage. The improved quality of the irrigation infrastructure then contributed to local participation in the payment of irrigation service fees, as previously stated (Section 6.3.1.1), and the timely and adequate supply of water to farmers. This, in turn, provided the enjoyment of benefits through improved crop yields and the resultant improvement in local livelihoods. By minimising damage to the scheme, maintenance costs were reduced (time and financial costs) and this reduced the FWUC's reliance on external support, hence enhancing the FWUC's level of self-dependency.

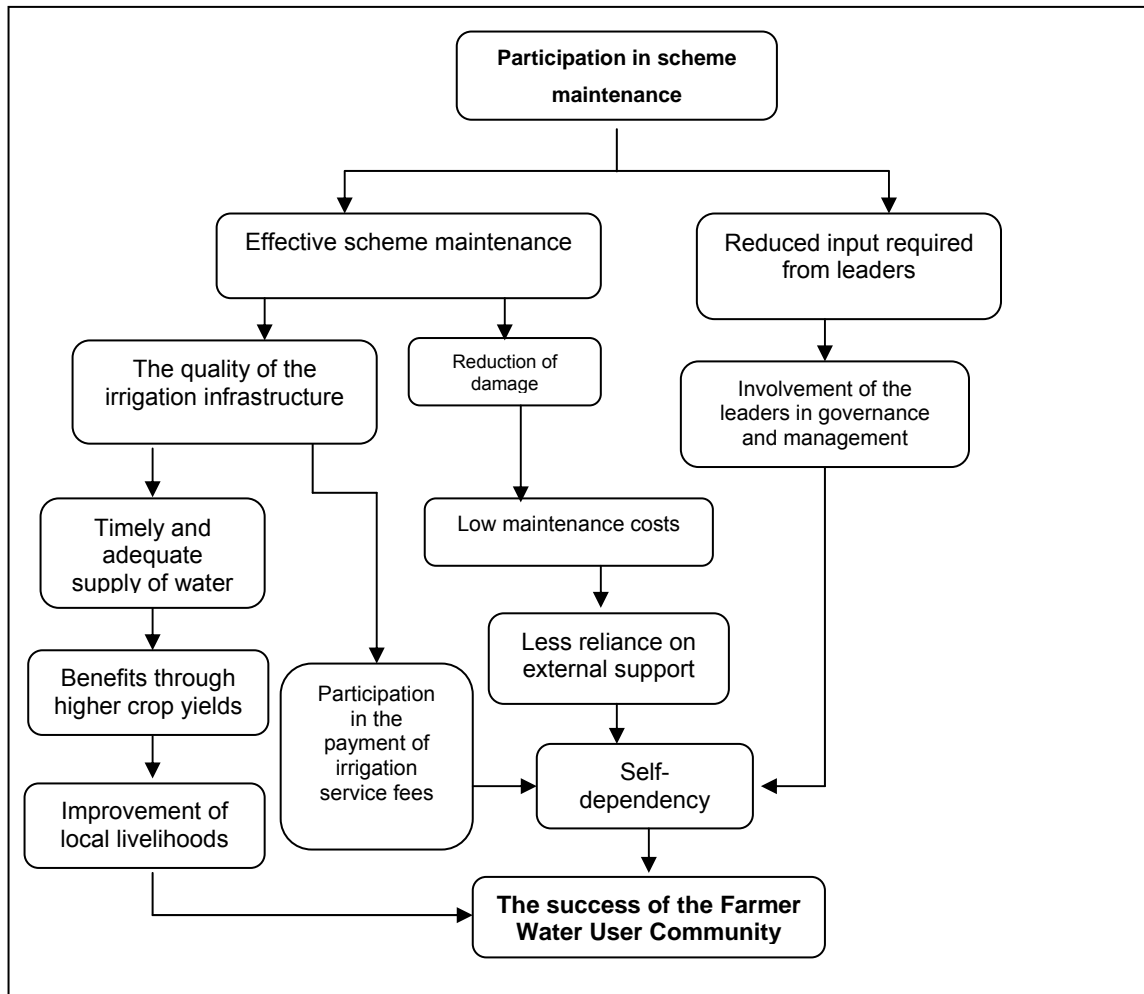


Figure 6.7. A diagram of the mechanisms through which farmer participation in scheme maintenance impacted on its success.

Farmers participated in scheme maintenance for a number of reasons (Figure 6.8). At first glance, it appeared that participation in scheme maintenance was determined by the FWUC rules. According to the rules, farmer members were required to help with scheme maintenance. If they failed to do this, they could lose their membership within the scheme or face a fine. However, in reality this punishment was not put into practice. The primary reason why farmers participated in scheme maintenance was more related

to their awareness of the importance of it in ensuring the timely and adequate supply of water for their farming operations. Farmers knew that if they did not maintain their own sub-canals, they would not be able to irrigate their land. Moreover, if they did not contribute to maintaining the dam, it was likely that the reservoir would not be able to store as much flood water, reducing the availability of water for cropping.

Farmers were aware of the importance of scheme maintenance because they had previous experience operating an irrigation scheme through their history of self-organisation. Because of this experience, farmers had learned a lot about the roles and responsibilities of leaders and members in regards to scheme maintenance and its importance for ensuring an adequate and timely supply of water. Secondly, training and capacity building by MoWRAM, and the local authorities, and the leadership capacity of the local leaders also contributed to greater local awareness of the importance of scheme maintenance.

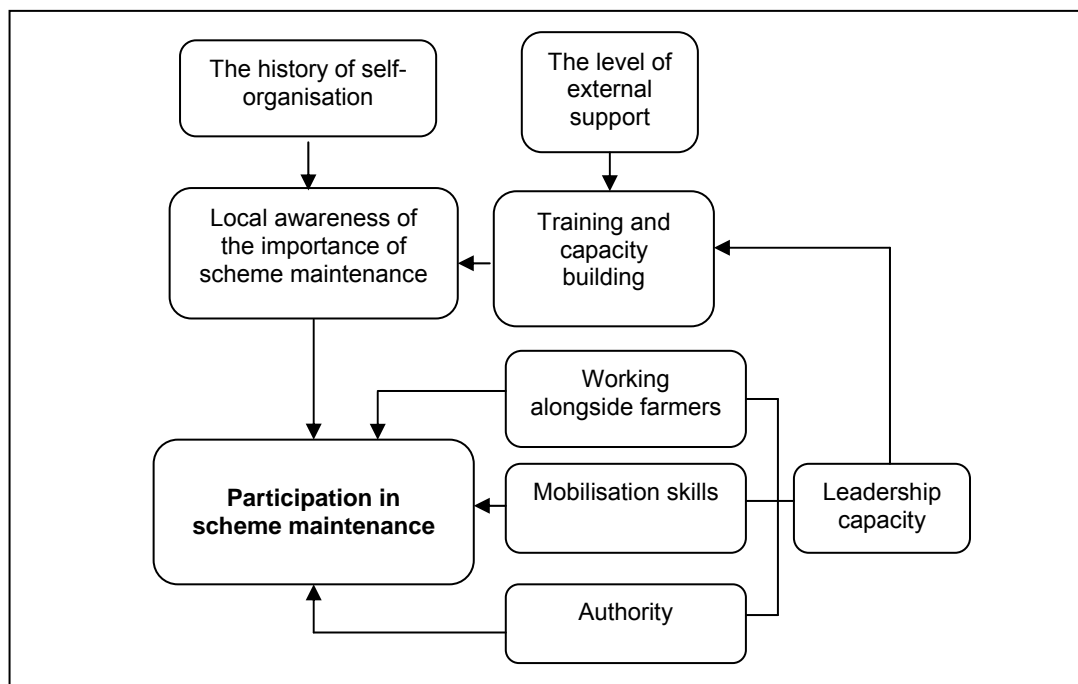


Figure 6.8. A diagram of the factors that influenced farmer participation in scheme maintenance.

Participation by farmers in scheme maintenance was also influenced by the quality of the leadership that was provided by the leaders. Farmers were more likely to participate in activities when the leaders worked alongside them. The farmers respected leaders who ‘got their hands dirty’ through taking part in the work. For example, a village chief said “farmers need leaders to do work”. The high participation

in maintenance was also related to the fact that the leaders were good at mobilising the farmers to undertake the work. To ensure a good turn out of farmers, the leadership organised the maintenance work such that the time input was relatively short and such activities were infrequent. This study found that the fact that the majority of leaders were village chiefs also helped the FWUC to gain high participation from members. Being village chiefs and deputies gave the leaders more authority to mobilise farmers.

6.3.1.4 Participation at FWUC meetings

A final area of local participation in irrigation management was FWUC meetings. FWUC meetings were either organised separately in each village or organised for the entire FWUC. Four major FWUC meetings were organised each year. The first meeting was held before farmers started growing crops, to discuss the areas to be irrigated. The second meeting was organised before the crops were harvested, to assess the crop production of individual households. The third meeting was scheduled after farmers sold their produce, to inform farmers of the days for fee collection in their villages. The fourth meeting was organised after the fee collection process was finished to announce the gross collected fees, all related expenses, and the net revenue that was deposited in the bank.

Besides these four meetings, there were other meetings organised by the leaders to inform farmers of incidents happening in the FWUC (i.e., damage to schemes), to share information about training or activities conducted by the leaders, or to discuss with members issues related to scheme maintenance plans or changes in FWUC rules. Some meetings were organised to allow farmers to meet with a delegation from the Ministry of Water Resources and Meteorology, non-governmental organisations, or other visitors to the FWUC.

This study identified that local participation at the FWUC meetings could be meaningfully separated into two categories: attendance at meetings and participation in decision making. The level of local attendance at FWUC meetings was high. The majority of leaders said that 60-70% of farmers came to the meetings. However, the researcher noticed that most of the participants were women (wives) who attended the meetings because their husbands were often busy working. This was not a problem because both men and women engaged in farming activities in the FWUC. Similarly, participation in decision making was also high. During a group discussion in Chum

Srok, participants said “Farmers now are smart and are not shy anymore. Farmers are not afraid of being wrong. Farmers are starting to believe that talking during meetings really is to share information with others”.

Local participation at the FWUC meetings impacted on the FWUC’s success through several mechanisms (Figure 6.9). First of all, local attendance at FWUC meetings was important to ensure that farmers were available to the leaders so they could inform, educate, or share information with them, hence increasing local awareness of the rules and irrigation management and thus optimising local participation in the payment of ISFs, water distribution process and scheme maintenance. Such participation then impacted on the self-dependency of the FWUC. The detailed description of mechanisms through which the local participation in the payment of ISFs, water distribution process and scheme maintenance impacted on the self-dependency of the FWUC was discussed in Sections 6.3.1.1, 6.3.1.2, and 6.3.1.3.

Second, local participation in decision making allowed the leaders to incorporate local needs and preferences into their decisions. Because the local farmers were involved in the decision making, they took the ownership of the decisions and were satisfied with the outcome and hence more likely to participate in the activities associated with the scheme.

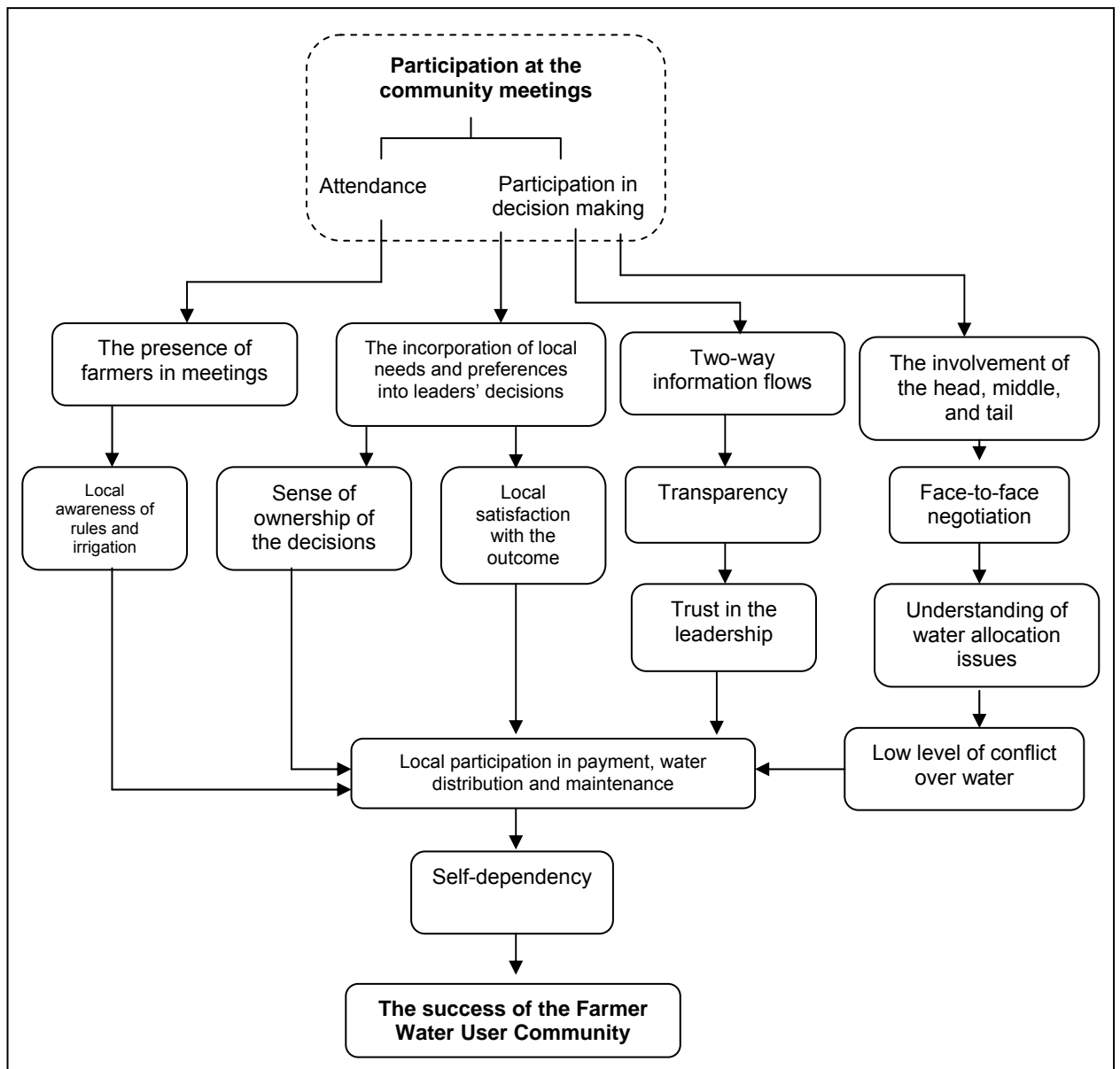


Figure 6.9. A diagram of the mechanisms through which farmer participation at the FWUC meetings impacted on the success of the FWUC

Third, ensuring two way information flows in which leaders were required to report on the budget and expenses while farmers were allowed to ask questions helped foster transparency and then trust between leaders and farmers, hence supporting higher local participation in fee payment. Fourth, involving farmers from the head, middle, and tail of the scheme in FWUC meetings to discuss water allocation allowed farmers from the upstream and downstream areas of the scheme to meet face-to-face, so that they

could negotiate with each other. This fostered a greater understanding of the water allocation issues facing farmers at different locations within the scheme, and led to reduced conflicts over water and thus higher local participation.

The level of local participation at the FWUC meetings was determined by several factors. Attendance at the meetings by local farmers was influenced by workload, leadership capacity including mobilisation skills and authority, and the perceived importance of the meetings (Figure 6.10). Farmers found it difficult to attend meetings during the planting and harvesting periods. Similarly, some farmers had supplementary jobs in addition to farming which made it difficult for them to attend meetings. To overcome these problems, the leadership organised meeting times during periods when the farm workload was low, and also allowed other family members, including wives or children above 18 years of age, to attend the meetings and voice their opinions.

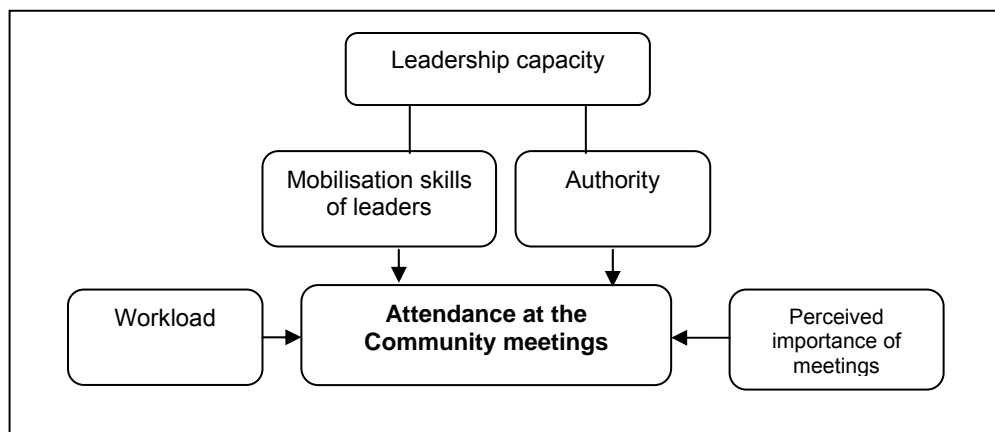


Figure 6.10. A diagram of the factors that influenced the local attendance at the FWUC meetings.

Farmers attended meetings in part due to the mobilisation skills of the leaders. For example, the leaders normally informed the farmers a few days before the meetings, set the meetings at a convenient time (usually after lunch), and were patient with farmers who were late for the meeting. Farmers also attended FWUC meetings because of the authority of the local leaders. The leaders at the O-treing Farmer Water User Community held authority firstly through the FWUC constitution, and secondly because of farmers' respect for their attitudes, knowledge, and skills. Thirdly, and more importantly, the authority to mobilise farmers also came from the leaders' positions as village chiefs. Field observations suggested that these leaders used their authority as village chiefs, rather than as FWUC leaders, to gather farmers to the meetings.

The perceived importance of the meeting was the fourth reason for local attendance at meetings. This related to potential benefits that might flow from the information provided or the decision made at the meeting. For example, farmers from Chum Srok and Chhouk Sor villages said that they were often interested in meetings that would allow them to make a request or to initiate discussions about their concerns in relation to cropping techniques, use of fertiliser, or scheme maintenance. Such discussions were normally beneficial to the participants.

It was found that rule enforcement did not have any effects on the local attendance at meetings. FWUC rules existed that farmers would be penalised if they failed to attend meetings, but in reality these rules were not enforced.

Attendance at meetings, on its own, was of limited use unless farmers actively participated in sharing information or making decisions with the leadership during the meetings. In the O-treing Farmer Water User Community, farmers were observed to participate in decision making and provide feedback to the leadership on a range of issues.

This level of participation in decision making at meetings was influenced by three factors: awareness of rights, leadership, and the importance of the issue (Figure 6.11). Firstly, local participation during meetings was influenced by local awareness of their rights. Farmers at the O-treing Farmer Water User Community were aware of their own rights because 1) they had a history of self-organisation, and 2) they had training and capacity building provided by the Ministry, local authorities, and local leaders.

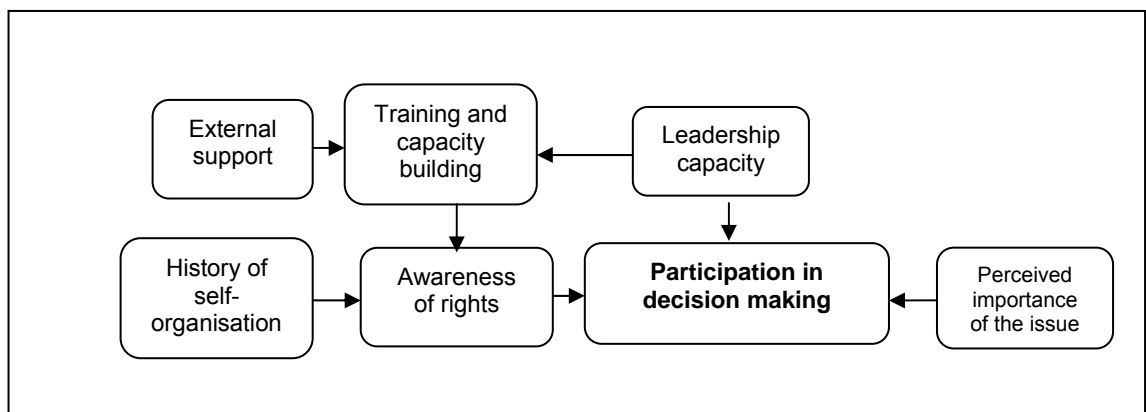


Figure 6.11. A diagram of the factors that influenced farmer participation in decision making during FWUC meetings.

Leadership capacity was the second reason behind farmers' actively participation in decision making. The leaders actively sought engagement and feedback from the farmers and believed that this was an important responsibility for them. Farmers were more likely to provide feedback to the leadership when they realised that their ideas were being taken seriously. Finally, farmers were more likely to participate in decision making if they perceived the issues to be important. Important issues were those that were likely to impact on the livelihoods of the farmers.

6.3.2 The governance and management of the scheme

Besides the level of local participation, the governance and management of the scheme was also critical to the success of the O-treing Farmer Water User Community. Factors that come under governance and management can be usefully separated into two categories: structures and processes. In the context of this study, the governance and management structures encompass the decision-making structure and leadership capacity. On the other hand, the governance and management processes include the formation process that determined the decision-making structure and designed the rules under which the FWUC would operate. It also includes the decision-making processes used by the FWUC to implement, enforce, and adapt these rules (Figure 6.12).

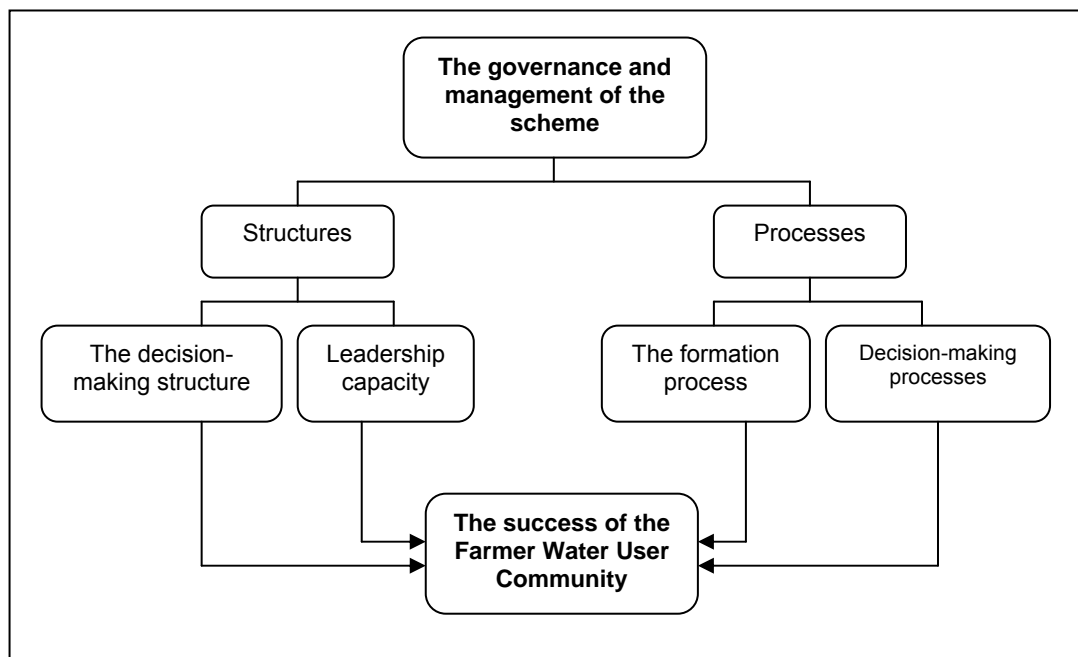


Figure 6.12. A diagram of the mechanisms through which the governance and management of the scheme impacted on the success of the FWUC.

6.3.2.1 The governance and management structures

The governance and management structures included the decision-making structure, and leadership capacity. The following sections describe the attributes of the governance and management structures and discuss how they influenced the success of the FWUC. Factors that impacted on governance and management structures are also described.

The decision-making structure

The decision-making structure of the O-treing Farmer Water User Community consists of three layers that were specified by the Ministry of Water Resources and Meteorology. At the highest level is the committee, whose role is to govern and manage the scheme. Underneath the committee are four groups who are responsible for the management and maintenance of each of the main canals. Under each group are several sub-groups that each comprised a village; every sub-group is made responsible for the management and maintenance of the sub-canals that supply water to the farmers in its village.

This decision-making structure worked well and impacted on the success of the O-treing Farmer Water User Community through two mechanisms (Figure 6.13). First, it made each village and group of villages responsible for the management and maintenance of the irrigation infrastructure that supplied them with water for farming purposes and this led to increased local participation, which then contributed to self-dependency. Second, this structure also meant that at the sub-group level, the number of farmers was small and as such, it was easy for the leaders to implement and enforce the rules. This again contributed to greater self-dependency and enhanced ability on the part of the FWUC to govern and manage the scheme. For example, the sub-group leaders could collect irrigation service fees and effectively mobilise farmers for FWUC meetings or maintenance, because they could easily identify those farmers who had defaulted on their payments or participation. The sub-group leaders could also share information with the farmers without difficulty. The sub-group leaders lived in the village and as such, were in regular contact with local farmers and aware of what was happening in the village. This allowed them to identify and respond to problems quickly.

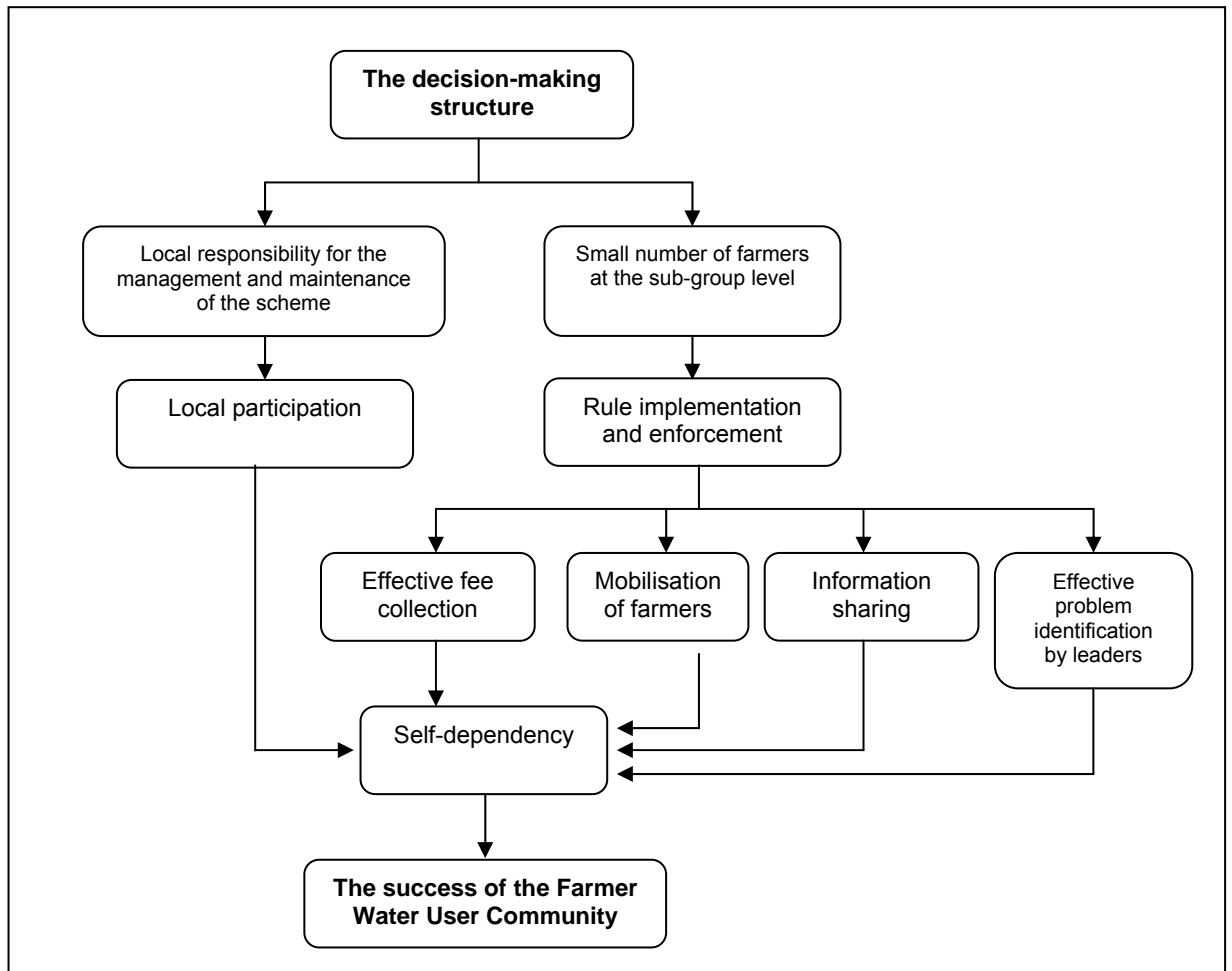


Figure 6.13. A diagram of the mechanisms through which the decision-making structure impacted on the success of the FWUC.

Leadership capacity

The second component of the governance and management structures is leadership capacity. The local farmers identified a number of attributes that they associated with strong leadership capacity in the FWUC. These can be usefully separated into: 1) attitudes, 2) knowledge and skills, and 3) authority. The attitudes the farmers associated with good leadership included: a positive work ethic, commitment to the irrigation scheme, honesty and transparency, and a willingness to: a) put the interests of the FWUC ahead of their own, b) work along-side the farmers, c) accept responsibility and d) continue to learn in order to improve the performance of the scheme. The farmers also identified that their leaders had important skills and knowledge including a thorough understanding of irrigation management, the ability to motivate and lead the FWUC, and the ability to solve problems creatively. Leaders also

had well-developed organisation, delegation and communication skills. In addition to this, the leaders also held authority, which was defined as responsibility and the power to mobilise farmers and manage the irrigation scheme.

The leaders of the scheme had a positive work ethic and spent long hours helping manage the scheme and undertaking such tasks as distributing water, monitoring the irrigation infrastructure, raising farmers' awareness about irrigation management, and mobilising farmers for meetings or maintenance work. This positive work ethic was complemented by the leaders' commitment to the irrigation scheme. Fieldwork observation revealed that the committee chairman often refused to come home if he had not finished his work. He sometime went out early in the morning or late at night if he knew there were problems relative to the scheme, e.g., an overflow of water resulting from unattended water application, conflicts over water, or a break in the main gates. Similarly, the leaders often undertook the more dangerous work such as diving into water to block holes or fix the main gates.

The farmers also believed that their leaders were honest and transparent in their governance and management of the scheme. This was reflected in how the leaders managed the FWUC budget. For example, they used the budget to pay for scheme maintenance and to respond to local requests and because of this, the farmers were convinced that the irrigation service fees they paid to the leaders had been used properly to improve the quality of the scheme infrastructure for the benefit of the FWUC as a whole. The leaders also held community meetings to inform the farmers of budget spending. The honesty and transparency of the leaders were also apparent in the farmers' everyday interactions with the leaders, and in the popularity of the leaders.

The leaders were willing to place the interests of the FWUC above their individual interests. For example, all of the leaders at the committee, group, and sub-group levels worked for little financial remuneration. Many of the leaders used their own motorbikes to patrol the irrigation scheme or they gave up time working on their own farms to help address FWUC problems. Similarly, the leaders of the O-treing Farmer Water User Community worked along-side the farmers to complete a task. For example, a leader said "If we just talk without getting involved in the work, the farmers will not listen to us. Leaders need to work even harder than members..."

The leaders also accepted that they were responsible for the work on the scheme. They helped arrange water requests for farmers, distribute the water, maintain the

irrigation infrastructure, and resolve conflicts for farmers. The leaders also helped each other to complete tasks for farmers and as such, farmers said that they had several leaders who they could reach out to for help. If their sub-group leaders were not available, they could ask for help from other group leaders or the committee. Interestingly, the farmers did not believe that higher education was an important attribute of good leadership capacity. Rather they believed that the attitudes of a leader were more important than their level of education. Highly educated people tended to leave the community and work for the government or private sector. They found that leaders with the right attitude, but a lower level of education, would seek out educational experiences to build their capacity so that they could better govern and manage the scheme. As such, a leader's attitude toward learning was more important than his or her level of education. The leaders sought out training from the Ministry and non-governmental organisations for areas in which they lacked expertise. One leader said "I found the techniques for measuring water quantity and water velocity very difficult to learn. However, I have asked the Ministry to provide additional training on this".

Another important attribute of leadership was the knowledge and skills of the leaders in the area of irrigation management. The knowledge and skills of the leaders were separated into the technical and organisational. The technical skills and knowledge included the ability of the leaders to distribute water to farmers and repair gates, canals, and the dam. They also included the way the leaders were familiar with the geographic location of the farmland, its topography, the scheme infrastructure, and the water routes through the FWUC. On the other hand, the organisational knowledge and skills included the ability of the leaders to motivate the farmers and lead the FWUC. The leaders were able to explain things to farmers and their explanations were clear and easily understood by the farmers. The leaders could also solve problems creatively. For example, the committee chairman often came up with strategies to solve problems. During fieldwork, it was observed that when the main gate locks were broken by offenders, the committee chairman designed new gate locks that were stronger. The leaders were also able to manage the budget, organise FWUC meetings, and complete the required paper work. They could communicate with external actors such as local authorities, non-governmental organisations, or the Ministry for support.

Authority was a third attribute of leadership capacity. The leaders at the O-treing Farmer Water User Community held authority over most aspects of irrigation management (Table 6.2). The only areas they were not responsible for were: 1) the

planning, funding and undertaking of large scale repairs and maintenance; 2) the punishment of serious offenders; and 3) the resolution of serious water conflicts.

Table 6.2. Division of authority amongst leaders in the O-treing Farmer Water User Community and other administrative bodies

		Farmer Water User Community	Ministry and Department of Water Resources and Meteorology	Commune Office	District Office
Mobilising farmers		√	---	---	---
Planning	Small repair or maintenance works	√	---	---	---
	Large repair or maintenance works	X	√	X	X
Distributing water		√	---	---	---
Maintaining the scheme (small-scale)		√	X	---	---
Financing	Collecting fees	√	---	---	---
	Withdrawing money from the bank	√	X	---	---
	Spending budget for administrative work and small-scale maintenance	√	X	X	X
	Spending budget for large-scale repairs or maintenance	X	√	X	X
Punishing offenders (verbal warning and cutting off water supply)		√	---	√	---
Punishing offenders (arresting and imposing a fine)		X	---	√	X
Resolving serious conflicts		X	---	X	√
<p>Note: √- Having power to make decisions X- Having rights to participate or be informed of --- Having neither power to make decisions nor rights to participate or be informed of</p>					

(Source: Based on a group discussion with the committee and key informant interviews)

Leadership capacity was found to be an important driver of success (Figure 6.14). First, because the leaders were honest and transparent, the farmers trusted them. Similarly, because the leaders had a positive work ethic, commitment to the irrigation scheme, and a willingness to put the interests of the FWUC ahead of their own, to work alongside farmers, and to accept responsibility, they were respected by the farmers. This trust and respect made the leaders popular with the farmers who were then more willing to participate in scheme activities (e.g., the payment of irrigation service fees, water distribution, scheme maintenance, and FWUC meetings).

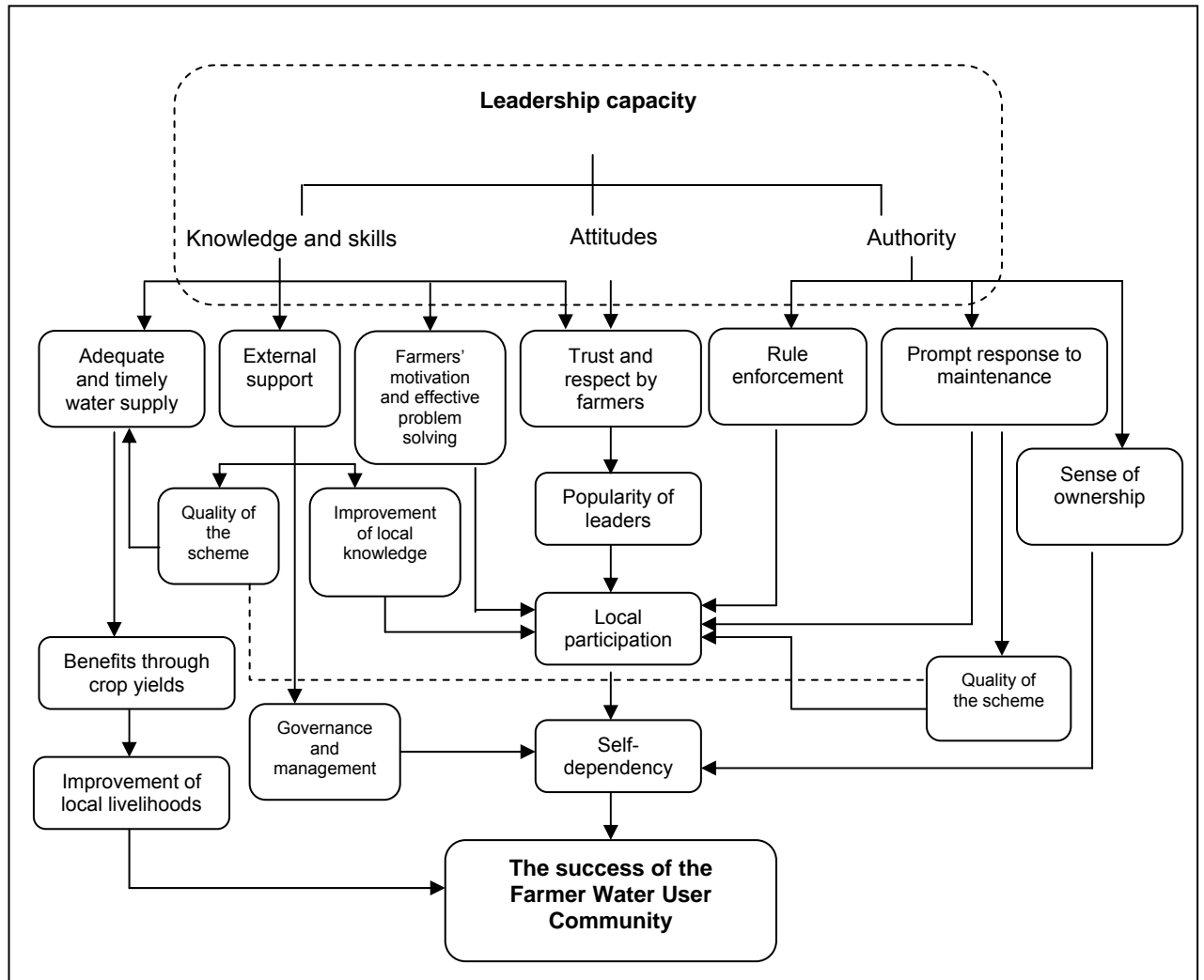


Figure 6.14. A diagram of the mechanisms through which the leadership capacity impacted on the success of the FWUC.

Furthermore, the knowledge and skills of irrigation management also led to trust by the farmers. Because of the strong technical and organisational skills of the leaders, the scheme was well run in terms of water allocation and distribution. This, in turn, led to the adequate and timely supply of water for cropping, resultant benefits through higher crop yields, and hence an improvement in local livelihoods. Moreover, the ability to motivate farmers and solve problems creatively also led to local participation. With their effective communication skills, the leaders could also ask for external support to improve the quality of the scheme infrastructure, strengthen their governance and management of the scheme, and improve farmers' knowledge (Section 6.3.6 on the impact of external support on success).

Because the leaders held the authority to manage the irrigation scheme with very limited interference from the Ministry or local authorities, they could respond promptly to maintenance problems and local requests for improvements to the scheme. This motivated farmers to participate in the payment of irrigation service fees. It also enhanced the quality of the scheme infrastructure, leading to higher local participation, as previously stated (Section 6.3.1) and the adequate and timely supply of water for the improvement of local livelihoods. This authority also allowed the leadership to enforce rules which then led to local participation in water distribution. Because the leadership held decision-making power over most of the important decisions associated with the scheme, both leaders and farmers developed a sense of ownership over the scheme which contributed to the self-dependency of the FWUC.

The leadership capacity of the O-treing Farmer Water User Community was influenced by several factors: the formation process of the FWUC, subsequent re-appointment process, the experience of the leaders, external support, incentives, the delegation of power by the government, and other positions as village chiefs or deputies (Figure 6.15). First, the leadership capacity was influenced by the formation process of the FWUC, which was facilitated by the Ministry with farmers setting the criteria by which they would select their leaders and then voting on the leadership candidates. This process helped select leaders with good leadership capacity. Second, it was found that some elected leaders still resigned from their jobs after having been working for a while. As such, the subsequent re-appointment process was critical for filling the vacancies. The appointment was still based on the criteria specified by the farmers during the formation process. The informal process was also critical for helping identify farmers who were interested in the work to replace those who lacked commitment. For example, one leader said, "I was not elected by the farmers. However, because I often got involved in irrigation work with the other FWUC leaders and they knew that I was industrious and could do the work, they appointed me to this position".

Third, the leadership capacity was also influenced by the experience of the leaders and the external support provided for training and capacity building. Most of the leaders at the O-treing Farmer Water User Community were reported to have engaged in irrigation management before the formation of the FWUC. Moreover, since its formation, the leaders had obtained extensive training from the Ministry of Water Resources and Meteorology. The leadership typically has attended between four and twelve training courses per year depending upon their positions in the structure.

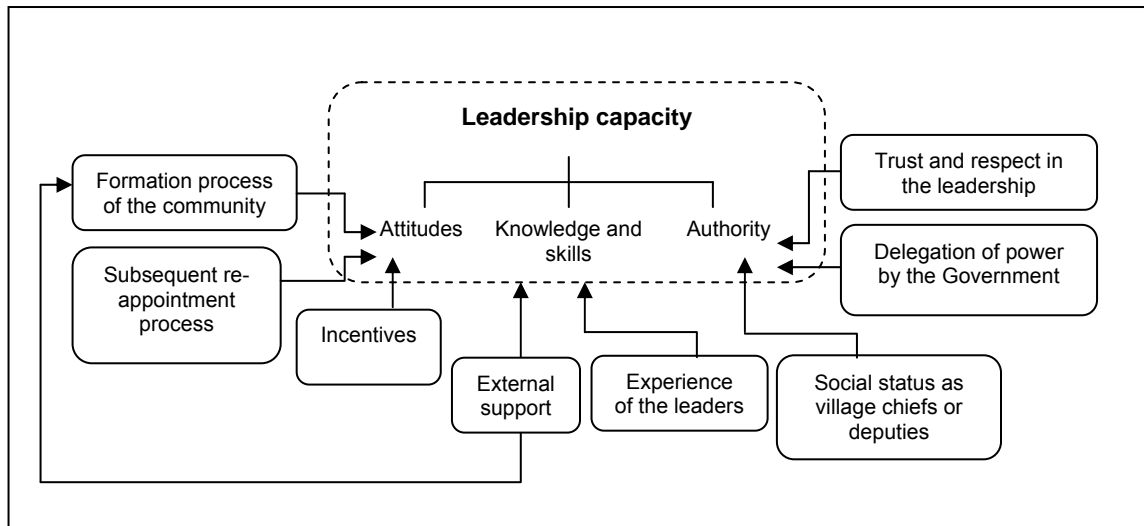


Figure 6.15. A diagram of factors that influenced the leadership capacity of FWUC leaders.

Fourth, incentives were another factor that influenced leadership capacity. Two types of incentives were identified: tangible and intangible. Tangible incentives included water and remuneration (less than USD 50.00/year) while the intangible rewards included the gratitude, local support and respect they received from the local farmers, and the satisfaction they obtained from seeing the livelihoods of their relatives, friends, and other members of the FWUC improved.

These incentives helped retain good leaders in leadership positions in the FWUC. It seems the leaders initially agreed to manage the scheme in order to obtain tangible rewards in the form of water, which allowed them to grow crops to enhance food security and to generate additional revenue. However, the leaders stated that it was the intangible rewards that motivated them to remain in their leadership positions. These intangible incentives convinced the leaders to keep working for the FWUC despite relatively low levels of remuneration.

Fifth, the authority of the local leaders came from three sources. First, the leaders at the O-treing Farmer Water User Community received the authority to operate the scheme from the government. In addition, the leaders also obtained authority from their positions as village chiefs or deputies. Another source of authority came from the trust and respect the farmers had for them because of their attitude, and the knowledge and skills with which they carried out the responsibilities of their positions.

6.3.2.2 The governance and management processes

The governance and management structures are an important element of the success of the O-treing Farmer Water User Community. It was found that the governance and management processes used by the leadership were also a significant determinant of the success of the FWUC. Two processes were highlighted as important for the success of the FWUC. The first was the process used by the government to form the O-treing Farmer Water User Community and the second was the decision-making process used by the FWUC to implement, enforce, and adapt the rules associated with the scheme. Each of these elements is discussed in detail in the following sections.

The Farmer Water User Community formation processes

The formation of the O-treing Farmer Water User Community was facilitated by the Ministry of Water Resources and Meteorology. During this process, it helped the farmers select suitable leaders and design rules for the operation of the scheme. The formation process was based on democratic principles that required local participation and decision making. Farmers were brought together by the Ministry in a series of public meetings to define the criteria for the selection of suitable leaders for the FWUC. Farmers and local authorities then nominated individuals as candidates using these criteria. After elections were held, farmers and the elected leaders crafted the rules under which the scheme would operate with the help of the Ministry.

The formation process influenced the success of the FWUC through two mechanisms (Figure 6.16). First, because the process focused on the selection of suitable leaders, the leadership capacity of the governance and management structure was enhanced, i.e. the farmers voted for leaders who they thought could govern and manage the scheme effectively. As previously stated, the leadership capacity influenced local participation which then led to self-dependency. Second, because the FWUC developed their own rules, the farmers were more willing to accept and comply with those rules. This, in turn, led to greater participation in the scheme.

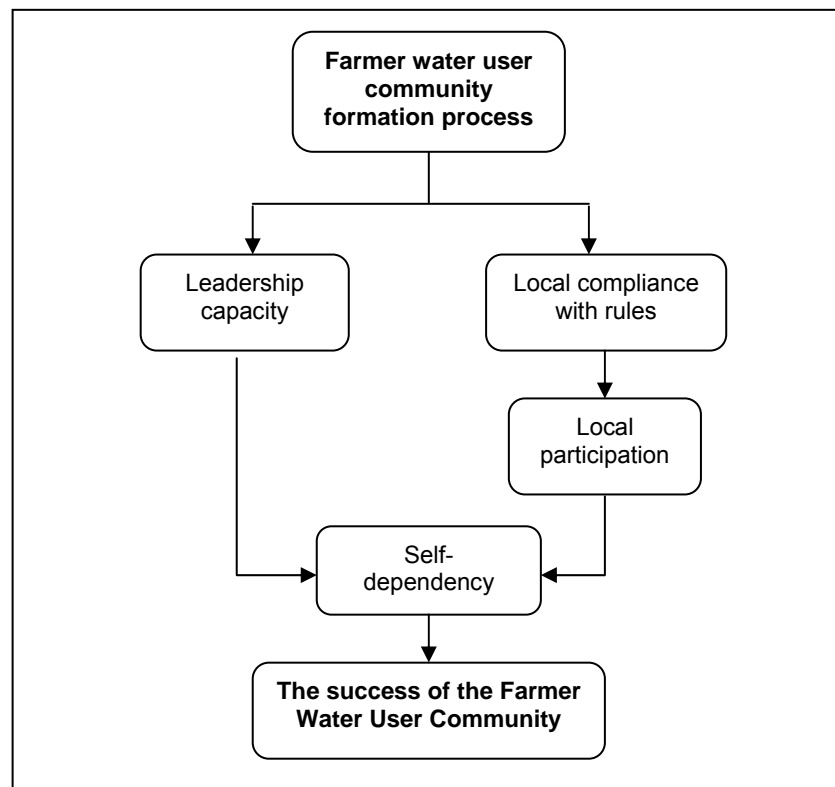


Figure 6.16. A diagram of the mechanisms through which the FWUC formation process impacted on the success of the FWUC

The formation process was influenced by two factors (Figure 6.17), the first of which was a high level of external support. The Ministry of Water Resources and Meteorology and the local authorities spent a lot of time and resources assisting with the formation of the Farmer Water User Community. The second factor was the local farmers' prior self-organisational experience with the management of the scheme. Because of this experience, the farmers were able to select leaders whom they knew would be effective and design rules for the scheme that were suitable for the local situation.

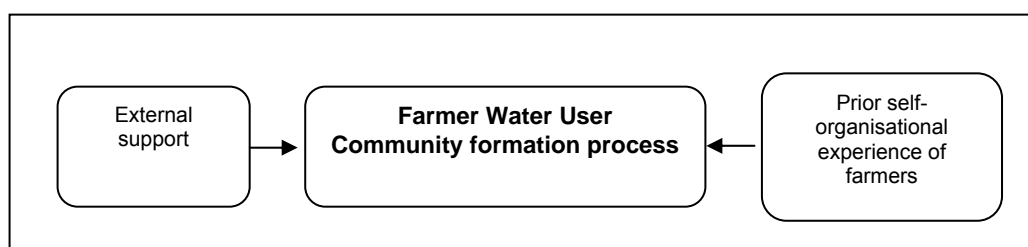


Figure 6.17. A diagram of the factors that influenced the FWUC formation process.

Decision-making processes - rule implementation

Rule implementation is the process of putting rules into practice, and it covers four areas in irrigation management: water allocation and distribution, scheme maintenance, fee collection, and financial management. The decision-making process used by the leadership of the FWUC during rule implementation could be described in terms of six criteria: consensus-based, inclusive, responsive, effective, transparent, and fair.

It was found that when making decisions on water allocation and distribution, and scheme maintenance and development, the leaders relied on local consensus and inclusiveness to make decisions. The leaders believed their decision-making processes had to be inclusive and consensus-based because if they were not, farmers might not take ownership in the decisions and the consequence of this was that they then would not participate in the operation of the scheme. "We (leaders) cannot decide things without discussion with farmers, otherwise we end up doing the work alone" one leader explained. An example of consensus-based decision making occurred at a water assessment meeting prior to the planting season. During the meeting, the farmers were informed about water availability in the reservoir and were asked to discuss who should be allocated water. To promote inclusiveness, the leaders made sure all the farmers (land owners, tenants, farmers above the reservoir, and farmers from the reservoir, and the head, middle, and tail of the scheme) were invited to the meeting and their needs were included in the decisions.

The leaders also tried to be responsive to farmers' needs. Local farmers could make requests during FWUC meetings and these were discussed and a consensus was reached as to whether or not to implement the request. If a request was beyond the capacity of the FWUC, the leaders would seek assistance from external sources such as the local authorities, or the Ministry of Water Resources and Meteorology.

The leaders also aimed to make effective decisions in such areas as water allocation and distribution, scheme maintenance, and fee collection. This was reflected in the efforts of the local leaders to engage and mobilise farmers to participate in water distribution and scheme maintenance and to ask for external support from the Ministry, local authorities or non-governmental organisations. The leaders also raised local awareness of rules as a mechanism for enhancing local participation. As for effective fee collection, the leaders announced the due date before going to collect fees at an

assigned place in each village. They also went door to door to collect the fees from those farmers who failed to come to the designated payment location.

The leaders promoted transparency and fairness in decision making, especially in relation to financial management and water distribution. For example, they reported the total budget, including funds accumulated from fee collection as well as expenses, to farmers and the Ministry. They also ensured fairness among farmers in water distribution. Only those who requested water were allowed to access water and the process was based on first come first served.

Rule implementation influenced the success of the O-treing Farmer Water User Community through several mechanisms (Figure 6.18). First, the promotion of consensus-based and inclusive decision making led to a low level of conflicts over water within the FWUC. Farmers were also much more likely to have a sense of ownership and comply with the rules because they had had a say in creating them. The low level of water conflicts, a sense of ownership, and local compliance with the rules contributed to the self-dependency of the FWUC. Second, the effective water distribution through the adequate and timely supply of water allowed the farmers to grow crops and obtain benefits through improved crop yields, which further improved their livelihoods. This also contributed to local participation by the farmers. Similarly, the regular scheme maintenance resulted in a high quality of the scheme infrastructure, while effective fee collection ensured that financial resources would be available to the leaders for maintaining and operating the scheme. This, again, had a positive effect on the quality of the scheme infrastructure, contributing to the adequate and timely supply of water to the farmers. Third, consensus-based, inclusive, responsive, effective, transparent, and fair decision making created a well-founded trust in the leadership on the part of the farmers, and thus ensured greater local participation in fee payment. This, in turn, led to greater self-dependency of the FWUC.

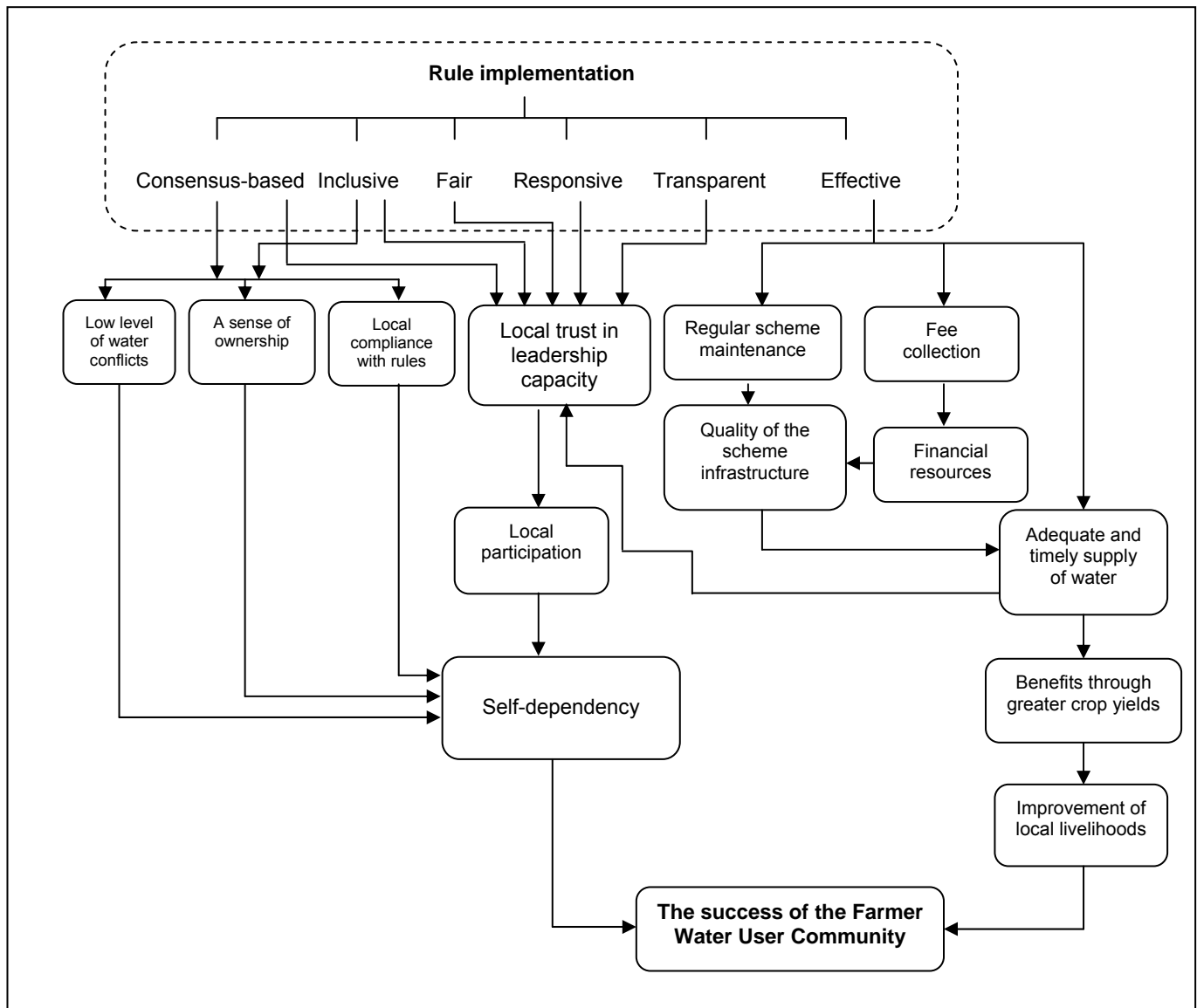


Figure 6.18. A diagram of the mechanisms through which rule implementation impacted on the success of the FWUC

The implementation of FWUC rules was influenced by a number of factors (Figure 6.19). Effective rule implementation was dependent upon the leadership capacity to lead including their authority. Additionally, local participation in the payment of irrigation service fees, water distribution, scheme maintenance, and FWUC meetings, along with access to financial resources, contributed to the successful implementation of FWUC rules.

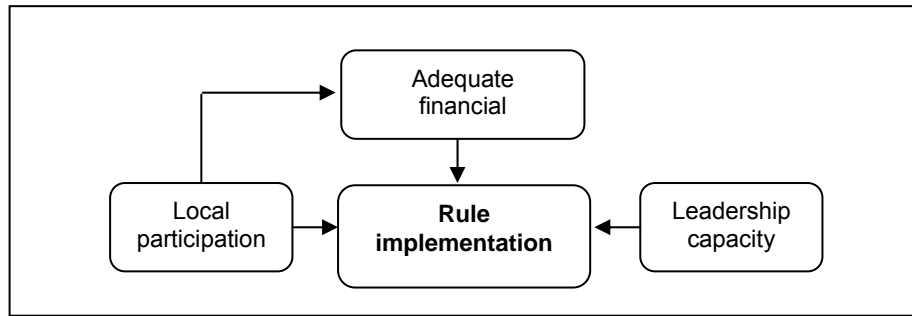


Figure 6.19. A diagram of the factors that influenced the effectiveness of rule implementation in the FWUC

Decision-making processes - rule enforcement

Rule enforcement is defined as the process of making sure that the rules are obeyed by the farmers through the punishment of those who disobey. In the O-treing Farmer Water User Community, only those farmers who filed a water request with the committee could obtain water. Farmers who did not follow this rule were denied access to water by the committee. Consistent rule enforcement impacted on the success of the FWUC through reducing water theft and ensuring fairness among members concerning water access (Figure 6.20). This then led to greater local participation in the scheme and hence, enhanced self-dependency of the FWUC.

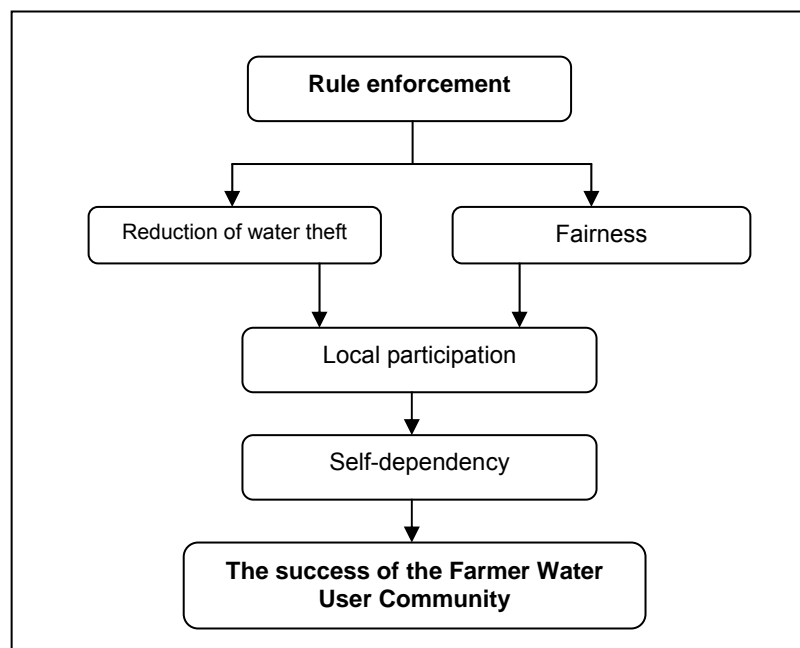


Figure 6.20. A diagram of the mechanisms through which rule enforcement impacted on the success of the FWUC

Rule enforcement was influenced by three factors: the authority of the leaders to enforce the rules, external support, and trust in the leadership capacity (Figure 6.21). First, the authority of the leaders to enforce the rules came from the government, their other positions as village chiefs or deputies, and the trust and respect the FWUC had for them. Second, the authority to enforce the rules was also reinforced by external support from the local authorities, especially at the commune and district level. The commune and district authorities helped raise local awareness of the rules and gave verbal warning to offenders. Finally, because the farmers trusted the leadership to distribute the water fairly and effectively, they were less inclined to break the rules.

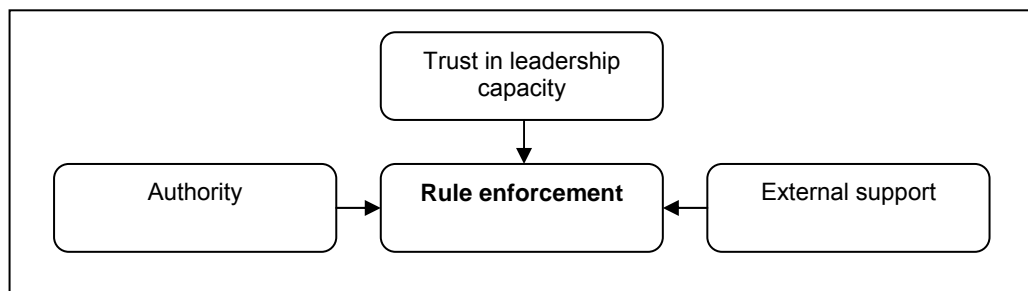


Figure 6.21. A diagram of the factors that influenced rule enforcement in the FWUC.

Decision-making processes - rule adaptation

Rule adaptation is defined as the process of adapting the rules in response to specific situations (see below). Rule were adapted on the bases of five factors: 1) crop failure, 2) leadership commitments or workload, 3) farmer workload, 4) water availability, and 5) the level of water access. The leadership used rule adaptation in four areas: 1) the collection of irrigation service fees, 2) the responsibilities to leaders, 3) farmer attendance at FWUC meetings and participation in scheme maintenance, and 4) water access. These adapted rules were informally adopted as rules-in-use that were accepted by all the farmers within the FWUC.

The constitution of the FWUC stipulated that farmers must pay full irrigation service fees regardless of the level of crop production they achieved in any one season. However, in practice the fees were paid based on the level of crop produce a farmer achieved. Farmers were required to pay full irrigation service fees if they achieved reasonable levels of crop production. However, if crop yields were considerably below expectations, farmers were charged a lower level of fees, and in the case of complete

crop failure, fees were waived. The farmers were also allowed to delay their payment until the next season if they lacked financial resources.

The rules also set out the specific responsibilities of leaders of the irrigation scheme and it was stipulated that if they failed to undertake these responsibilities, a fine would be imposed. However, in practice leaders could take a reasonable amount of time off for other livelihood activities without punishment. These leaders were allowed to delegate some of their tasks associated with the irrigation scheme to other members of the FWUC.

The rules also stipulated that farmers had to participate in FWUC meetings and maintenance activities. However, those who did not attend these activities were not punished. Farmers were often busy during planting and harvesting periods and did not always have time to attend meetings or help out with repairs and maintenance on the scheme. In response to this problem, the leaders adjusted the schedules of the meetings and maintenance work accordingly, or they used the FWUC budget to hire available farmers to do the work. The leaders also asked for participation from farmers at the head and middle of the scheme more often than farmers at the tail, because these members obtained a greater level of water for their farmland.

Similarly, the rules stated that all farmer members were entitled to access to water. However, this rule was adapted in accordance with water availability within the FWUC. If irrigation water was plentiful, all the members could access adequate water. If the FWUC had excess water beyond that required by the members, it could allocate the surplus water to non-members for a fee to generate extra revenue. However, if irrigation water was insufficient for the needs of the farmers, a collective decision was made about who would be allocated adequate water and who would not receive any, during the dry season. The farmers had learnt from experience that ultimately, there was no benefit from receiving inadequate water during the dry season because they would bear the cost of establishing their crop only to see it failed as the water supply ran out. As such, the FWUC decided it was better to allocate sufficient water to fewer farmers than to grant an equal, but insufficient, amount to all. Only those who farmed near the main canals or the reservoir (usually the head and middle farmers) were allocated water during the dry season in years of inadequate irrigation water supply.

The adaptation of FWUC rules also impacted on the success of the FWUC through several mechanisms (Figure 6.22). First, the adaptation of the fee collection rule to

accommodate variations in crop production was viewed by the FWUC as a fair rule for those farmers who experienced crop failure. This, in turn, increased farmers' trust in the leadership and improved their participation in the scheme. Second, the adaption of the rule that specified the responsibilities of leaders helped retain good leaders in leadership positions within the FWUC, hence maintaining consistent leadership capacity which contributed to FWUC self-dependence. Third, the adaptation of the rule concerning participation at meetings and in maintenance activities based on farmer workload and the level of water access was also viewed as fair by farmers, especially by those farming at the tail of the scheme who were not allocated water when the supply was inadequate. This again led to trust and increased local participation. Last, the adaptation of the water allocation and distribution rule based on the availability of water in the reservoir helped avoid crop failure and the associated financial losses throughout the FWUC when water was in short supply, and this contributed to the improvement in local livelihoods.

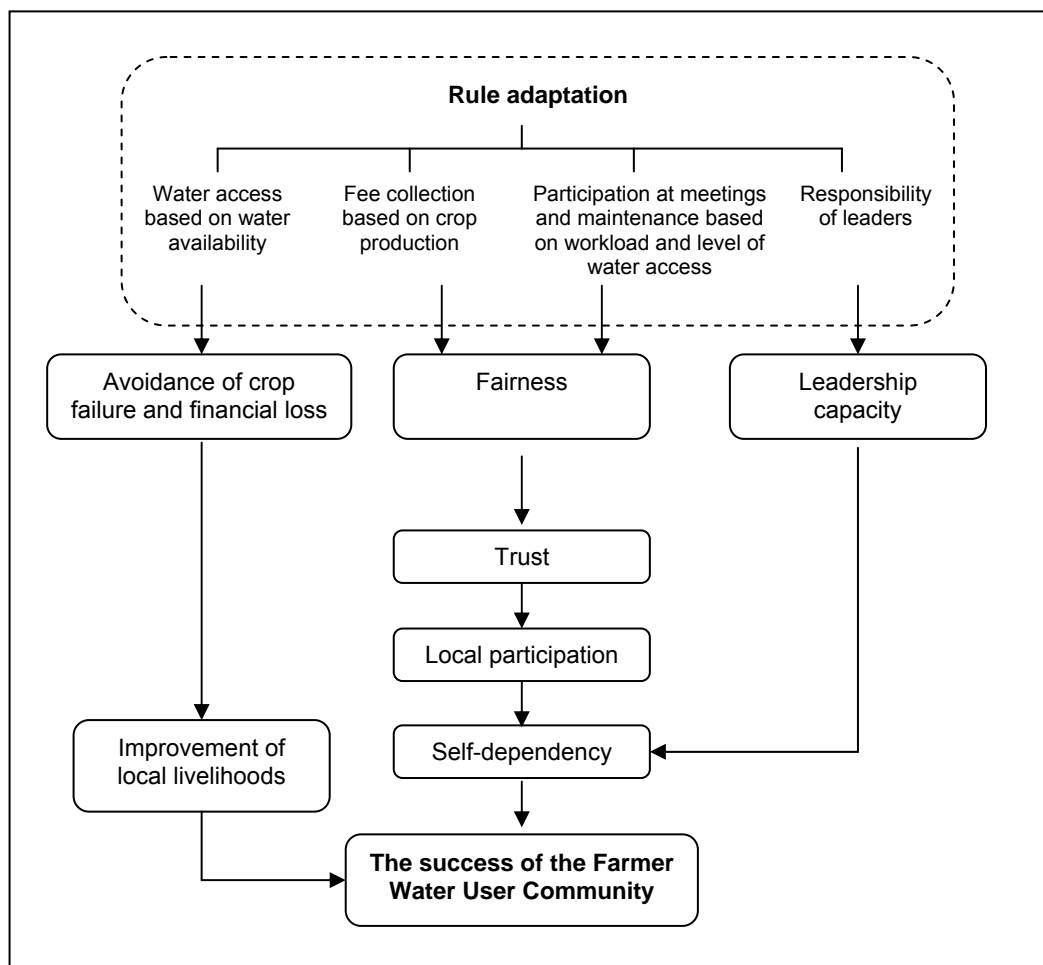


Figure 6.22. A diagram of the mechanisms through which rule adaptation impacted on the success of the FWUC

Rule adaptation was influenced by two factors: leadership capacity including the level of authority exercised by the leaders, and external support (Figure 6.23). The leaders could adapt the rules because they had the local knowledge and the skills to govern and manage the scheme appropriately for their area. The leaders were creative and worked closely with the local farmers so that they were aware of local issues and local needs. They listened to their farmer members and took their concerns into account when adapting the rules. Furthermore, the leaders could adapt the rules because they held authority over most aspects of irrigation management without interference from external actors. The leaders obtained external support from the Ministry and other local authorities who helped provide consultation to assist with effective adapting of the rules.

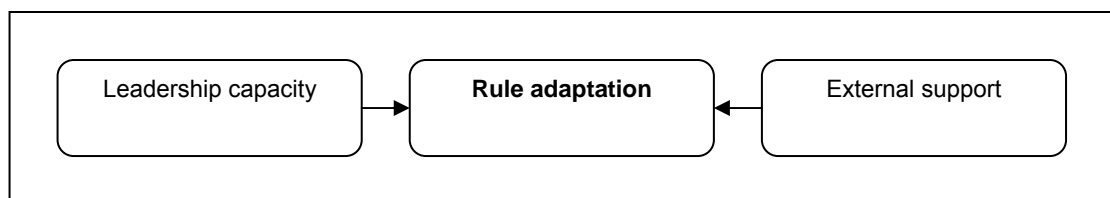


Figure 6.23. A diagram of the factors that influenced rule adaptation in the FWUC

6.3.3 The value of the benefits that flowed from the irrigation scheme

The value of the benefits that flowed from the irrigation scheme was another factor that influenced the success of the O-treing Farmer Water User Community. Two types of benefits were provided by the irrigation scheme: enhanced food security and additional revenue. Farmers in the O-treing Farmer Water User Community relied on rainfall to grow rice during the wet season. However, the rainfall was often inadequate, so irrigation water was used to ensure high crop yields. Farmers needed the irrigation water in order to sow seeds and transplant seedlings in some years, while in others, farmers used the irrigation water to irrigate their land until their rice was ready for harvest.

The majority of farmers viewed the enhanced rice yields during the wet season as the most important benefit that flowed from the irrigation scheme. This was because farmers in the FWUC primarily grew wet season rice for food consumption. Wet season

rice ensured food security in their households. Some families who did not have other sources of revenue sold a portion of their wet season rice yield to generate revenue to cover their other expenses.

The other benefit derived from the irrigation scheme was the revenue generated from the sale of crops produced during the dry season. The farmers grew dry season rice or other crops such as watermelons, wax gourds, or pumpkins. Because there was little rainfall over this period, the farmers relied almost entirely on irrigation water for production. Importantly, the revenue generated from these crops was almost two to four times the total cost of production including the irrigation service fees (Table 6.3). As such, dry season crops were a good source of revenue.

Table 6.3. Examples of the costs accrued and revenue produced from dry season crop production, 2008

Land size (ha)	Type of crops	Total costs (USD) (including ISFs)	Total revenue (USD)	Total revenue (% of costs)
1.00	Watermelon	75	500	769
0.30	Watermelon	43	160	400
0.10	Watermelon	64	125	198
0.35	Wax gourd	104	250	250
0.20	Wax gourd	152	300	200
0.15	Wax gourd	62	150	250
0.30	Pumpkin	43	150	375

The revenue generated by dry season crops was important to local farmers because there were few jobs during the dry season and the farmers lacked the skills to work in areas other than farming. During a group discussion in Ang Sangkream, participants said “The O-treing irrigation scheme has been valuable because it supports our living. Without this irrigation, we would have nothing to do in the dry season. We cannot go to sell dishes, salt, or oil door to door like villagers in Paing Na because we have never done that before”. Other farmers also pointed out that they could find employment during the dry season, but the revenue they earned from such employment was not as much as the revenue they could generate from growing crops over the same time period. A farmer in Ang Romeas village said “I earn more than 2 millions riels from growing crops within 2 months. I cannot think of other jobs that provide such a lucrative benefit.”

Not all the farmers in the O-treing Farmer Water User Community could generate revenue from dry season crop production. Only Ang Sangkream village in Chung Rouk commune could irrigate all of its farmland during the dry season. Villages at the tail of the scheme such as Chrey and Ka Yiev had the lowest percentage of land under irrigation (13% and 10% respectively). In the area above the reservoir, at Prey Gniel commune, the amount of farmland under dry season irrigation ranged from 52% in Chhouk Sor village to only 8% in Prey Rongieng village.

Interviews and group discussions indicated that farmers who failed to grow crops during the dry season did not blame the leaders for this. This was partly because these farmers were pleased they could at least get irrigation water during the wet season. Moreover, the farmers believed that the lack of water supply to their farm was the result of low water availability in the reservoir due to low rainfall, and understood their irrigation to be hampered by the difficult topography and the distance of their farmland from the scheme. These farmers trusted that when the irrigation water was plentiful at the level that reached their land, the leaders would distribute it to them. Further, farmers at the tail of the scheme were not interested in obtaining irrigation water during periods of water scarcity because of the high time costs associated with water access. These farmers had to follow the water from the reservoir to their farms which could take one or two days per irrigation.

The value of the benefits that flowed from the irrigation scheme impacted on the success of the FWUC through two mechanisms (Figure 6.24). First, the benefits from enhanced crop yields and additional revenue ensured the improvement in local livelihoods. Second, it also provided the major incentive for farmers to participate in the scheme. The farmers realised that if the scheme infrastructure was well-maintained and managed they would obtain benefits in terms of enhanced food and livelihood security. As such, the farmers were willing to participate in the payment of ISFs, and help with repairs and maintenance of the scheme infrastructure and with water distribution and attend the associated FWUC meetings. Greater participation in the scheme has led to greater self-dependency.

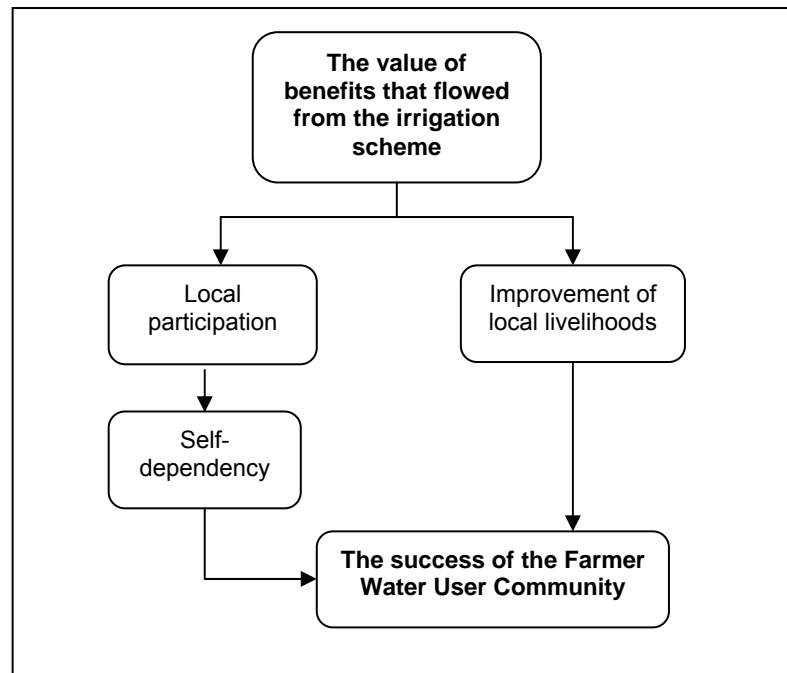


Figure 6.24. A diagram of the mechanisms through which the value of benefits impacted on the success of the FWUC

The benefits from the irrigation scheme were influenced by two factors (Figure 6.25). The farmers enhanced their yields for wet season rice and some of them were able to grow dry season crops partly because they received a sufficient and timely supply of water as a result of the effective governance and management of the water distribution process and the quality of the scheme infrastructure. In addition to this, farmers could also obtain revenue because they had good access to markets for their dry season crops. Farmers had the choice of selling direct to the district and/or Phnom Penh markets, or selling through a middleman. Detailed information on market access is described in Section 6.3.7.

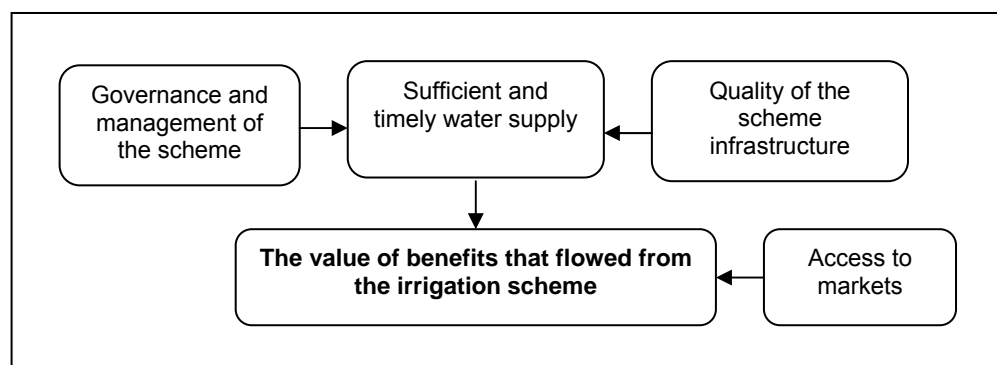


Figure 6.25. A diagram of the factors that influenced the value of benefits that flowed from the irrigation scheme

6.3.4 The quality of the irrigation infrastructure

One of the important factors that has influenced the success of the O-treing Farmer Water User Community is the quality of the irrigation infrastructure. This is reflected in the large reservoir (2,563,750 m³) that is available to capture the rain that falls on the catchment. The reservoir is also well constructed with little leakage which ensures minimal water losses. The combination of these characteristics ensures sufficient water storage and hence a low likelihood of crop failure during the wet season, along with surplus water for cropping during the dry season. This, in turn, ensures food security and additional revenue for the O-treing Farmer Water User Community, a critical factor in sustaining the farmers' livelihoods (Figure 6.26).

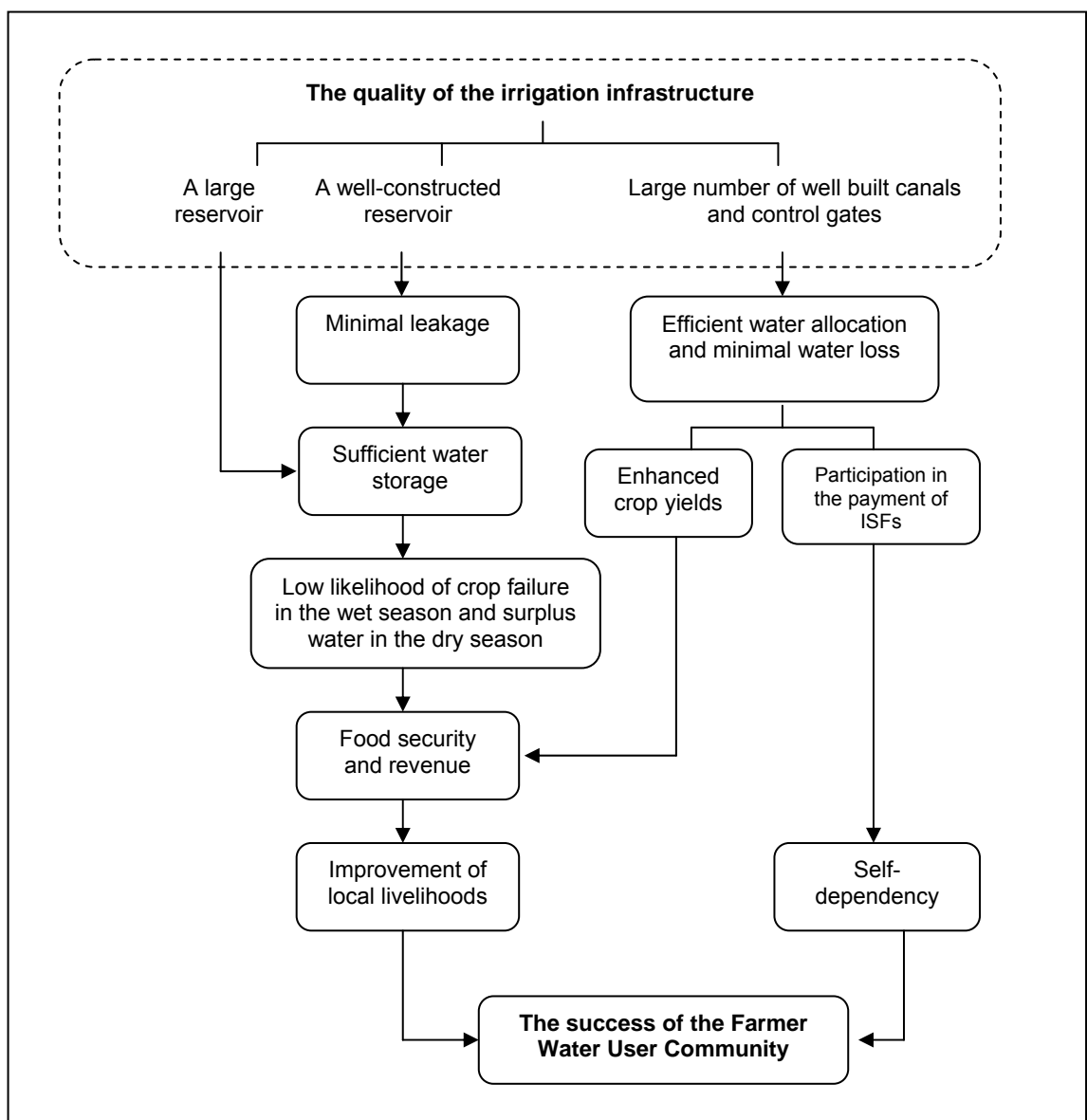


Figure 6.26. A diagram of the mechanisms through which the quality of the irrigation infrastructure has impacted on the success of the FWUC

The quality of the irrigation infrastructure is also reflected in the large number of well built canals and support structures (control gates) that allow water to be efficiently allocated, with minimal water loss, to the members of the FWUC. This ensures high crop yields that further improve food security and revenue from dry season crops. Because the irrigation infrastructure provides the farmers with an adequate and timely supply of water, they are willing to participate in the fee payment which in turn has led to greater FWUC self-dependency.

There are several reasons why the O-treing irrigation scheme has a high quality of the scheme infrastructure (Figure 6.27). First, as a historical coincidence, the Pol Pot regime built a good basic irrigation scheme for the FWUC in the 1970s. Second, the FWUC obtained external support from the government and from non-governmental organisations for major rehabilitation of the scheme. This major rehabilitation was assisted by support from the local authorities (i.e., the communes and the district) to address land conflicts resulting from scheme rehabilitation. Third, the governance and management of the scheme through good leadership capacity has ensured the infrastructure is well-maintained. The leaders have collected fees to fund the maintenance, mobilised local farmers to participate in maintenance work and hired local farmers to carry out more specialised work. Fourth, the quality of the scheme was also reliant on the level of local participation in scheme maintenance. Finally, the infrastructure was in good condition because the scheme is situated in a favourable location where the occurrence of flooding and storms are relatively rare.

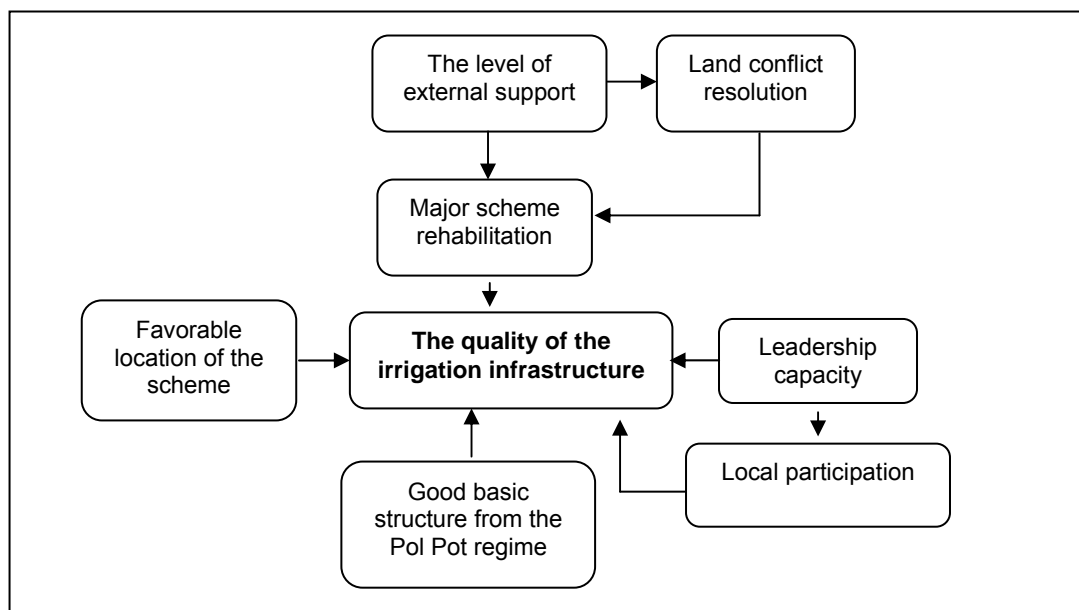


Figure 6.27. A diagram of the factors that influenced the quality of the irrigation infrastructure

6.3.5 The characteristics of farmers

The characteristics of farmers are another important factor that influences the success of the O-treing Farmer Water User Community. This research identified four common characteristics of farmers that influenced the success of the O-treing Farmer Water User Community. These included: 1) the group size, 2) the homogeneity of the local farmers, 3) the farmers' dependency on cropping for their livelihood, and 4) the farmers' level of prior experience with self-organisation in irrigation management. First, the FWUC is structured into groups and sub-groups, so the number of farmers is also divided into small. Because the size of farmer group and sub-groups is small, the leaders can implement and enforce FWUC rules easily. The small groups of farmers also ensure frequent interactions among the farmers and allow them to monitor each other in water distribution and scheme maintenance. This contributes to effective rule implementation and enforcement and then leads to self-dependency of the FWUC.

Second, the local farmers in the FWUC are relatively homogenous because they share the same culture, ethnicity, interests and cultivation practices. Further, the majority of the farmers in the FWUC are classified as having a medium level of poverty in that they share similar endowments and livelihood strategies. Because the farmers are relatively homogenous, they have similar beliefs, views, and perceptions, which facilitate cooperation in the management of the irrigation scheme (Figure, 6.28).

Third, the farmers have a high level of dependency on cropping for their livelihoods. As such, they believed that the irrigation scheme was critical to their livelihoods. Because of this, they actively participated in the scheme (Figure 6.28). Fourth, the farmers had experienced the opportunity for prior involvement with self-organisation in irrigation management as the FWUC was at first self-organised and then became informally organised by the District Office and Department of Agriculture from 1995 until 2000 (see Chapter 5, Section 5.2). This familiarity with self-organisation affected the success of the FWUC in three ways (Figure 6.28). First, the local leaders had pre-existing leadership capacity in the management of an irrigation scheme. This contributed to the effectiveness of the governance and management of the scheme. Second, local farmers were allowed to develop effective rules that were based on their past experiences, and this again contributed to the effective governance and management of the scheme. Third, the farmers were aware of the importance of their participation in irrigation management in terms of its impact on their livelihoods, and this influenced their participation in the FWUC.

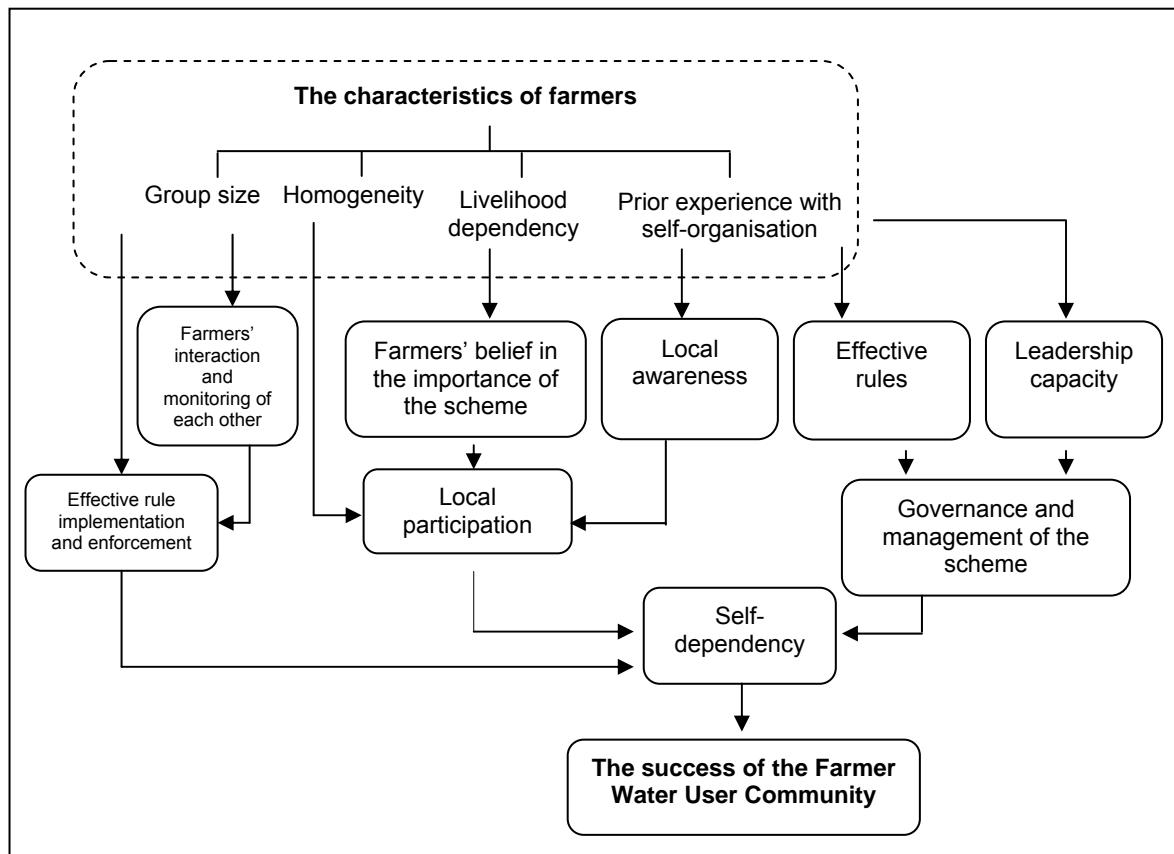


Figure 6.28. A diagram of the mechanisms through which the characteristics of farmers impacted on the success of the FWUC

6.3.6 The level of external support

The level of external support was the first external factor that influenced the success of the O-treing Farmer Water User Community. The FWUC obtained a high level of support from the government (the Ministry and Department of Water Resources and Meteorology), local authorities (district and commune), and non-governmental organisations (WFP and Social Foundation). This support took a number of forms and included: scheme rehabilitation and development, assistance with the formation of the Farmer Water User Community, training (capacity building), provision of financial resources as shared expenses in the first two years, consultation and assistance with rule enforcement, and conflict resolution.

The external support initially impacted on three key components of the O-treing Farmer Water User Community (Figure 6.29). First, it improved the quality of the irrigation

infrastructure by rehabilitating the scheme. Second, it improved the knowledge and skills of local farmers and leaders concerning irrigation management through training and capacity building programmes. Third, it enhanced the governance and management of the scheme by helping with the formation of the FWUC, providing finance to the leadership, and assisting with consultation, rule enforcement and conflict resolution. The improved quality of the scheme infrastructure contributed to the timely and adequate supply of water to farmers, hence leading to the benefits of greater crop yields which then contributed to the improvement of local livelihoods. Similarly, the improvement in farmers' knowledge led to farmer participation in irrigation management, and the improvement in leaders' knowledge contributed to good leadership capacity, which then impacted on the governance and management of the scheme. The local participation and the governance and management of the scheme then impacted on the self dependency of the FWUC. The local participation and the governance and management of the scheme then impacted on the self dependency of the FWUC.

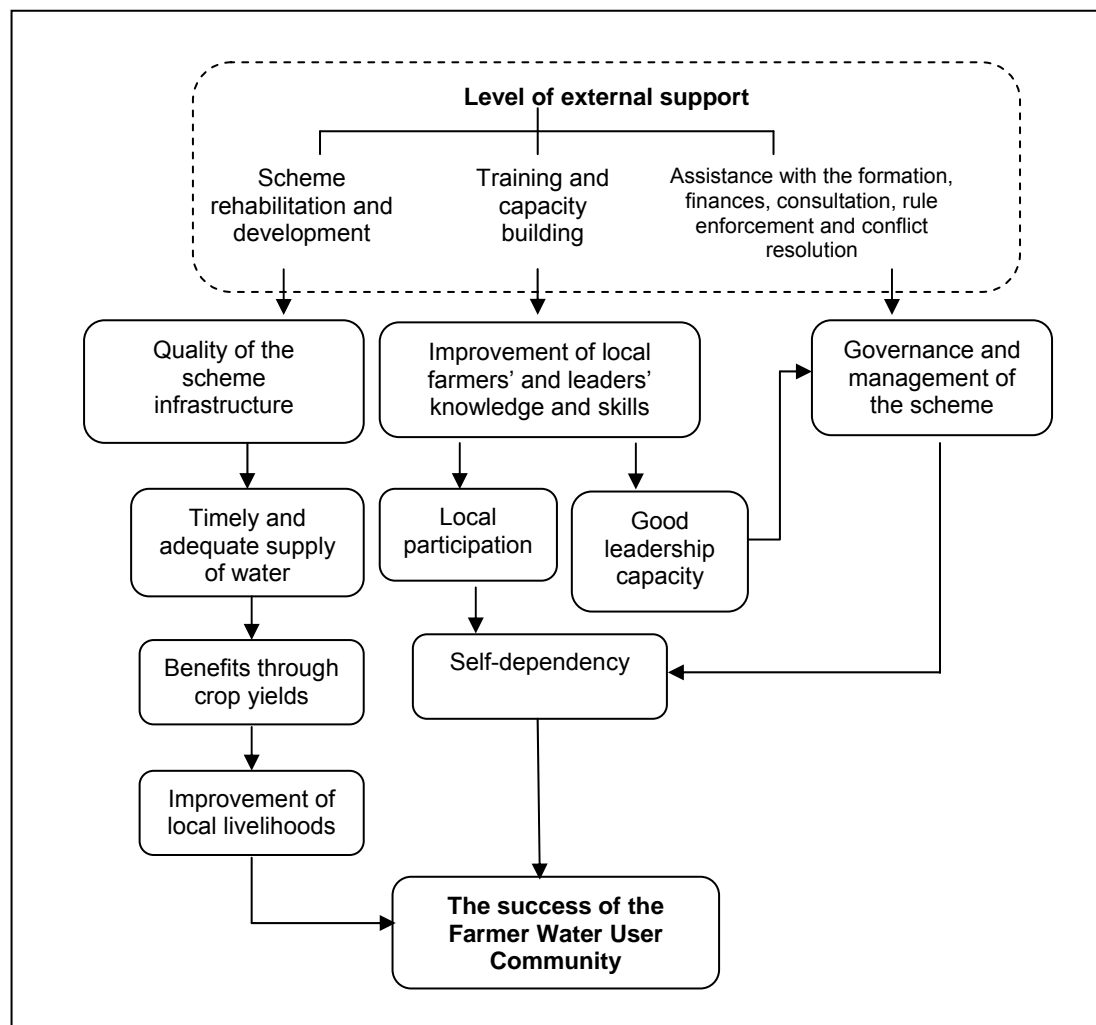


Figure 6.29. A diagram of the mechanisms through which external support impacted on the success of the FWUC

The researcher also observed that the support provided by the government and local authorities was ongoing, but tended not to interfere with local autonomy. The government and the local authorities provided ongoing support in terms of consultation, rule enforcement, and conflict resolution, but did not tend to interfere with local decisions as FWUC leaders still held most of decision-making power (see section on leadership capacity).

The FWUC obtained external support from the government and the NGOs for two reasons (Figure 6.30). First of all, the O-treing Farmer Water User Community was established as a pilot PIMD scheme by the Ministry of Water Resources and Meteorology to implement the Participatory Irrigation Management and Development programme. As such, the government was motivated to provide support to this FWUC. Furthermore, because the FWUC had good leadership capacity, the government and the NGOs were willing to support the scheme.

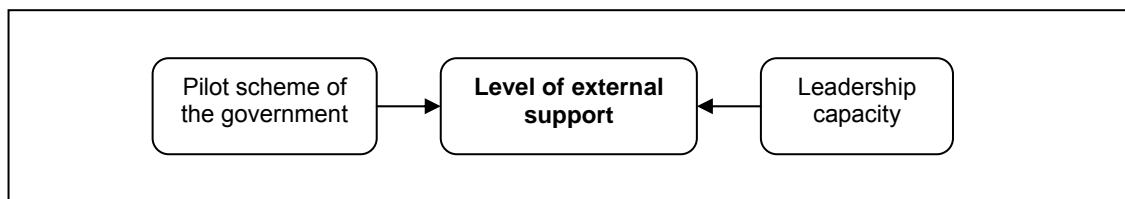


Figure 6.30. A diagram of the factors that influenced the level of external support for the FWUC

6.3.7 Market access

Market access was the other external factor that influenced the success of the O-treing Farmer Water User Community. Because the local farmers had access to good markets for their produce, they obtained revenue from which they could pay their irrigation service fees, further enhancing the self-dependency of the FWUC. Having received revenue from crop production, the livelihoods of local farmers were also improved (Figure 6.31). Farmers accessed markets in two ways: they either sold directly their produce at markets, or they sold it to middlemen at the farm gate.

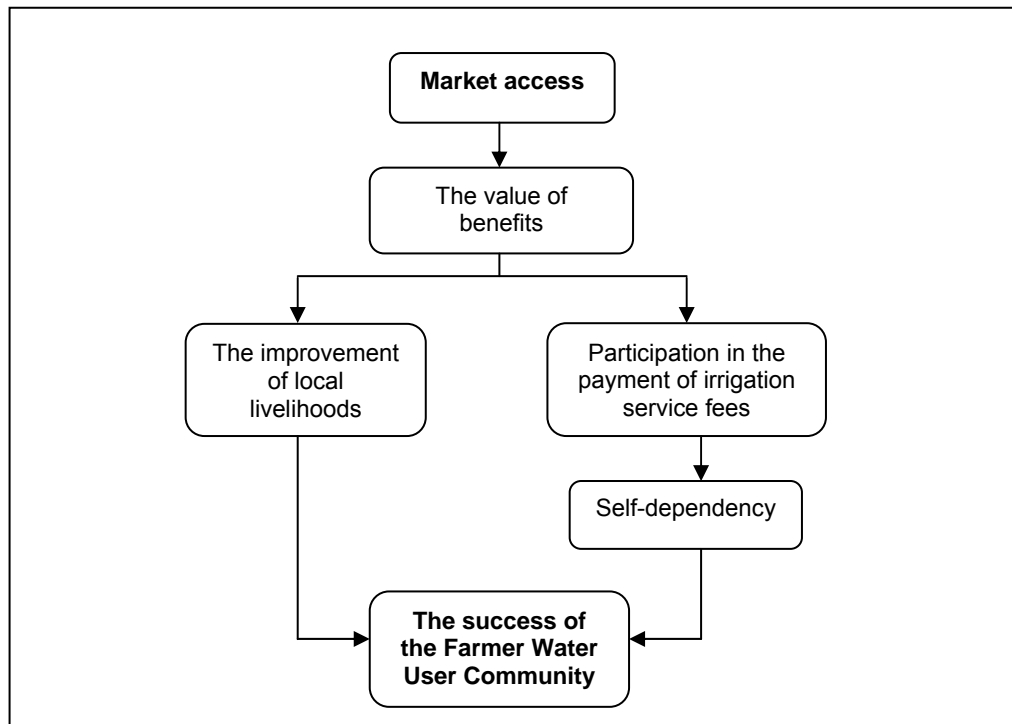


Figure 6.31. A diagram of the mechanisms through which the availability of market access impacted on the success of the FWUC

Farmers could sell their produce at two local markets (Tram Kna and Doeum Roka markets) and numerous markets in Phnom Penh. There were no constraints to market access. The FWUC had good local roads and was located along National Road 3 that led to Phnom Penh. Interviews indicated that farmers would travel 15 minutes by motorbike or taxi in order to bring their produce to the local markets which cost them around USD 2-3. Farmers could also bring their produce to markets in Phnom Penh which would take them less than two hours by taxi and cost around USD 5-10. Such transportation costs were not expensive relative to the returns farmers could obtain from selling their produce at these markets.

The price farmers received at the markets was normally double what they received from selling to middlemen at the farm gate. However, the majority of farmers preferred to sell their produce at the farm gate because they could sell it all at once. This was good for their cash flow and they did not need to worry about storage and losses. The middlemen were also willing to pay for the produce before harvest and cover the farmers' growing costs such as fertiliser, pesticide and labour until harvest date. The middlemen would also harvest and transport the produce to market. Farmers who sold

their produce at the markets had to be in regular contact with retailers and this incurred both time and financial costs that the majority of farmers preferred to avoid.

There were several middlemen in the FWUC. The majority of these middlemen were outsiders from various places across the country while some were local farmers. It was likely that the middlemen came to the FWUC to purchase their produce for three reasons (Figure 6.32). First, because the FWUC was close to the local markets and the markets in Phnom Penh and the road conditions were good, transportation costs were not expensive. Second, the O-treing Farmer Water User Community was one of a few places in Kong Pisei district that produced a large proportion of watermelons and wax gourds during the dry season. As such, middlemen often came to the FWUC to buy crop produce. In addition to this, middlemen liked purchasing produce from the FWUC because of the high quality of crops they would find there. A farmer in Ang Sangkream said:

I know that three or four places in Kong Pisei District that also supply watermelons, but they do not grow as much as our farmers do during the dry season. This is because they do not have plentiful water like us. Farmers in those places can cultivate only 5 to 10 hectares, while for us, we grow hundreds of hectares...The middlemen often come to our place because they are sure that we will have produce to sell.

while a farmer in Chum Srok commented:

Our produce is of a good quality. Our watermelon is sweet and our wax gourd is tasty, so consumers like buying it. Although we sell it in the local markets, we always get better prices than produce from other places. Middlemen know this, so they like buying our produce.

and a local middleman remarked:

I buy wax gourds from farmers and then I sell them to wholesalers in Phnom Penh. The wholesalers buy all the produce I have. No matter how much I have, I can sell all of it.

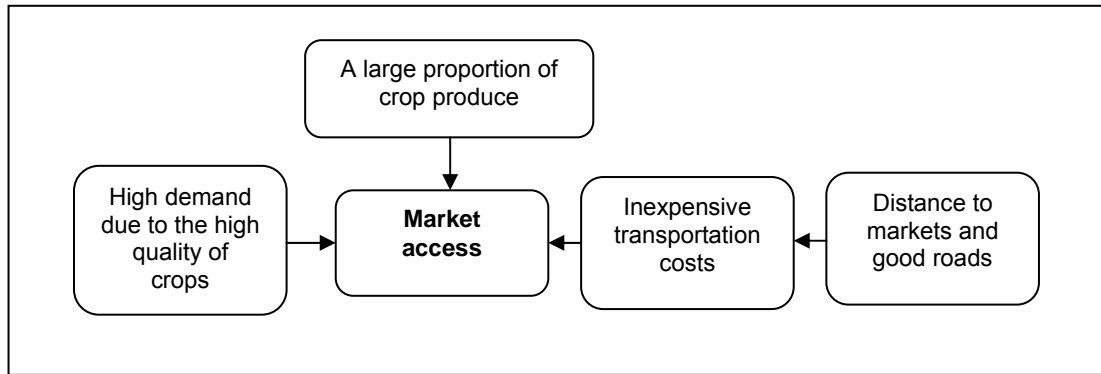


Figure 6.32. A diagram of the factors that influenced market access

Farmers stated that different middlemen offered different prices depending upon whom they sold the produce to. Middlemen from Phnom Penh, Koh Kong province, and Kandal province often gave higher prices than other middlemen because of high demand in those areas. The price also changed according to the time of year. Farmers were reported to obtain high prices between December and April when there was less competition from growers in other districts.

6.4 Conclusion

In this chapter, the empirical case study results were presented. It was found that different stakeholders used different criteria to define the success of the O-treing Farmer Water User Community. Based on these different views, the success of the O-treing Farmer Water User Community was likely to be centred on two features. First, the success of the FWUC referred to the level of the self-dependency attained by local leaders and farmers which was reflected in their ability to manage the irrigation system with limited external support. Second, the success was reflected in the degree to which the scheme improved the local livelihood of the FWUC in terms of food security and household revenue from crop production.

The success of the O-treing Farmer Water User Community was underpinned by five internal and two external factors. The interactions between these internal and external factors are complex, and contain a range of feedback loops. This research found that the level of participation by the local farmers, the governance and management of the scheme by the local leaders, and the level of external support by the local authorities,

the Ministry of Water Resources and Meteorology, and non-governmental organisations were the three main factors underlying the success of the FWUC.

CHAPTER 7

DISCUSSION

7.1 Introduction

This chapter provides a discussion of the case study results reported in Chapter 6 relative to the existing literature in Chapter 3. It begins with classification of the case, and follows this with a discussion on the definition of success. Key factors that influenced the success of the O-treing Farmer Water User Community, the mechanisms through which these factors impacted on success, and the mechanisms that in turn influenced these factors are discussed in relation to what has been found in the literature.

7.2 Classification of the case

In this research, the case under consideration was observed to possess several characteristics that differentiate it from other cases (Table 7.1). For example, the FWUC had a history of self-organisation and had received considerable external support from the government, as well as non-governmental organisations. The FWUC was formed by the government and farmer members from two communes made up part of its membership. The FWUC is relatively homogenous in that the majority of the local farmers shared similar cultural and ethnic characteristics, cultivation practices, livelihood strategies, resource endowments, interests and experience in irrigation management, and level of dependency upon farming. The majority of farmers grow rice as their main source of livelihood in the wet season, and typically grow crops (water melons, wax gourds, pumpkins and rice) for additional revenue in the dry season.

The irrigation scheme is reservoir-based and water is sourced from flood water and catchment runoff. The scheme operates in both the wet and dry seasons and is classified as medium-scale. However, it is at the lower end of this scale because it can only irrigate 300 hectares during the dry season³. As with many other schemes in Cambodia, the O-treing irrigation scheme was built during the Pol Pot regime. It is

³ Irrigation schemes in Cambodia are classified into three types: (i) small, covering less than 200 hectares, (ii) medium, covering from 200 hectares to 5,000 hectares, and (iii) large, covering greater than 5,000 hectares (MoWRAM, 2000)

located in a favourable setting where the occurrence of flooding and storms is relatively minimal. The O-treing FWUC is also a pilot scheme for the implementation of the Participatory Irrigation Management and Development programme and because of this, it obtained most of its authority and responsibility for irrigation management from the government. The FWUC has also been encouraged to ask for external support from the Ministry of Water Resources and Meteorology, and the local authorities. Similarly, because it is a pilot scheme, the FWUC obtains financial support as shared expenses from the government, which is unusual in Cambodia. More importantly, the FWUC is situated close to urban and local markets (40km from Phnom Penh) and as such, it has good access to markets for selling produce.

Table 7.1: Important characteristics of the case study

Characteristic	Case study classification
<i>History</i>	
Self-organisation	Yes
External support	Yes
<i>The establishment of the FWUC</i>	
Government's initiative	Yes
<i>FWUC characteristics</i>	
Farmer members	2 communes
Community type	Relatively homogenous
Livelihood dependency	Rice and crop farming
Type of crops in the wet season	Rice
Type of crops in the dry season	Watermelons, wax gourds, pumpkins and rice (small proportion)
<i>The scheme infrastructure and natural disasters</i>	
Type of scheme	Reservoir-based
Scale	Medium (300ha in the dry season)
Operation of the scheme	Wet and dry seasons
Time of construction	Pol Pot regime
Flooding and storms	Minimal
<i>The policy-related characteristics</i>	
Recognition by the government	Yes (a pilot scheme of the government)
Shared expenses with the government	Yes
<i>Market access</i>	
Close to urban markets	Yes

7.3 Definition of success

Few studies have investigated what the success of a Water Users' Association (WUA) actually means from the perspective of various irrigation stakeholders. Rather, the success of WUAs has mostly been defined by scholars, i.e. Marothia (2002), and does not necessarily reflect the users' experience. The findings from this research, however, are meant to contribute to the existing body of literature by highlighting the different criteria used by various groups of WUA stakeholders when they go about defining success. It was found, for example, that local farmers used only a few criteria to define success, and these were associated with efficiency of water distribution, the quality of the irrigation infrastructure, and improvement in local livelihood. On the other hand, local leaders and local authorities were observed to extend the definition of success to include the level of local awareness of irrigation management, the amount of conflict over water, and the level of local participation by farmers. The government was found to focus on the FWUC's level of self-dependency and its sense of ownership toward irrigation management, whilst still recognising the importance of the improvement in local livelihood and the level of local participation.

There were also some overlaps in the criteria provided by each of these three stakeholders. For instance, it was found that all three shared one common criterion for success, which was the improvement in local livelihood. Additionally, two other common criteria were shared by the local farmers, the local leaders, and the local authorities, namely the quality of the irrigation infrastructure and the efficiency of water distribution. The local leaders, local authorities, and the government also shared one common criterion, the level of local participation.

7.4 Factors that influence the success of the FWUC

The results of this research identified five internal and two external factors that influenced the success of the Farmer Water User Community. These factors included: 1) the level of local participation, 2) the governance and management of the scheme, 3) the benefits that flowed from the irrigations scheme, 4) the quality of the scheme infrastructure, 5) the characteristics of the farmer members within the FWUC, 6) the level of external support, and 7) market access. These are similar to the factors identified in the literature (Olson, 1965; Wade, 1988a; Ostrom, 1990; Baland & Platteau,

1996; Pierre and Peters, 2000; Meinzen-Dick et al., 2002; Bene & Neiland, 2006). The following sections discuss each of the seven factors relative to the existing literature.

7.4.1 The level of local participation

Findings from this research led to the conclusion that participation by farmers in irrigation management was an important determinant of the success of the FWUC, which confirmed the prescriptive work of Olson (1965) who believed participation by members was a driver for the success of a group. The study found that farmer participation could be usefully separated into four different modes of participation: participation in the payment of irrigation service fees, participation in the water distribution process, participation in scheme maintenance, and participation at FWUC meetings. This is similar to the ways of participation identified by Meinzen-Dick (1997), but it separates water distribution from scheme maintenance.

This research also identified different mechanisms through which each mode of participation influenced the success of the FWUC. It was found that the payment of irrigation service fees ensured the availability of financial resources for regular maintenance and repair of the scheme, which then led to the improved quality of the scheme infrastructure. The availability of financial resources also enabled the FWUC to become more self-dependent and less reliant upon the government, so this mode of participation actually helped reduce the scheme's costs to the government. Further, the financial resources were important for paying the local leaders for their input to the scheme. No other authors were found to have identified this range of mechanisms. However, Meinzen-Dick and Reidinger (1995), in a manner similar to this study, highlighted the importance of local participation in reducing the operational and maintenance costs of irrigation projects to government.

Regarding involvement in water distribution, the participation of the farmers impacted on the success of the FWUC in three ways. First, it ensured the timely and adequate supply of water to farmers for crop production, which led to an improvement in local livelihood. Second, it reduced the likelihood of flooding and overflows, hence ensuring the quality of the scheme infrastructure. Third, it reduced the labour input required from the leaders, thus helping to retain the leadership capacity within the FWUC. It also, in turn, helped ensure the self-dependency of the scheme. No other research highlighting this range of mechanisms was identified in the current literature.

Concerning scheme maintenance, local participation influenced the success of the FWUC in two ways. First, it helped reduce input requirements for leaders, thereby allowing those leaders to remain actively involved in the FWUC. Second, it ensured effective scheme maintenance, which then led to the improved quality of the scheme infrastructure for delivering a timely and adequate supply of water, and then to the improvement in local livelihood through crop production. This range of mechanisms was also not found to be described in the relevant literature.

For this research project, local participation at FWUC meetings was separated into two useful categories, attendance at meetings and participation in decision making. It was found that local attendance at FWUC meetings was important to ensure that farmers were aware of the issues associated with irrigation management. However, it was the involvement of farmers in the decision-making process that critically influenced the success of the FWUC. The results of this research confirmed the prescriptive work of Beierle (1999) and Creighton (2005), who found that participation in the decision-making process allowed leaders to incorporate local needs and preferences into their decisions, which then led to a sense of ownership of the decisions and greater local satisfaction with the outcome. Participation in decision making also fostered transparency, and then trust, between the leaders and farmers, and improved general understanding of the water distribution issues faced by farmers in various locations within the FWUC.

The results of this research demonstrated that different modes of participation were influenced by different factors, as reported by the literature. Participation in the payment of irrigation service fees was mainly influenced by 1) the quality of the irrigation infrastructure, 2) the benefits that flowed from the irrigation scheme, 3) the costs of irrigation service fees relative to the benefits and the cost of alternative water sources, 4) farmers' trust in leadership, 5) the farmers' awareness of the importance of participation in fee payment, and 6) peer pressure. In contrast to Maleza and Nishimura (2007) and Thun (2008), it was found that rule enforcement did not influence local participation in fee payment.

Data from this research identified the quality of the scheme infrastructure as a factor that influenced fee payment, because of its impact on crop production as a result of an efficient and reliable supply of water. Similar findings were also reported by Maleza and Nishimura (2007) in the case of an irrigation scheme in Bohol, Philippines.

This case study also showed that since farmers obtained considerable benefits from the irrigation scheme, they agreed to pay irrigation service fees to their leaders, as reported by Maleza and Nishimura (2007). However, this was also partly influenced by the fact that local farmers relied on the irrigation scheme benefits for their livelihoods, as proposed by Korten (1986). Their cooperation with fee payments was also motivated by the relatively low cost of the fees in relation to the level of benefits obtained from the irrigation scheme, and as compared to the costs of alternative sources of water.

Furthermore, farmers agreed to pay fees because they trusted the leadership to manage the scheme in a fair and transparent manner, and put the interests of the FWUC first. Farmers also trusted the leadership when they could see that the leaders worked hard to distribute water, as found by (Wade, 1988b), maintain the scheme, and address farmer problems effectively.

Another reason farmers paid irrigation service fees was because they were aware of the importance of their participation in fee payment. This result was consistent with the work of Maleza and Nishimura (2007) who found that farmers in Bohol did not pay fees to leaders because they either did not understand the purpose of fee collection or were unaware of fee collection rules. This also supported the view of Tewari and Khanna (2005) who observed that most of farmer members in successful irrigation schemes were aware of their rights and of the importance of participation. Such awareness of the importance of participation was determined by the farmers' previous experiences with self-organisation, as suggested by Ostrom (1999), and the training and capacity building provided by local leaders and outsiders.

Peer pressure was also found to be a factor in the farmers' level of participation in paying irrigation service fees, in much the same manner as reported by Levi (1988) and Ostrom (1990). Farmers paid these fees because they did not want to be embarrassed in front of their neighbours. This supports the view of Ostrom (1990) who contended that when a majority of farmers decide to participate in a community, other farmers will not be able to free-ride because their lack of contribution would be detected and they would suffer social disgrace as a punishment for breaking the rules.

In investigating the factors that contribute to farmer participation in the water distribution process, this research identified the following as influential: 1) the benefits

that flowed from the irrigation scheme, 2) the level of rule enforcement, and 3) local awareness of the rules. Little has been written about this part of irrigation management. However, this study led to the conclusion that farmers were willing to participate in water distribution because it ensured sufficient water supply to their land for high crop yields and early harvests, resulting in considerable benefits to their households. Rule enforcement was also found to be critical to the avoidance of water anarchy, and to preventing farmers from obtaining water in excess of their requirements. This result confirmed Ostrom's (1990) view that rule enforcement restricted illegal access to resources and discouraged local users from exploiting the resources. Further, similar to local participation in the payment of fees, participation in water distribution was influenced by the farmers' awareness of the rules.

This study also resulted in the finding that participation in scheme maintenance was mainly determined by 1) leadership capacity, and 2) local awareness of the importance of scheme maintenance. It was apparent that farmers were more likely to participate in scheme maintenance if leaders worked along side them, and had the skills and authority to mobilise farmer members. Moreover, local awareness of the importance of scheme maintenance was an important factor contributing to local participation in it. This awareness was enhanced through training and capacity building. Awareness was also high because the FWUC had a history of self-organisation in relation to irrigation management, as believed by Ostrom (1999).

However, one factor previously mentioned in the literature was not found to be related to levels of participation in scheme maintenance. This factor was the level of enforcement of the FWUC rules.

Data analysis for this research additionally highlighted three factors that influenced local attendance at community meetings. First, leadership capacity, which was related to the leaders' skills and their authority to mobilise farmers, impacted on farmers' attendance. Second, the workload of farmers was also a factor that influenced local attendance at community meetings. This meant that the leaders' skills in organising meetings for times when farm workloads would be low was important. Third, farmers' perceptions of the meetings as important affected their level of attendance. However, rule enforcement was not found to influence local attendance of community meetings in this case study.

Little has been written in the literature about the factors that influence farmer participation in decision making. In this case study, it was seen to be mainly determined by the leadership's efforts to seek engagement with and feedback from farmers, as well as the farmers' own awareness of their rights and their perceptions about the importance of specific issues during community meetings.

7.4.2 The governance and management of the scheme

The results of this case study demonstrated that the governance and management of the scheme influenced the success of the FWUC in terms of both the structures and the processes involved, as suggested by Pierre and Peters (2000) and CBNRM (2007). The governance and management structures included decision-making structures and leadership capacity, while the governance and management processes encompassed the formation process and the decision making processes used to implement, enforce, and adapt the FWUC rules.

Decision-making structure

This research found that the decision-making structure of the FWUC was an important factor in its success. The decision-making structure impacted on the success of the FWUC in two ways. First, it made each village responsible for the management and maintenance of the scheme and hence led to local participation. Second, this structure helped divide the number of farmers into small groups and sub-groups, and as such made it easy for the leaders to implement and enforce community rules. These findings confirmed the views of Uphoff (1986), Ostrom (1990), and Tang (1991) that large irrigation schemes needed to be structured into multiple layers or nested enterprises. Agrawal and Gibson (1999) proposed that when a community is structured into multiple layers to keep the number of farmers grouped together relatively low, the opportunity for frequent interactions and reduced transaction costs for making collective decisions was optimised.

Leadership capacity

The results from this study also demonstrated that leadership capacity was one of the most important factors contributing to the success of the FWUC. Leadership capacity can be usefully separated into three key attributes: 1) attitudes, 2) knowledge and skills,

and 3) authority. Although other authors have mentioned some of these attributes, they have not specified this set of attributes. For example, Ross and Lappin (1967) mention attitudes, but not skills and knowledge or authority. Similarly, Cemea and Meinzen-Dick (1992) described leadership capacity in terms of skills and knowledge, but not attitudes or authority. This research did not find education as a prominent attribute of leadership capacity, as was reported by Ross and Lappin (1967) and Meinzen-Dick (1992). Rather, it was found that individuals with a high level of education tended to leave the FWUC to work for the government and private sector organisations. As such, individuals who took up leadership positions tended to have lower levels of education and the more important attribute was their attitude to learning. Furthermore, this research did not find external recognition as an important attribute of leadership, as found by Meinzen-Dick et al. (2002). However, it confirmed Ross and Lappin (1967) that social status was one of key elements that enables the leadership to gain authority to manage the scheme.

During this case study, it was found that attitudes associated with good leadership included: 1) a positive work ethic, 2) commitment to the irrigation scheme, 3) honesty and transparency, and 4) a willingness to: a) put the interests of the FWUC ahead of their own, b) work along-side the farmers, c) accept responsibility and d) continue to learn in order to improve the performance of the scheme. In reviewing the current literature, this specific combination of attributes was not found in works by other authors. However, Ross and Lappin (1967) highlighted two similar attributes - positive identification and a hard-working disposition - and Tewari and Khanna (2005) identified four attributes including the ability of leaders to get on well with people, to speak for them, to have frank and honest discussions, and to spend the time or make an extra effort to solve problems.

This study also found knowledge and skills to be a second attribute of leadership capacity, in much the same manner as that documented by Cemea and Meinzen-Dick (1992). This knowledge and skills factor included technical skills and knowledge associated with irrigation management (e.g. water distribution, repairs of gates, canals, and the dam, geographical location of farmland, topography, the scheme infrastructure, and the water routes), and organisational skills (e.g. ability to motivate farmers and lead the FWUC, explain things, solve problems, manage the budget, organise Community meetings, complete the required paper work, and communicate with external actors), as suggested by Cemea and Meinzen-Dick (1992).

The research results also highlighted authority as a third attribute of leadership capacity. This finding is in line with the prescriptive work of Sinha (1988) and Coates (1997) who defined the authority held by leaders as the power to make decisions and to ask their people to implement them.

Leadership capacity influenced the success of the FWUC through several mechanisms and these could be related to the attitudes, skills and knowledge, and authority of the leaders. In relation to attitudes, it was found that when the leaders were honest and transparent, the farmers trusted them. This is similar to the work by Wade (1988b) in India, who found the trust of farmers was dependent upon the performance of leaders. Further, this research also found that the farmers respected the leadership because of their positive work ethic, commitment to the irrigation scheme, and a willingness to put the interests of the FWUC ahead of their own. This trust and respect made the leaders popular and hence ensured farmers' participation.

According to the research findings, knowledge of and skills in irrigation management also led to the development of trust by the farmers in the leadership of the FWUC, and this trust then enhanced farmer participation in the irrigation scheme. The organisational skills and knowledge of leaders also helped improve water distribution in the FWUC, ensured external support from the government and NGOs, and motivate farmers to participate in irrigation management. On the other hand, the authority demonstrated by the leaders was seen to ensure that the FWUC rules were enforced. This authority also contributed to building a sense of ownership, which was in line with the work of Nakashima (2000) in Pakistan. Vermillion (2001) who stressed the importance of authority through property rights stated that local leaders needed rights so that they could raise revenue from farmers. This research found that to raise revenue, leaders needed adequate authority to collect fees with limited interference from the government.

The leadership capacity of the FWUC in this case study was found to be influenced by the formation, the subsequent informal leadership selection process, the experience levels of the individual leaders, the external support available to the leadership, the various types of incentives provided to the leaders, the delegation of power by the government, and other leadership positions held by the leaders. It was found that during the formation of the FWUC, the government helped the farmers specify the selection criteria for the leadership positions and the farmers then elected the leaders they thought best met these criteria. This allowed the farmers to select leaders with the

right attitudes, skills and knowledge to govern and manage the irrigation scheme. This process was similar to that suggested by Ross and Lapin (1967) and Perera (2006). However, some elected leaders resigned from their positions, and as such, having an informal selection process available through appointments was critical. This informal re-appointment process allowed the FWUC to seek for leaders with the right attitudes, skills and knowledge to replace those who had vacated their positions. Katon et al. (1997) and Pomeroy et al. (1996) also reported that elections were not the only way to identify good leadership in fishery co-management in the Philippines.

Furthermore, this research identified that leadership capacity was also influenced by the prior experience of the leaders. Several authors (Fabricus, 2004; Tewari & Khanna, 2005; Altrichter, 2008; Johnson III & Stoutjesdijk, 2008) had reported that one of the problems with local leaders was their lack of experience in administration and record keeping. Importantly, the majority of the leaders in this scheme held positions as village or commune chiefs, engaged in irrigation management, and had experience at administration. The level of external support was also an important determinant of the leadership capacity of the scheme because the government and NGOs provided training to the leaders of the FWUC. The importance of training in relation to leadership capacity has been stressed by several authors (Ostrom & Gardner, 1993; Musa, 1994; Tewari & Khanna, 2005).

Incentives also played a role in enhancing leadership capacity within the FWUC. These incentives could be usefully separated into two types, tangible and intangible incentives, similar to those suggested by Uphoff (1985) and Hunt (1989). Consistent with the prescriptive work of Ross and Lappin (1967), the intangible incentives (gratitude, local support by farmers towards leaders and respect) were seen to be more critical than tangible incentives in motivating local leaders to remain involved in leadership positions within the FWUC.

Leadership capacity in terms of authority was also influenced by the delegation of power by the government, referred to as 'legal rights' by Schager and Ostrom (1992) and Meinzen-Dick et al. (1997), and by some of the leaders' social status as village chiefs or deputies. Further, this research found that authority also came from the trust and respect the leaders earned through their attitudes and behaviour, a point also made by Katz and Khan (1978).

Formation process

The formation process of the O-treing FWUC, which was facilitated by the Ministry of Water Resources and Meteorology, was found to have influenced the success of the FWUC through two mechanisms. First, it ensured good leadership capacity of the FWUC when farmers voted for leaders who they thought could govern and manage the scheme in their area. Second, it ensured local compliance with the rules and then local participation when farmers were allowed to develop their own rules. This confirmed the work of Hønneland (1999), who believed that local people are more likely to comply with established rules of their own making. According to Ostrom (1990), local people should craft their own rules to suit their condition and needs while other studies (Ostrom, 1992; Tang, 1992; Ostrom, 1994; Lam, 1996a; Meinzen-Dick et al., 1997; Meinzen-Dick et al., 2002; Shivakoti & Ostrom, 2002; Keremane, 2006) have reported that rules that are crafted by local people often resulted in better outcomes than if such rules were externally imposed.

The formation process was influenced by external support and farmers' experience in self-organisation. This research found that it was important for outsiders (the government and local authorities) to spend enough time and resources assisting the formation process. Ballabh et al. (2002) believed that locals need resource people for consultation in order to craft effective rules. The formation process was also influenced by farmers' experience in self-organisation with the management of the scheme. Having the experience, farmers were able to select suitable leaders to manage the irrigation scheme and design rules suitable for the local situation, as believed by Ostrom (1999).

Decision-making processes

The decision-making processes were usefully separated into rule implementation and enforcement, as suggested by Menzies (2004). Besides rule implementation and enforcement, this study also supported Pinkerton and Weistein's (1995) findings and confirmed Ostrom's (1994) and Imperial's (1999) views that rule adaption was also important.

The decision making processes used by the leaders to implement the FWUC rules had to meet six criteria. They had to be: consensus-based, inclusive, responsive, effective, transparent, and fair. No other studies identified this range of criteria. Pinkerton and

Weinstein (1995) highlighted three criteria (accountability, representativeness and effectiveness) that encompassed several sub-criteria. Tanako and Sato (2005) suggested only one criterion which was fairness.

Rule enforcement was conducted in a way that optimised fairness among farmers, and was mainly applied in issues of water distribution. According to Thibaut and Walker (1975), fairness can be separated into distributive and procedural fairness. In this study, procedural fairness was found in which farmers looked at procedure used by their leaders to distribute water to their farmland in order to perceive fairness.

The leaders also adapted rules as necessary in regards to water availability. Ostrom (1994) and Imperial (1999) believed that rules should be adapted over time to be compatible with the changes in the physical and biological setting of the resource under management. Besides water availability, this study found that the rules were also adapted by leaders on the basis of crop failure (similar to reports by McKay and Keremene, 2006), leadership commitments or workload, farmers' workload, and the level of water access by farmers. Rule adaptation was applied to four issues: 1) the collection of irrigation service fees, as found by McKay and Keremene (2006), 2) responsibility of leaders, 3) attendance of farmers at FWUC meetings and maintenance, and 4) water access.

It was found that as long as the rule adaptation was based on a collective decision, farmers would comply with the rule. In this case study it was observed that rules were informally adapted through community discussions, and were then widely established as rules-in-use and accepted by all the farmers within the FWUC.

Rule implementation influenced the success of the FWUC through several mechanisms. When based on consensus and inclusiveness, it led to a low level of water conflict, a sense of ownership over the decisions, local compliance with the rules, and most importantly farmers' trust in the leadership. Similarly, farmers' trust in the leadership was also enhanced if leaders made decisions based on responsiveness, transparency, and fairness. Further, effective decision making relative to the operation, maintenance and water distribution ensured the adequate and timely supply of water to farmers. Little has been identified in the literature about how rule implementation impacted on success. However, Wade (1988b) found that rule implementation based on fairness influenced local behaviour to participate in irrigation management.

Rule implementation was influenced by three factors. It was influenced by leadership capacity including the authority of the leaders, as suggested by Vermillion (1994) and (1998). It was also dependent upon the level of local participation in the payment of irrigation service fees, water distribution, scheme maintenance, and FWUC meetings, which were in line with the view of Ostrom (1990) who believed that effective rule implementation required local participation in monitoring and sanctioning each other's performance. Further, financial resources were also important in ensuring rule implementation. Vermillion (1994) suggested that local leaders needed adequate financial resources to operate and maintain irrigation schemes while Jaujay (1990) and Pomeroy et al. (2001) believed that financial resources were important in paying administrative costs.

Besides rule implementation, this research also indicated that when leaders enforced rules to ensure fairness among farmers, the FWUC could achieve a greater level of local participation. Tanaka and Sato (2005) based on a study in Japan found that when farmers perceived decision making by leaders as fair, they participated in irrigation management. Rule enforcement in water distribution also helped reduce the level of water theft within the FWUC. This finding supported Ostrom (1990), who believed that rule enforcement helped restrict illegal access to the resources and discourage users from exploiting them in excess of their requirements.

Rule enforcement was influenced by the level of authority of the leaders, as suggested by Vermillion (1994; 2001). Besides authority, rule enforcement was also determined by external support to help raise local awareness of the rules and assist in enforcement, as suggested by Maleza and Nishimura (2007), and farmers' trust in the leadership.

Rule adaptation contributed to the success of the FWUC by ensuring fairness among farmers. This research supported the finding of Tanaka and Sato (2005) that fairness was critical to success. It was also found that once farmers judged the process to be fair, they trusted the leadership of the FWUC and this then led to greater participation. This was in line with the work of McKay and Keremene (2006), who found that rule adaptation ensured farmers continued to participate in the scheme in India. Farmers considered it as fair when the leaders were able to adapt irrigation service fees in accordance with the level of crop production, and when the leaders were able to adapt participation rules in accordance with farmers' workload. The adaptation of water distribution rules based on water availability also helped avoid crop failure and the associated financial losses, which led to the improvement of local livelihoods. Finally,

the adaptation of the rules specifying the responsibilities of leaders helped retain good people in leadership positions, hence maintaining strong leadership capacity in the FWUC. This led to the enhanced self-dependency of the FWUC.

It was found that the rule adaptation was influenced by two factors. It was influenced by leadership capacity to govern and manage the scheme. Further, it was determined by external support to help provide consultation to assist with rule adaptation. No other scholars have highlighted this in the literature.

7.4.3 The value of the benefits that flowed from the irrigation scheme

This research found that benefits from the irrigation scheme, such as food security and additional revenue, were critical to the success of the FWUC. These benefits influenced the success of the FWUC by providing incentives for farmers to participate in the scheme and ensured the improvement of local livelihoods. Similar findings were also reported in previous studies (Uphoff et al., 1990; Meinzen-Dick & Reidinger, 1995; Meinzen-Dick, 1997; Meinzen-Dick et al., 1997; Subramanian et al., 1997; Regmi, 2008). Further, this research found that such benefits were important for local farmers because the farmers lacked skills to work in other areas during the dry season.

In this case study, it was observed that benefits were not equitably shared among members of the FWUC during the dry season, in much the same manner as observed by Quiggin (1993). This research did not find socioeconomic conditions to be the cause of inequitable water access, as proposed by Jain (2002) and Kerr (2002) in studies on community forestry and watershed development in India. Rather, the data demonstrated that the topography and proximity of farmland to the scheme was a key factor in seasonal occurrences of inequitable access to water. Interestingly, farmers who did not obtain water still cooperated with the leaders despite not receiving water at times, because they were at least able to obtain water during the wet season. These findings are similar to those of Jain (2002), who concluded that unequal benefit sharing did not prevent farmers from participating in resource management as long as they were better off compared to the previous times when the resource was not managed.

Furthermore, the farmers studied in this research did not blame their leaders for the lack of water supply because they were aware of the reasons for it. These farmers also had previously experienced crop failure, which discouraged them from taking water

during periods of water scarcity. Farmers did not appear to be interested in taking water if the costs for water access were high, compared to the potential benefits they received from it, which is similar to the view of Meinzen-Dick et al. (1997).

Aside from their awareness, their experience of crop failure, and their perception of the costs, these farmers had learned to trust the leaders to allocate sufficient water to them when water was available. This research found that farmers' trust in the leadership capacity of their leaders was critical to the maintenance of farmer cooperation, especially when the FWUC failed to provide tangible incentives (i.e., water) to farmers on a continual basis. According to Oakerson (1990), this is called a pattern of reciprocity that farmers learned what to expect from others.

This case study provided three findings as to how the FWUC ensured benefits to farmers. The governance and management of the scheme and the quality of the scheme infrastructure was critical for ensuring the sufficient and timely supply of water to the farmers' crops. In conjunction with these two factors, the fact that the farmers could access markets for their produce allowed them to obtain economic returns (additional revenue) as a supplement to food security. This was similar to the view of Meinzen-Dick et al. (1997) who believed market access helped increase economic returns to farmers.

7.4.4 The quality of the irrigation infrastructure

This research identified the quality of the scheme infrastructure – including the reservoir, canals, sub canals, and control gates – as a key contributing factor to the success of the FWUC. This has also been reported by Uphoff et al. (1990), Perry (1995), Meleza and Nishimura (2007), and Regmi (2008). However, the findings from this study did not find size of command area and boundary definition as factors that influenced success as reported by Wade (1988a), Ostrom (1990), and Meinzen-Dick et al. (2002).

The quality of the scheme infrastructure influenced the success of the FWUC through three mechanisms that can be combined into two. First, as the FWUC had numerous well-built canals and control gates, leaders were able to efficiently distribute water to members; the impact of this was noted to be in line with the findings of Regmi (2008). The efficient water distribution then led to local participation in the payment of irrigation

service fees. Similar results were also reported by Perera (2006), who found that the poor irrigation infrastructure in Cambodia was a reason for the refusal of farmers to work together to manage irrigation schemes. Second, the capacity of the scheme infrastructure to store sufficient water, as reflected in the size and condition of the reservoir, was also found to be critical to the success of the FWUC. The large and well-constructed reservoir available to the FWUC in this study made it possible for the FWUC to ensure sufficient water storage from the high rainfall in the wet season to meet farmers' needs during the dry season when rainfall was low.

This case study also demonstrated the factors involved in establishing high-quality scheme infrastructure. First, the FWUC inherited an irrigation scheme with a good basic structure from the Pol Pot regime as a coincidence of history. Second, external support was important. The quality of the scheme infrastructure was enhanced further when the government and NGOs helped rehabilitate the scheme before turning it over to the FWUC. The local authorities also played a role by arbitrating land conflicts during the scheme rehabilitation. Meinzen-Dick et al. (1997) recommended that the government should conduct proper rehabilitation or construction of irrigation schemes because this would help reduce the operation and maintenance costs incurred by local farmers, a point later made by Perera (2006). Third, the high quality of the scheme infrastructure was also reliant upon regular scheme maintenance by the local leaders and farmers. Finally, the O-treing scheme is located in a favourable location where flooding and storms are relatively infrequent, and this has helped reduce maintenance costs. Perera (2006), and Chem and Craig (2008) found that the poor condition of irrigation systems in Cambodia was partly because they were often damaged by annual floods.

7.4.5 The characteristics of farmers

This research identifies four attributes of farmer characteristics that influenced the success of the FWUC, as reported by Wade (1988a), Ostrom (1990), Baland and Platteau (1996), and Meinzen-Dick et al. (2002). These four attributes were the group size, the homogeneity of the local farmers, the farmers' dependency on cropping for their livelihood, and the farmers' level of experience with self-organisation.

First, although the FWUC could be classified at the smaller end of "medium" in size with a large number of farmers, it was found that when the number of farmers in the

FWUC was divided into small groups and sub-groups, the leaders were able to implement and enforce community rules more easily. These small groups and sub-groups also led to more frequent interaction among farmers, and allowed them to be able to better monitor each other effectively, as believed by Weissing and Ostrom (1991), and Agrawal and Gibson (1999). This finding shows that a medium sized scheme with a large group can operate in a similar manner to small groups if organised along the lines suggested by Uphoff (1986), Tang (1991) and Ostrom (1990).

Second, this research also showed that as the farmers were homogenous in terms of culture and ethnicity and they shared similar endowments, livelihood strategies, beliefs, views, and perception, they were able to work together to manage irrigation scheme effectively as suggested by Lowdemilk et al. (1978) and Baland and Platteau (1996). Similar findings were also reported by Freudenberger and Mathieu (1993) in their study of a community fishery in southern Burkina Faso.

Third, it was also found that because the local farmers in this study had a high dependency on cropping for their livelihoods, they more readily agreed to participate in the FWUC. This finding is in line with the empirical study of fishery communities by Pinkerton and Weistein (1995). Perera (2006), in researching irrigation schemes, found that as the main source of livelihood for some Cambodian farmers came from other sources, they chose to spend most of their time engaged in these other activities rather than farming with irrigation water.

Finally, this research also found that the farmers' prior experience with self-organisation in irrigation management was important for the success of the FWUC because it provided the FWUC with leadership capacity to manage the irrigation scheme, as suggested by Ostrom (1999) and reported in later empirical work by Perera (2006). This research also found that the prior experience with self-organisation allowed farmers to develop effective rules and it enhanced local awareness of the importance of participation in irrigation management, as suggested by Ostrom (1999) in the context of community forestry.

7.4.6 The level of external support

This research identified the level of external support as an important factor in the success of the FWUC. External support from the Ministry of Water Resources and

Meteorology and NGOs took several forms: scheme rehabilitation and development, assistance with the formation of the FWUC, training and capacity building, provision of financial resources, and consultation. These factors were similar to observations made in the work of Meinzen-Dick et al. (1997), and Maleza and Nishimura (2007). Besides MoWRAM and NGOs, this research also highlighted the importance of external support from local authorities in providing assistance with rule enforcement and conflict resolution, as found by TWGAW (2006).

This external support impacted on the success of the FWUC in three ways. First, through scheme rehabilitation and development, the external support enhanced the quality of the scheme infrastructure, which then led to the adequate and timely supply of water to farmers and an improvement in local livelihoods. Second, external support through capacity building also helped improve the knowledge and skills of local farmers and leaders. The improvement in farmers' knowledge led to their participation in irrigation management, as found by Tewari and Khanna (2005) and Maleza and Nishimura (2007), and the improvement in leaders' knowledge and skills impacted on leadership capacity and then the governance and management of the scheme. Third, the external support also enhanced the governance and management of the scheme through the assistance provided during the formation of the FWUC, assistance with rule enforcement, and conflict resolution and the provision of finance.

This research also found that when external support was ongoing, the governance and management of the FWUC was strengthened over time. Subramanian et al. (1997) and Meinzen-Dick (1997) believed that external support should be ongoing because it helps promote cooperation among farmers when local leaders are unable to do this.

It was also found that external support for the FWUC neither interfered in local decisions nor made local farmers reliant on external agencies. The FWUC still held most of the decision-making power in irrigation management, more than both the local authorities and the Ministry. This finding was consistent with the work of Jain (2002), who found that the success of WUAs in Udaipur was enhanced because the external support provided to them did not create the dependency of WUAs on external agencies. Jain (2002) also stressed the importance of external support through capacity building to develop the self-dependency of WUAs.

7.4.7 Market access

The case study highlighted market access as another factor that influenced the success of the FWUC, which is in line with the empirical work of Tubpun (1986) regarding small tank irrigation in Thailand. Market access was shown to contribute to the success of the FWUC through enhancing benefits (revenue) obtained from the irrigation scheme, which then led to increased local participation. Similar results were reported by Jackson (1991) in Eastern Madura, Indonesia.

The results of the case study demonstrated three factors were involved in local farmers' access to markets. First, it was found that market access was influenced by distance and transportation costs, similar to findings reported by Meinzen-Dick et al. (2002) and Rweyemamu (2003). As the FWUC was close to markets and road conditions were good, transportation costs were inexpensive, and as such farmers could access markets easily. Similarly, as reported by Rweyemamu (2003), private traders or "middlemen" were interested in travelling to the FWUC to purchase produce because the FWUC was located close to major markets.

Second, this research also found that market access was determined by the fact that the FWUC produced a large proportion of dry season crops within the district. Because the FWUC produced much of the district's dry season crops, the middlemen visited the FWUC to purchase the produce. This finding was in line with the work of Rweyemamu (2003), who also found market access was reliant upon the amount of crops farmers produced. Third, the high quality of the crops grown by the FWUC was also found to enhance market access.

Another important finding of this research was that the majority of the farmers in the FWUC did not sell their produce at the markets. Rather, they preferred to sell it to middlemen at the farm gate for lower prices. Rweyemamu (2003), based on a case study in Tanzania, reported that farmers ended up selling their crops at the farm gate because of their distance from the market and the limited amount of crops they produced. However, in this case study, it was found that farmers chose to sell their crop produce at the farm gate because that way they could sell all of it at once, which was good for cash flow. This meant that farmers did not have to worry about storage and the resultant storage losses. Further, the middlemen were also willing to pay the farmers for their produce before harvest and they also covered the associated growing

and harvesting costs. As such, selling crop produce at the farm gate made it more convenient and fairly profitable for farmers than selling at markets.

7.5 Summary and conclusion

This case study comprises several important theoretical characteristics. The FWUC had a history of self-organisation, the FWUC was fairly homogenous, and its members relied heavily upon cropping for their livelihood. The scheme is reservoir-based and classified at the lower end of a medium-scale operation, running in both the dry and wet seasons. The scheme is located in the area where the flooding and storms are minimal. The FWUC was formally established and hence recognised by the government and it is also close to urban markets. The FWUC was considered as the most successful case in Cambodia by the Ministry of Water Resources and Meteorology in terms of self-dependency and improvement in local livelihoods.

This chapter discussed the findings of this research relative to the existing literature concerning factors that influenced the success of the FWUC. It was found that the success of the FWUC was driven by seven factors, five internal and two external, as suggested by the literature. The five internal factors included: 1) the level of local participation, 2) the governance and management of the scheme, 3) the level of external support, 4) the characteristics of the farmer members within the scheme, and 5) the quality of the scheme infrastructure. The two external factors comprised: 1) the benefits that flowed from the irrigation scheme, and 2) market access. The mechanisms through which these factors impacted on the success of the FWUC were discussed. Similarly, important mechanisms that influenced the seven factors were also examined. In the next chapter, the conclusion and implications of the research findings will be described. Evaluation of the methodology and suggestions for future research are also provided.

CHAPTER 8

CONCLUSIONS

8.1 Introduction

The Participatory Irrigation Management approach was introduced into Cambodia in 2000 in recognition of the need for community participation as part of the effort to improve irrigation management. This research investigates a successful Farmer Water User Community (FWUC) under the implementation of the PIM approach in Cambodia with the goal of identifying the factors that have influenced the success of this FWUC. The results of this study can assist the government of Cambodia, donors, and non-governmental organisations (NGOs) to improve the performance of other, less successful, FWUCs in Cambodia.

The aim of this research was to identify factors that influence the success of a Cambodian FWUC in irrigation management. This was achieved by addressing the following objectives:

1. To identify the internal and external factors that influenced the success of the FWUC;
2. To determine mechanisms through which these internal and external factors have contributed to the success of the FWUC;
3. To identify mechanisms that have influenced these internal and external factors; and
4. To determine the relationships among these internal and external factors that influenced the success of the FWUC.

In this chapter, the conclusions from the study are provided, and implications of the research findings for the Ministry of Water Resources and Meteorology, donors, NGOs, local authorities, community leaders, and farmers are discussed. The methodology is then evaluated and areas for future research are highlighted.

8.2 Research conclusions

This research identified that different stakeholders used different criteria to define the success of the Farmer Water User Community. One common criterion was found across the three groups of stakeholders, namely the improvement in local livelihood. Local leaders and local authorities had three of the same criteria (the quality of the irrigation infrastructure, the efficiency of water distribution, and improvement in local livelihood) as farmers, but they also stressed the awareness of irrigation management, the level of conflict over water, and the level of local participation. The government's criteria covered areas similar to that of local leaders in terms of improvement in local livelihoods and the level of local participation, but additional key concerns involved self-dependency and the level of ownership. From these three views, the success of the FWUC was centred on two features – the self-dependency of local leaders and farmers in irrigation management and improvement in local livelihood in terms of food security and household revenue from crop produce.

This research identified seven factors, five internal and two external, which influenced the success of the FWUC. The internal factors were: 1) the level of local participation, 2) the governance and management of the scheme, 3) the value of the benefits that flowed from the irrigation scheme, 4) the quality of the irrigation infrastructure, and 5) the characteristics of the farmer members within the scheme. The external factors were: 1) the level of external support provided to the scheme, and 2) market access.

Overall, relationships between these factors led to the conclusion that the success of the FWUC required farmer participation and this participation was enhanced when farmers obtained benefits from it, either from food security or increased revenue from crop sales. Without these benefits there was little incentive for the farmers to participate in the scheme. In addition to this, access to markets was important for farmers to obtain these benefits from the scheme. It was also critical that the irrigation infrastructure was of a high quality to ensure the delivery of an adequate and timely supply of water to the farmers, so that they could grow crops that provided them with the benefits. The governance and management of the scheme was another critical factor, and in particular the leadership capacity of the FWUC. Leadership capacity was critical because it ensured the maintenance and development of the irrigation infrastructure, the timely and adequate supply of water to farmers, farmers' trust and respect, and the level of local participation.

The success of the FWUC also required a certain level of external support from the government, NGOs and local authorities. Important areas of external support included the rehabilitation of the irrigation infrastructure, assistance with the formation of the FWUC to ensure the election of good leaders and the design of effective rules, capacity building, provision of financial resources, assistance with rule enforcement, consultation, and conflict resolution.

Farmer characteristics were also of importance. The success of the FWUC was assisted by the fact that the community had a history of self-organisation, the community was relatively homogenous, and its farmers were dependent upon farming for their livelihoods.

This research reconfirmed previous work that the success of the FWUC required farmer participation. Four different modes of participation were identified, which included: participation in the payment of irrigation service fees, participation in the water distribution process, participation in scheme maintenance, and participation in FWUC meetings.

Farmer participation influenced the success of the FWUC by providing resources and information to support leadership to manage the scheme and improve the quality of the scheme infrastructure. Participation in the payment of irrigation service fees ensured the availability of financial resources for regular scheme maintenance and repairs. Participation in the water distribution process provided labour and information to the FWUC to ensure the timely and adequate supply of water to farmers and to reduce the amount of labour input required from leaders. In scheme maintenance, participation by farmers contributed labour and information for reducing maintenance costs and maintaining the quality of the scheme infrastructure. Participation in FWUC meetings provided information to enable effective decision making, a sense of ownership, transparency, satisfaction, and trust between the leaders and farmers.

There was a multitude of factors that influenced farmer participation. Different factors impacted on the different modes of participation. Farmers' awareness of rights, rules, and the importance of participation influenced every mode of participation while rule enforcement was shown to influence farmer participation in water distribution, but not in fee payment, scheme maintenance, or community meetings. Benefits from the irrigation scheme were important in ensuring local participation in fee payment and

water distribution, but not in scheme maintenance and community meetings. Participation in scheme maintenance and community meetings was very much dependent upon leadership capacity, as when the leaders demonstrated the skills and authority to mobilise farmers and worked alongside them.

Trust and respect for the leadership, the quality of the scheme infrastructure that ensured the adequate and timely supply of water to farmers, and peer pressure were other factors that influenced local participation in the payment of irrigation service fees. Trust between the leaders and farmers occurred as a result of the attitudes, knowledge, and skill of the leaders, and the nature of their decision-making processes. Because the leaders were able to manage the scheme in a fair and transparent manner, put the interests of the FWUC first, work hard, maintain the scheme, distribute water effectively and address farmers' problems, then the farmers trusted the leaders. Trust was also built if the leaders had skills and knowledge to distribute water to farmers adequately and on time.

Success also required the good governance and management of the scheme. This research found that the key attributes of the governance and management that influenced the success of the FWUC were the decision-making structure, the leadership capacity of the leaders, and the nature of the decision-making processes they initiated. A multiple-layered decision making structure was important for ensuring that the number of farmers was small in any one decision-making sub-group. This made it undemanding for the leaders and farmers to monitor and interact with each other, as suggested by Agrawal and Gibson (1999).

Leadership capacity was found to comprise three attributes: attitudes, knowledge and skills, and authority. The level of education was not a prominent attribute of leadership capacity because members of the community who had high levels of education tended to leave the community to take up professional positions. As such, the attitude of the leaders towards learning was much more important than their level of education, in terms of leadership capacity. Leadership capacity was critical for the success of the FWUC because the attitudes of leaders helped ensure trust and respect between the leaders and farmers, leading to local participation. The knowledge and skills of the leaders was also important for developing trust, improving the effectiveness of water distribution, enhancing external support, and promoting local participation in irrigation management. On the other hand, the authority of the leaders helped ensure effective rule enforcement, a prompt response to local requests, and sense of ownership.

This leadership capacity was driven by the formation process of the community, the informal re-appointment process, the social status and experience of the leaders, the level of external support, the existence of incentives, and the delegation of authority by the government. As farmers selected their own leaders using their own criteria, they could identify leaders with the right attitudes, and knowledge and skills for the positions. However, the selection does not always determine the right leaders. An informal process to re-appoint farmers to replace those who had vacated positions is also required. This research supported Katon et al. (1997) and Pameroy et al. (1996) that elections were not the only way to identify good leadership.

Aside from the delegation of authority, this research also found that external support from the government through capacity building was also critical for enhancing leadership capacity of the FWUC. The leadership capacity was also dependent upon the existence of incentives. Interestingly, intangible incentives were more critical than tangible incentives in helping retain local leaders in leadership positions. Intangible incentives included: gratitude, respect, and the support of farmers towards their leaders.

The decision making processes the leaders used to implement, enforce, and adapt community rules also influenced the success of the FWUC. The decision making processes tended to be consensus-based, inclusive, responsive, effective, transparent, and fair. This was important because it generated trust and respect amongst the farmers, which in turn led to a high level of local participation in the irrigation scheme. This style of decision making also gave local farmers a sense of ownership and ensured local compliance with rules, a low level of water conflicts in the community and effective water distribution.

This research demonstrated that the adaptation of rules needed to be based on collective decisions to ensure local compliance. It does not matter whether or not the rules were formally adapted. As long as the rule adaptation was based on a collective decision, the adapted rules would be accepted as rules-in-use by farmers.

The benefits that flowed from the irrigation scheme were another key factor that influenced the success of the FWUC. This research found that benefits that flowed from the irrigation scheme exceeded the costs of participation and because of this, farmers participated in the scheme. Farmers achieved food security in their households once they obtained irrigation water to supplement rainfall for wet season rice. Farmers

also obtained additional revenue as economic returns in addition to food security from growing dry season crops.

The benefits were not equitably shared among FWUC members because of fluctuations in the availability of water from the reservoir and unequal water access as a result of topography of farmland, as well as the proximity of various farms to the scheme. Unequal benefit sharing did not prevent farmer members from participating in irrigation management as long as the farmers were better off compared to the previous situation when the scheme was not managed. This research revealed that farmers did not blame the leaders for the occasional lack of water supply to their farmland if they were aware of the cause of the problem, if they had previous experience with crop failure, if the costs of water access were high compared to benefits derived from it, and more importantly if they trusted the leadership to allocate sufficient water when water was available.

The success of the FWUC also required the high quality of the scheme infrastructure. As the scheme had a large well-constructed reservoir and a large number of well-built canals and support structures (control gates), the scheme was able to hold sufficient water and ensure the efficient supply of water to farmers. The quality of the scheme infrastructure was predominantly influenced by external support from the government and NGOs who helped rehabilitate the scheme, by regular scheme maintenance on the part of the leaders, and by the farmers' participation in scheme maintenance activities. The quality of the scheme has also depended upon its location, where the risk of floods and storms is reasonably minimal.

Although the Ministry and local authorities provided considerable support to the FWUC, they delegated almost all the decision-making authority to the FWUC, and this support was ongoing. This was seen to be important in that it allowed the leaders to respond promptly to problems and farmer requests, and gave the farmers and leaders a sense of ownership over the scheme.

Finally, this research revealed that the success of the FWUC occurred in part when the farmers could access markets for their produce. Market access helped enhance the benefits that flowed from the irrigation scheme, which then led to local participation. Market access was influenced by the FWUC's relatively short distance from markets and the consequent lower transportation costs, by the reasonably large proportion of

the district's production the community produced, and the high quality of their irrigated crops.

8.3 Implications of findings

The findings from this research have implications for the Ministry of Water Resources and Meteorology, the local authorities, NGOs, donors, local leaders, and local farmers. This research highlighted that different stakeholders use different criteria to assess the success of FWUCs. These views should be taken into account in the planning and evaluation of PIM schemes.

This research provided a framework that described the factors that influenced the success of FWUCs in irrigation management, and explored the interaction that occurred between those factors. The framework suggests that to implement a FWUC successfully it is important to consider the characteristics of farmers who depend on the irrigation scheme, promote local participation, strengthen the governance and management of the schemes, enhance the benefits that flow from the irrigation scheme, improve the quality of the scheme infrastructure, seek external support, and optimise market access for selling the farmers' produce.

The Ministry, NGOs, local authorities, and local leaders should help promote local participation through awareness raising of rights, rules, and the importance of participation in irrigation management because this ensures the level of farmer participation in every mode – fee payment, water distribution, scheme maintenance, and community meetings. Furthermore, to ensure farmer participation in maintenance and community meetings, local leaders should work alongside farmers and have skills to mobilise them. Leaders should organise maintenance work or community meetings that require short time input from farmers and when the farm workload is low. Leaders should make maintenance work less frequent for individual farmers. Leaders should also inform farmers of meetings a few days in advance and organise them at a convenient time for the farmers. Labour hiring for scheme maintenance should also be applied by the leaders when the community labour is in short supply or when there is a need for farmers with specialist skills.

Local leaders should enforce water distribution rules to ensure farmer participation in water distribution. Leaders should also make sure that farmers obtain adequate and

timely supply of water for cropping. As farmers have adequate and timely supply of water, they attain crop yields, which then motivate them to participate in fee payment and water distribution. The adequate and timely supply of water is reliant upon the quality of irrigation schemes. Irrigation schemes that were built during the Pol Pot period are often poor. One way to address this requires the Ministry, NGOs, or donors to take responsibility for scheme rehabilitation beforehand. The Ministry, NGOs, or donors have to make sure that the quality of the scheme infrastructure is of a high standard before providing other support to the community. Irrigation schemes should have a large number of well-built canals and support structure because this is critical for ensuring efficient supply of water to farmers in different locations with minimal loss of water. Furthermore, if irrigation schemes are located in areas where flood and storm are commonplace, the Ministry, NGOs, or donors are required to provide additional maintenance support to help reduce the costs incurred by the farmers.

The Ministry, NGOs, and local authorities should also help enhance leadership of FWUCs. Good leadership can lead to adequate and timely supply of water and trust between the leaders and farmers, which then lead to farmer participation and then the success of FWUCs. To ensure good leadership, the leadership selection process is critical. The Ministry, NGOs, and local authorities have to spend a considerable amount of time facilitating the selection of leaders and allow farmers to select their own leaders. Leadership selection should focus on finding leaders with the 'right' attitudes, and knowledge and skills. For example, the focus should be on finding those leaders who have a positive work ethic and commitment to the irrigation scheme, and those who are willing to put the interests of the community ahead of their own, work along-side farmers, accept responsibility, and continue to learn. This research also suggests that education should not always be a key criterion for leadership selection. The selection should be targeted to finding those who have social status or experience in irrigation management because leadership capacity often resides in these people. The selection should also focus on those who have knowledge about geographical location, topography of farmland, scheme infrastructure, and water routes. More importantly, persons who are suitable for leadership should be those who live in the communities and depend on irrigation schemes for their livelihood. These people would have high incentives to work for communities and be recognised by their members.

Other important factors that enhance leadership capacity are the continuous capacity building after the selection process, the delegation of most of the decision-making authority by the Ministry and local authorities, and the maintaining of incentives

especially intangible incentives by the farmers towards their leaders. It is also recommended that the efforts to maintain good leadership capacity should focus on appointing farmer members who have potential in irrigation management to replace those leaders who leave positions.

This research strongly suggests that leaders need to build trust with the farmers in order to ensure farmer participation and the success of FWUCs. Local trust in the leadership is critical because it ensures a low level of conflict over water in communities and cooperation and participation by farmer members in irrigation management despite the occasional lack of water supply. Trust is developed depending upon the leadership capacity of leaders if the leaders have good attitudes and knowledge and skills to manage the irrigation schemes and the nature of their decision making processes.

To implement FWUC successfully, the Ministry and the local authorities should make sure that the leadership makes decisions to govern and manage the scheme to meet six criteria of being consensus-based, inclusive, responsive, effective, transparent, and fair. The use of these criteria will help foster trust and respect between the leaders and farmers and this is a reason why farmers participate in managing an irrigation scheme. To make sure decision making by the leaders meets these criteria, the Ministry and local authorities should help build their capacity through training, provide consultation, delegate most of the decision-making authority to the local leaders, and assist them in rule enforcement. They should build capacity of the leaders relative to water distribution, scheme maintenance, community meetings, budget management, and related paper work. The Ministry and local authorities should help provide budget support if necessary, because local leaders need adequate financial resources to be able to operate a scheme effectively. Additionally, farmers will have to do their part by participating through fee payments, assisting with water distribution and scheme maintenance, and attending community meetings with the leaders.

The efforts to maintain the high value of benefits from irrigation are also important in ensuring the success of FWUCs. To do this, farmers should obtain adequate and timely supply of water for cropping. Furthermore, the amount of irrigation service fees should be set in accordance with the benefits that flow from irrigation schemes and the costs of the alternative source of water in a community. Local leaders should allow farmers to pay a portion of full irrigation service fees when farmers face crop failure. NGOs also need to set up microcredit or self-help groups on fertiliser or seeds to help

reduce production costs incurred by farmers. The Ministry and NGOs should also help identify or set up markets for farmers to sell their crop produce.

To ensure the success of FWUCs, the Ministry, NGOs, and local authorities should help provide support. The support should be in a variety of forms such as rehabilitation and development of irrigation schemes, assistance with the formation of FWUCs, capacity building, provision of financial resources, assistance with rule enforcement, consultation, and conflict resolution. Support should be ongoing and FWUCs should hold most of the decision-making authority to manage their own irrigation schemes.

This research suggested that the Ministry, NGOs, and donors should take into account the characteristics of farmers within irrigation schemes. Farmers are more likely to participate in irrigation management if they are dependent upon irrigation schemes for their livelihood, if they have experience in self-organisation, and if they are reasonably homogenous.

8.4 Evaluation of the methodology

A single embedded case study approach was applied in this research because it addressed research objectives by allowing the researcher to gain an insight into the case situation and explore various issues raised by different groups of stakeholders to identify factors that influenced the success of the FWUC. A multiple case-study method could also be useful for this type of research because it allows researchers to compare results across case studies to achieve information richness. However, because of the complexity of the case and the time requirements involved, a multiple-case study is not recommended for a small research project. However, a multiple-case study design might be used if one was investigating one or two of the factors as opposed to all the factors.

This research supports the view that within-case sampling is critical for obtaining good data about the case. The snowball strategy was useful in identifying respondents who could provide information on particular issues, as suggested by Fossey et al. (2002), while the maximum variation sampling strategy enabled the researcher to identify common patterns that cut across variations in the community, as proposed by Patton (1990) and Sandelowski (1995).

The fieldwork in this study was separated into two phases, which allowed the researcher to have time to reflect on the data collected from the first series of interviews before undertaking the second phase of data collection. Similarly, for future research it is recommended that fieldwork be divided into multiple phases and that sufficient time be allowed for each phase. The best time for fieldwork should be in-between the growing and harvesting periods, because during this period, the researcher will have more opportunity to observe farmer practices associated with crop production and harvest. Staying in the community is highly recommended because it allowed the researcher to build rapport with members of the FWUC, which made data collection less difficult. It also allowed the researcher to observe many of the practices associated with irrigation management such as water distribution.

The use of multiple techniques of data collection was applied in this research and it is also recommended for future research. The use of multiple techniques of data collection provided complementary data to complete the analyses involved in this research. For example, the use of group discussions provided data that supplemented information from key informant interviews. Similarly, participant observation was used to obtain information that was inaccessible through interviews and group discussions. The informal conversational interviews were critical to accessing data from individuals who could not attend formal interviews, for example, the middlemen. Audio recording was useful because it helped capture and store a complete record of the data for detailed analysis; it is also highly recommended for future research. However, it is worth noting that a researcher needs to provide an explanation of the purpose of using audio recording to respondents and to ask for their permission beforehand.

The initial literature review that guides the development of a theoretical framework for the study was critical in this research project, because it helped guide the researcher throughout the fieldwork process. However, the researcher learned that she needed to keep an open mind to avoid missing observations of data that might appear outside the framework provided by the existing literature.

The researcher also faced difficulties in analysing the data. Due to a lack of time and resources for managing the large volume of data that was collected, the researcher chose to not transcribe the data. Rather, she found that by listening to the audio tapes and summarising in English the key points under each individual question, data analysis could be accomplished within the constraints of the project. However, the researcher faced difficulties in maintaining the original meaning of the recorded

statements. To address this issue, the researcher took two courses of action: reviewing field notes before and after listening to the tapes, and repeating the listening process more than once.

8.5 Future research

A range of future research areas have been developed from this study. Subsequent research should focus on assessing the extent of the success of a FWUC by using the three criteria - efficiency, equity, and sustainability - suggested by Ostrom et al. (1994). Future research can also replicate this study by investigating another successful case to see if the same results are found. Furthermore, if time and resources are available, future research could focus on conducting multiple successful cases with different variables of community characteristics or external support to compare and contrast factors that influence success. Another focus should also be on selecting successful cases and unsuccessful cases to see whether or not factors found in successful cases are found in unsuccessful cases. These results will help add more value to the findings of this research.

One finding of this research was that the success of the O-treing Farmer Water User Community was influenced by the level of farmer participation. By using a qualitative case study strategy, this research identified several factors that influenced farmer participation in irrigation management. It is recommended that future research use a survey strategy to identify factors that influence local participation, as this would help supplement the findings of this research. This study also suggests that future research might further investigate whether or not the factors that influence farmer participation vary according to a farmer's location in the scheme (e.g., above the reservoir, or at the head, middle, and tail of the scheme).

Trust in leadership capacity was found to influence farmer participation in irrigation management and ensure a low level of water conflict in a community. Future research should further investigate this. It should also further identify what factors influence the development of farmers' trust in local leadership.

This research identified three attributes of leadership capacity that influenced the success of the O-treing Farmer Water User Community. These three attributes were: attitudes, knowledge and skills, and authority. Future research should re-focus on this

to see whether or not the same leadership attributes are found in other successful cases of FWUCs.

Another finding from this study was that good leadership capacity was influenced by the incentives that are provided. However, it was the intangible incentives (respect, gratitude, and support) from farmer members that motivated the leaders in this FWUC to remain in their leadership positions. Farmers showed great respect and gratitude to their leaders when the leaders had a positive work ethic, were committed to their work, and were willing to put the interests of the FWUC ahead of their own, as well as to work alongside farmers, and to accept responsibility. The factors that influenced these characteristics could be investigated further in future research.

This study found that the level of external support from the Ministry, local authorities and NGOs was high in the FWUC under consideration. External support proved to be critical to the success of the FWUC because it helped enhance the quality of the scheme infrastructure, optimise the governance and management of the scheme, and improve farmers' awareness of irrigation management leading to increased local participation. Apart from the fact that the O-treing scheme was a pilot scheme of the government, the FWUC obtained external support from local authorities because of its leadership capacity. Future research needs to further investigate this, especially the identification of factors that influence the level of external support from local authorities. This will help address problems stemming from the lack of support by local authorities for some irrigation schemes in Cambodia.

Finally, this research suggests that future study should use the Institutional Analysis and Development Framework suggested by Ostrom et al. (1994) to analyse the interactions of irrigation stakeholders in irrigation management. The focus should be on identifying what factors and conditions enhance the level of cooperation between irrigation stakeholders in a community. This will help supplement the findings of this research.

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