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INSTITUTIONAL ANALYSIS OF WATER GOVERNANCE AND MANAGEMENT OF IRRIGATION SCHEMES IN HAITI

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ABSTRACT

The critical role of institutional settings and arrangements in the determination of performance in natural resources management, especially since the development of New Institutional Economics, seems to be out of discussion. Although institutional reforms had been earlier implemented in more developed economies (such as Japan, USA, France…) in late 1980s governments in developing countries have embarked in vast reforms aimed at devolving responsibilities over irrigation water management to local institutions crafted by resource users. In Haiti, although some previous isolated trials, such institutional changes in the water sector have started in late 1990s. In this Master Thesis dissertation we analyze the devolution process (over irrigation water governance and management) in Haiti and we study the community-based management in three irrigation schemes from an institutional point of view.

Findings show that the government in Haiti has a clear vision and sound objectives to transfer irrigation management responsibilities to farmers' institutions and organizations. It has elaborated a comprehensive methodology to reach that goal, and efforts have been made towards enacting new laws to sustain the process. Nevertheless, the process is hampered by several deficiencies which include absence of an appropriate public organizational structure having the capacity and means to plan and implement a transfer program. Furthermore the program itself has not yet been elaborated, and the necessary political will to support and back up the process, especially by bringing needed means and realizing required administrative reform, is also lacked. Issues such as water rights and water pricing systems are also not yet tackled by the ongoing reform.

Given the current legal framework and socio-economic conditions of irrigated agriculture in Haiti, the field study shows evidence that institutional settings and arrangements crafted by water users or at least with their strong participation perform better in providing related services to farmers than the former authoritarian rules established by the centralized bureaucracy management. Formal rules that are established by Water Users Associations are combined with informal rules-in-use to deliver irrigation water related services to users, while raising their participation in scheme administration, operation, and management related tasks. Relevant criteria and indicators are used to assess and discuss the management performance of the studied schemes. Finally, we

make suggestions that can bring improvements in both the ongoing devolution process and scheme management.

The dissertation is structured in seven chapters. The first one describes the study, which includes background information, problem statement, objectives of the study, and the hypotheses we have formulated to guide the study. The second chapter is devoted to outline some relevant theories and present the theoretical and analytical framework. The third chapter describes the material and methods that are used to gather data and information. Chapter four presents the synthesis of an extensive literature review: it includes the analysis of the main IMT strategies implemented worldwide and the discussion of the major factors that explain differences in success from one country to another. Finally, the devolution or IMT process in Haiti is analyzed in this chapter. Chapters five and six present the findings of the field study. While chapter five discusses the community-based management of irrigation water in the three selected schemes, chapter six presents the results and discussions of their management performance. In the seventh and last chapter we draw the most important conclusions of the study and we make some suggestions for improvements in both the devolution process and irrigation scheme management.

The Author

LIST OF ABBREVIATIONS

AVSF	“Agronomes et Vétérinaires sans Frontières”
BID	InterAmerican Bank for Development
CAMEP	Autonomous Metropolitan Drinking Water Company
CCID	Central Committee of Irrigation in Dubre
CCIGG	Central Committee of Irrigation in Grison-Garde
CCISR	Central Committee of Irrigation in Saint-Raphael
CICDA	International Center for Cooperation and Agricultural Development
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CPR	Common Pool Resource
EDH	Electricity Company in Haiti
FAO	United Nations Organization for Food and Agriculture
GAA	German Agro Action
GDP	Gross Domestic Product
GRI	Working Group on Irrigation
HDI	Human Development Index
HTG	Haitian Gourde
IAD	Institutional Analysis and Development
IDA	Institutional Decomposition and Analysis
IFAD	International Fund for Agriculture and Development
IHSI	Haitian Institute for Statistic and Computer
IMF	International Monetary Fund
IMT	Irrigation Management Transfer
IWMI	Integrated Water Management Institute
LID	Land Improvement District
MARNDR	Ministry of Agriculture, Natural Resources, and Rural Development
MDE	Ministry of the Environment
MDI	Interior Ministry
MTPTC	Ministry of Public Works, Transport, and Communication
MPCE	Ministry of Planning and External Cooperation
MSPP	Ministry of Public Health and Population
NGO	Non Governmental Organization

OD4SS	Organization for the Development of fourth Section Sanyago
ODN	Organism for the Development of the North Department
ODVA	Organism for the Development of the Artibonite Valley
O&M	Operation and Management
PPI	Projet de Réhabilitation des Petits Périmètres Irrigués
SCIPA	Service Coopératif Inter-Americain de Production Agricole
SNRE	National Service of Water Resources
SNEP	National Service of Drinking Water
SRL	Society of Limited Responsibility
UNDP	United Nations Development Program
US	United States
USA	United States of America
WBI	World Bank Institute
WUA	Water Users Association

Units

ha	hectare
HTG*	Haitian Gourde
Km	kilometer
mm	millimeter
sq km	square kilometer
US$	Dollar of the United States

***Note: When the field study was held in Marc-April 2007: 38 HTG = US$1**

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CHAPTER I

INTRODUCTION

1.1. – General

Humankind has been worrying about natural resources management since long. In 18th century already, the classical economists (T. Malthus, D. Ricardo, J. Mill) had great concern about the capacity of natural resources, specifically land, to insure well being of the increasing world population in a sustainable manner. In the first half of the last century the neoclassical economists, especially Gray and Hotelling had established rules for achieving optimum level of natural resource allocation. Welfare economy, institutional economy in particular, has tackled issues related to externalities, property rights and use and allocation of public goods in order to prevent overexploitation and depletion of resources. Water is one of the most important natural resources on which life depends; it has been considered as the very lifeblood of the world (Swain, 2004). Its great importance, its multiple uses[1], while the quantity available to satisfy the increasing populations needs[2] is limited; render water allocation and management to an often complex and difficult task responsible for many conflicts (see also Hoornbeek, 2004). There are many examples of regional and trans-boundary water conflicts[3] between riparian countries or even national level conflicts.

Agriculture is without controversy the most important user of water resources, at least and especially in most developing countries (World Bank 2006). Agriculture is accountable for 67% of the total water withdrawal on the earth (Swain 2004, Karlro and Balooni…). The irrigated area has drastically increased worldwide, especially in developing countries during the last half century. Moreover besides technological progress, it has played and still plays a major role in agricultural productivity and production increases, as well as food security in those countries. Irrigation has stabilized

[1] The most common uses of water are: agriculture in general, industry, domestic uses, hydropower generation, means for transportation, recreational activities including swimming, environmental and climatic regulation purposes.

[2] In 50 years, from 1940 to 1990, the world population has increased from 2.3 billion to 5.3 billion inhabitants; and for the same period the per capita use of water also has doubled from 400 to 800 cubic meters per person per year. It is projected by 2025, 3 billion people will be living in countries facing water stress

[3] For example the cases of the Jordan River in the Middle East, the Nile River, the Mekong River, the Euphrates – Tigris Rivers basin, the Aral Sea water conflicts and degradation, the case of Zambezi in Africa, conflicts between Mexico and the USA over the pollution of Rio Grande, to quote only those ones.

food production and prices by enabling greater production control and scope for crop diversification (Andrew, 2006). Around 20%[4] of the world agricultural land is irrigated and this fraction produces almost 50% of agricultural food worldwide (Jean-Noel, 2005; Herard 2005). However, irrigation is not only the largest consumer of water resources, it also contributes to many water-related problems such as soil degradation and salinization; national and trans-boundary water conflicts; pollution of surface and groundwater; and so on. In addition, numbers of irrigation systems, especially large-scale Government agency owned and managed schemes, are accused a low efficiency and weak management performance. As major consumptive water user, and with increasing pressure on water resources, irrigation systems have to release water for other uses and will have to produce more crops per drop (Malano et al 2004, Gorantiwar and Smout 2006, Vermillion 1999).

Concerning the development and management of water for agriculture, one may notice four important facts since the second half of the last century. First, there is a trend (or at least great debates) to shift from constructing heavier infrastructure such as big reservoirs and dams towards more attention on managerial aspects. Water suppliers and planning agencies have changed their focus and explore efficiency improvements, implement options for managing demand, and reallocate water (Gleick, 2000), for mainly environmental, economic, and social reasons. Second, water resources development, preservation, and management have been placed at the top agenda of debates at global level (Salman 2003, Rogriguez 2004). Many people view in the water development, allocation, and management related issues the greatest, if not the only, challenge policy-makers and other relevant stakeholders have to tackle during this century. In this regard number of international conferences, forums, summits, and so fourth have been held to tackle water related issues. Amongst those events we especially mention the Dublin Statement and the Rio Conference. The Rio Conference has defined water as an economic good and prescribed that it must be valuated as such. The Conference postulated also that the stakeholders should be involved in its management. Third, since Hardin's article in 1968 on "the tragedy of the commons" a fast growing number of works have been done to tackle the problems related to common asset management, and especially management of common pool resources (CPR). As typical CPR (Bromley

[4] According to Thenkabail et al (2006) the estimated irrigated area in the world was 8 million ha in 1800, 95 million ha in 1940, and currently it is estimated to be over 274 million hectares.

1992), irrigation systems that are self-managed by local communities have been ranged among good examples of alternatives to overcome the tragedy (Ostrom 1990, Bromley 1992) in that sector. Fourth, consequently and because of the perceived inadequacy and inefficiency in publicly managed irrigation schemes, governments in several developing countries have undertaken processes to turn responsibilities over operation and management of irrigation schemes to Water Users Associations (WUA). In this regard Vermillion (1999) has pointed out that from the late1980s a new paradigm of irrigation development has come to the forefront – the era of reform. He argues that irrigation systems will not be able to perform as expected without basic institutional reforms consisting of the devolution of some or even all irrigation management related responsibilities to water users associations.

1.2. - The case of Republic of Haiti – Background information

1.2.1. - Geography, population and socio-economy

Located in the Caribbean Sea between 18°01 and 20°06 North latitude and 71°58 and 74°29 of west longitude, Haiti occupies the western part of the Island of Haiti (Hispaniola) which is situated between North and Central America in the golf Americano-Mexico. It is bounded in the east by Dominican Republic and elsewhere by the sea (the Atlantic Ocean and the Caribbean Sea). The country size is 27,750 sq km and it has several islands[5]. The agricultural land is about 1 405 000 ha, which represents 50.6% of the total area.

In 2005 the population was 8.373 millions inhabitants; out of which 60% lives in rural area (IHSI, 2005). The active population represents 54%[6] of the total population. Haiti, one of the less developed countries in the Americas, is characterized by the predominance of agriculture in its economy; contributing for 25% of the GDP (MARNDR et BID, 2005) and accounting for around 50% of the overall employment (see also FAO, 2000 and World Bank 2005b). However, since the 1980s the performance of this sector has been stagnant mainly due to degradation of the quality of the country's capital

[5] Such as : "Ile de La Gonave" (684 sq. km); "Ile de La Tortue" (193 sq. km); "Ile à vache" (52 sq. km); "Iles Cayimites" (45 sq. km), and 'la Navase' that now belongs to the USA.
[6] Around 50% of the active population works in agriculture related activities

stock[7]; and the political and economical environment that has discouraged investment. Additional reasons include the inability or the clumsiness of the state to provide the needed public goods and services that could promote the sector's development, and to establish an institutional framework necessary to gives incentives to economic growth within the country. As a consequence most of the cultivated crops, even the irrigated ones, have shown negative trends of yields which are constantly becoming lower than the other countries in the region (see also FAO, 2000; World Bank, 2005b and 2006b).

Over 50% of the population lives below the US$1 a day and 76% below the US$2 a day poverty line (IMF, 2006 and World Bank, 2006b). The adult illiteracy was 39% in 2000, live expectancy 52 years in 2002, and fertility rate 4.4% in 2000. The inflation rate was 8% in April 2007. Haiti occupies 153rd rank in the 2006 HDI (Human Development Index) of the UNDP (United Nation Program for Development). According to World Bank (2006b) the real income per capita in Haiti fell down by an average of 1% per year from 1961 to 2001, which results in a decline of the real income per capita of 40% during four decades in which economies were growing fast worldwide.

1.2.2. – Climate and water resources

The climate in Haiti is tropical and humid with irregular heavy rains. Haiti is often affected by strong hurricanes, storms, and heavy seasonal rainfalls. On average every five years there is a cyclone with devastating effects. Its mountainous relief with short and steep river channels, combined with huge lack of proper infrastructure, renders the country vulnerable to natural disasters even at normal periodic precipitations levels. The annual average rainfall is 1461 mm (FAO, 2000), with a variation from 500 mm per year along the southern coast of the North peninsula to almost 3000 mm per year at Sault Mathurine on the south peninsula. The average annual temperature is around 29^{0}C

In 2000, FAO[8] has estimated the total renewable water resources in Haiti at 14.025 km^3 and the water withdrawal for agriculture at 0.93 km^3 representing 7% of the total renewable water resources within the country. Haiti annually receives an average of 40 billions cubic meters of water by precipitation (MARNDR 1991, quoted by MDE 2001).

[7] Capital stock includes soil fertility, irrigation infrastructures, roads…
[8] FAO: United Nations Organization for Food and Agriculture. It is a specialized agency of the UN system.

Nevertheless, during the second half of the last century the available surface freshwater has drastically decreased within the country ((MDE, 1998) due constant decline of rivers water flow as a consequence of environmental degradation. Moreover, Haiti is ranked among the countries that are going to struggle with water stress and scarcity by 2025.

1.2.3. – Irrigation

Although annual precipitation is relatively high, irrigation has been considered indispensable to secure agricultural production because of the unequal rainfall distribution pattern within the year and the high values of evapo-transpiration[9]. Thus, Irrigation has been developed since the very beginning of the practice of agriculture in the 16th-17th centuries during the colonization era to supplement water from rainfall. The development of irrigation is still seen as a factor that can enable an increase in agricultural productivity and production, leading towards food security (AVSF-CICDA, 2004) and rural development in Haiti. Four main irrigated plains constitute the country's most important agricultural areas: the '*Plaine du Nord', Fort Liberté* area in the North, the Lower Artibonite and Estere Valleys in the Artibonite Department, the '*Cul de Sac'* plain in the West and the '*Les Cayes'* flat in the South. In annex 2.3 it is presented the repartition of irrigated area by geographical department according to FAO AQUASTAT data.

1.3. – Problem statement

In the 1990s, the Haitian Government has started a process of devolution in irrigation water management targeting to raise agricultural production and productivity through a more efficient and effective management of irrigation schemes. Such a change is justified mainly by the perceived inefficiency of government agency-managed schemes as well as the incapacity and inadequacy of the government to support the relevant costs for operating and managing irrigation systems. Moreover, the sub-sector of irrigated agriculture has been facing many problems as a result of historical inheritance, the socio-economic condition of farmers, the socio-political framework, the institutional arrangement and the rule of law within the country. The envisaged devolution process

[9] Refers to the total quantity of water which evaporated from a certain area including the crops transpiration, for a given field crop it corresponds to crops water requirements

program mainly consists of transferring day-to-day irrigation scheme management related activities to water users and their organizations (MARNDR, 2000a). Several projects have been implemented by government bodies and by Non-Governmental Organizations with the overall objective to increase and strengthen farmers' institutions and organizations to take responsibilities over the management of the irrigation schemes.

However, the ongoing process is facing its own challenges such as:

- lack of a suitable legal and institutional framework to sustain the new management style of schemes (MARNDR 2000 and GRI, 2005);
- inexistence of a water rights system that could govern the resource development, allocation, and exploitation;
- lack of supporting measures to enhance the profitability of farming activities in order to improve farmers ability to finance increased operation and management costs occurred with the transfer;
- inexistence of a water pricing system; as a consequence water users associations establish, on case to case basis without any reference within the country, water charges to insure, in best situations, yearly management of schemes which are transferred to them. In this regard Legal, Rieu, and Fall (2003) have objected that Water Users Associations in general are facing the challenges relating to the long term sustainability of their schemes, both at technical and economic levels;
- environmental degradation causing water shortage as well as irrigation infrastructure deterioration by sedimentation (Herard, 2005)

World Bank (2005b) has argued that access to irrigation in Haiti is hampered by the absence of public sector institutions, by the inexistence or inefficiency of water works, and by the lack of local capacity to make the required investments. The established water users associations (WUAs) are very often not financially sustainable due to low level of both irrigation fees and collection rate, which is sometimes the consequence of low productivity of agricultural production. Weaknesses in the management of schemes by farmers' associations can be situated at different levels, especially in the transfer process itself and also in the established institutions and institutional settings at the level of irrigation systems. In addition, there is a huge lack of research dealing with the problems that are faced by the process. In this study we aim at analyzing the

governance of irrigation water, in three irrigation schemes, from an institutional point of view.

1.4. – Research questions

Given the problematic of the transfer process we are asking the following questions:

What are the main reasons for changing paradigm in the governance and management of irrigation systems?

How is the institutional environment, surrounding the irrigation management transfer process in Haiti, characterized?

What are the characteristics of institutions and institutional settings established by water users at the level of irrigation schemes to run their schemes?

How water users associations perform tasks and responsibilities to deliver related services to farmers? How do they interact with other stakeholders?

How are the schemes performing?

How the process and schemes management can be improved?

1.5. – Objectives of the study

General Objective

With in mind the above research questions the study targets to analyze the governance and management of irrigation water in three irrigation schemes in the framework of irrigation management transfer (IMT).

Specific objectives

Specifically the study targets to:

- Analyze the institutional environment surrounding the irrigation management transfer process in Haiti;
- Study the community-based management in three irrigation schemes in the North of Haiti;
- Analyze the management performance of those schemes based on some selected criteria and indicators;
- Make suggestions for the improvements of the IMT implementation process, as well the management of the selected irrigation schemes.

1.6. – Hypothesis

Three hypotheses are formulated as follows:

- The actual institutional settings and arrangements to implement the IMT process within the country are not likely to lead to successful management transfer;
- Community-based management improves management performance of schemes;
- Financial self sufficiency is the major constraint faced by users associations in managing their schemes.

1.7. – Limitations of the study

A first limitation is that the lack of available information and data on management performance prior to the management transfer process renders comparison between the two equilibriums, before and after/during management transfer, difficult. Second, because of limited time and means all schemes we have studied are situated in the same department and experienced the same transfer process (projects implemented by an NGO). Richer analyzes would have been made if we could analyze schemes with different transfer process experiences[10]. Third, there may be some biases in the choice of farmers who have participated in the group discussions, since committees members of Water Users Associations had to choose and gather them for us. Finally, the professional background of the researcher as well as his status of employee in the Ministry of Agriculture could not be hidden in the discussions with water users, and this may have influenced somehow their responses as witnessed from some of the questions often asked to us.

1.8. – Structure

As shown in figure 1 below this dissertation is structured in seven chapters. The first one which is the introduction presents the study design and thus contains some background information related to the topic, the problem statement, the research questions, the objectives of the study, and the elaborated hypotheses. In the second chapter some relevant theories often used in institutional analysis are briefly presented, the theoretical and analytical frameworks on which the study is based are described, and the conceptual and analytical framework to carry out the institutional analysis of irrigation water governance in three selected irrigation schemes in Haiti is presented. Chapter III

[10] In fact depending on the size of irrigation schemes, the specific regions, and especially on whether transfer projects have been implemented by governmental bodies or private (usually NGO) transfer process experiences can differ from case to case within the country.

explains the method and material used to gather relevant data and information. Chapter IV is devoted to literature review; the major IMT strategies implemented worldwide including the case of Haiti are presented and based on countries experiences in implementing irrigation management transfer programs the main factors which are likely to explain success or failures of such programs are synthesized. The chapter ends with a focus on the concerned case of Haiti IMT process. Chapter five and six present the findings and discussions of the study. While chapter V presents results related to institutional settings and arrangements established by WUAs to manage their schemes; chapter VI is devoted to analyze schemes management performance. Based on the findings and discussions, in the seventh and last chapter, the conclusions as well as some suggestions for the improvement of IMT process and schemes management are proposed.

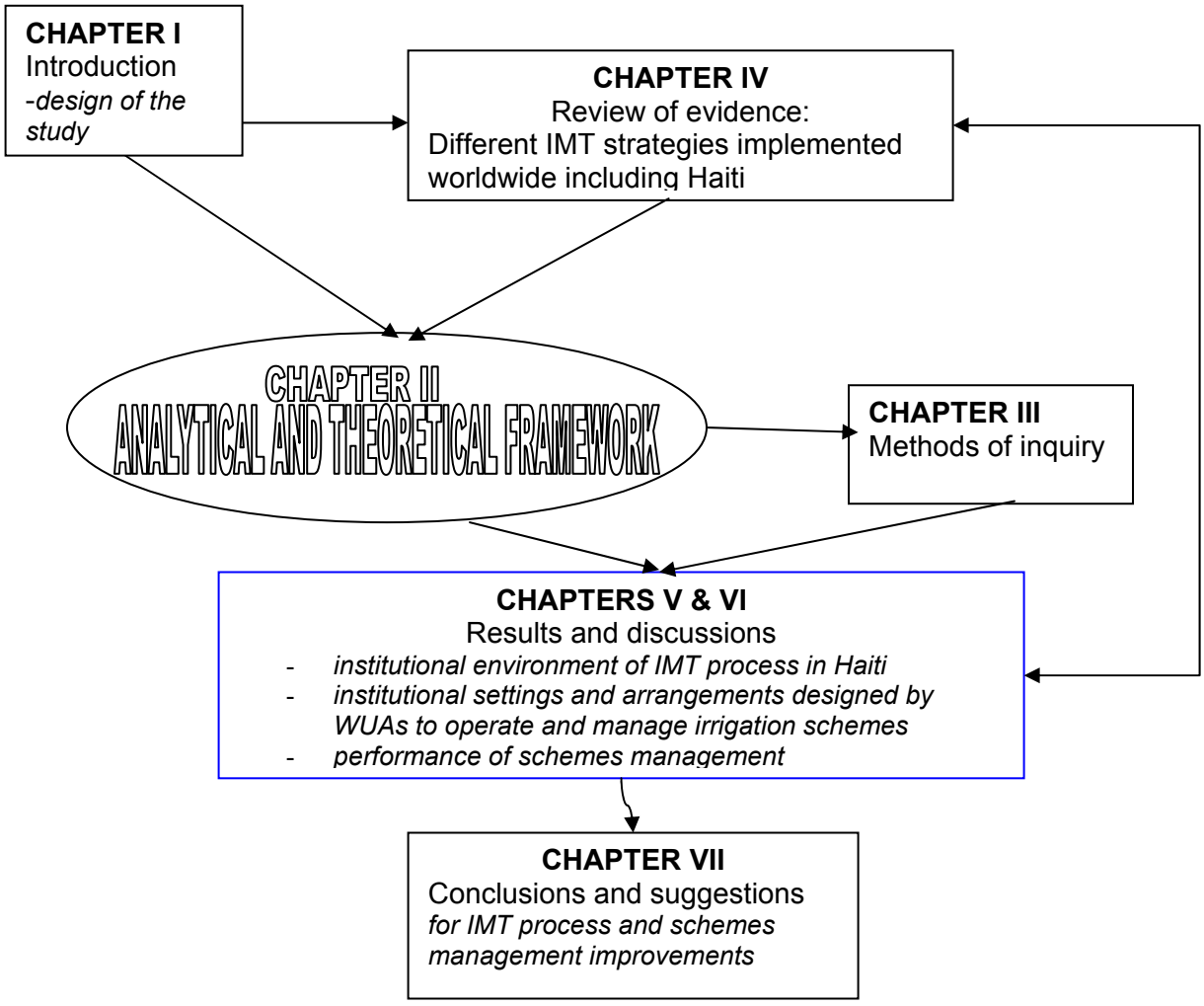


Figure 1: Structure of the dissertation

CHAPTER II

THEORETICAL AND CONCEPTUAL FRAMEWORK TO THE INSTITUTIONAL ANALYSIS OF WATER GOVERNANCE AND SCHEMES MANAGEMENT IN HAITI

The New Institutional Economic theory gives sound conceptual and theoretical frameworks to study institutions and institutional changes in the governance and management of common-pool resources such as water. In this chapter some relevant concepts are defined, an insight on the problematic of irrigation water governance and management is given, and some major theories on which analyses are based, are outlined. The theoretical frameworks are presented as well as the conceptual and analytical framework to carry out the institutional analysis of irrigation water governance and schemes management in Haiti and specifically in three selected schemes.

2.1. – Concepts definition: Institutions, Organizations, and governance of irrigation water

Analyzing the institutional arrangements in the water sector, Carruthers and Morrisson (1996) have identified the core activities which need to be carried out in managing water; these include construction of infrastructure, collection and/or abstraction of water, water allocation, and resource mobilization for maintenance of the collection and delivery systems. Each of those activities requires a set of decisions, institutional arrangements in which different parties are involved. For example they identify three main types of institutions for the control of transactions between parties over the allocation of water: the market, hierarchy or government agency, and community or commune. Therefore, institutions and organizations are core concepts in studying institutional arrangement over the governance of irrigation. Literature reveals that there is neither one single definition for institution, nor a common understanding on the difference between institutions and organizations. Carruthers and Morisson (1996), quoting Knight (1992), state that an institution is a set of rules that structures the actions among actors. They define it as rules that establish economic relationship between individuals (see also North and Thomas 1970). While organizations, according to them, are collective actors who might be subject to institutional constraints. Hagedorn (2006) has pointed out that institutions are the rules of the game in a given society referring to all kind of rules that

enable to harmonize human behavior, while organizations are mechanisms, tools or instruments to make work or apply those rules or to play the game (see also Nikku 2002, Bandaragoda 2000). An organization can also be an institution. According to Saleth (2004), institutions are entities defined by a configuration of legal, policy, and organizational rules and practices that are structurally linked and operationally embedded within a well-specified environment. According to North (1990), the major role of institutions in a society is to reduce uncertainty by establishing a stable structure to human interaction. Grief (2005) has argued that institutions refer either to rules, organizations, contractual forms, or patterns of behavior; which change in response to environmental changes.

Fisher et al., (2004) quote Huppert and Vermillion (…) to define governance as a body of rules, enforcement mechanisms, and corresponding interactive process that coordinate and bring into law the activities of involved parties and people to a common outcome. It is a result of a multitude of actors and mechanisms. Governance is everything that happens with regard to resource management in a given situation. Gupta (2004) has defined water governance as a combination of administrative and politico-social measures, which need to be undertaken, accordingly to needs and priorities of a given region, for insuring management, conservation, and equitable distribution of water.

2.2. - Problematic of irrigation water management

In this section we focus on two aspects of the problematic of irrigation water management: its nature of common-pool resource and issues linked to the management form (or in other words in a given situation, the established institutional settings and arrangements) of irrigation schemes.

2.2.1. – Irrigation water as a common-pool resource

Common pool resources or common property resources indifferently called ‘the commons’ can be defined as scarce and subtractable resources. Ostrom (1990) states that a Common Pool Resource (CPR) refers to a natural or man-made resource system that is sufficiently large as to make it costly to exclude potential beneficiaries from obtaining benefits from its use. The high cost of exclusion is responsible for the ever-

present temptation to free-ride that exists in CPR. Because CPR shares part of its attributes with private goods (rivalry) and the other with public goods (non excludability), institutions and/or organizations undertaking the management and governance of such resources, according to Ostrom (1990), will face some problems that are similar to those which providers of private goods are facing, as well as some problems similar with those which public goods providers encounter. Table 2.1 below presents the basic economic classification of goods in function of two criteria: excludability, indicating whether it is difficult to exclude people from using the given good; and rivalry, indicating whether there is competition to use or obtain the good. Irrigation water, as an economic good, belongs to that class of Common Pool Resource (CPR) (Bromley 1992), because in most cases it constitutes an important input for agricultural production, which exists in limited quantity within the irrigation schemes; and the water withdrawn by an irrigator is no longer available for others. This rivalry in using water exists not only between irrigators but also between its use for agriculture and other uses. When such resources which are scarce and subtractable are exploited in an open access regime by a great number of users, it may lead to what Garret Hardin (1969) has qualified: “the tragedy of the commons”.

Table 2.1: basic classification of goods

Classic division of goods in economy		**Excludability**	
		Easy	Difficult or costly
Rivalry / subtractability	High	Private good**,** e.g. cars, clothes, bread	**Common Pool Resource (CPR)**: e.g. irrigation water, fish in the sea, biodiversity, forest…
	Low	club good e.g. bridges, cable TV	Public good e.g. national defense, 'free to air'.

Source: adapted from Ostrom, Gardner, and Walker (1994) and Theesfeld, 2001

2.2.2. – Irrigation water governance and management form

As mentioned above, during the last decades governments in several countries worldwide have undertaken ambitious programs in the water sector in which the common aim was to turn responsibilities over the operation, administration, and management of irrigated schemes to more private entities such as Water User Association (WUA). Reasons for such reforms can be found in the way irrigation schemes were running before changes have occurred. Kumar (2006) and Chambers (1988) have evoked four management forms of irrigation systems: private management,

irrigation managed entirely by government agency (Agency-managed irrigation), systems managed entirely by farmers (farmers-managed systems), and systems jointly managed by farmers and government (joint managed irrigation systems) (See also Imperial 2005). Although all those types of management may have advantages as well as disadvantages, the failures of agency-managed irrigation systems seem to be the major, if not the only, justification for changing paradigm in irrigation management and governance. The World Bank (2006) has stated that performance of irrigated agriculture, in publicly managed schemes, generally falls below technical and economical potential. Literature reveals various problems face by government agency-managed irrigation schemes. The most important ones are: 1) inadequate water availability at the lowest outlets, because government agencies fail to distribute water equitably between upper and lower ends of irrigation systems; 2) poor management of irrigation schemes; 3) inadequate allocation for operation and maintenance; 4) inadequate distribution of water; and lack of incentives for saving water (World Bank 1998, Yercam 2003, Pasaribu & Routray 2005, Gupta 2004, Schuman 2006). Although Investments in large-scale irrigation systems are often very high and totally subsidized, water supply tends to be unreliable, unpredictable and inequitable; and also insufficient budget is allocated to O&M (Operation and Maintenance) (Schuman 2006, Gupta 2004). Also a lack of adequate institutional instruments to properly run the operation and management of agency-managed irrigation schemes has been demonstrated (Trung et al. 2005, Gupta 2004, Rodriguez 2004, Makkaoui 2006).

In general; there is lack of incentives for irrigation officers or even the entire agency to act at improving performance and producing better outcomes since there is no relationship between their remuneration and management performance of irrigation systems (Ostrom 1990, Easter 1993). In this regard, Howe and Dixon (1993) have noted that if the salaries of the O&M personnel would be dependent on the users' payments, motivation for good performance would be provided. Ostrom (1990) has also pointed out that when external experts, working without the participation of irrigators, have designed systems with the primary aim of achieving technical efficiency (see also Trung et al. 2005), they frequently have failed to achieve either the desired technical efficiency or the level of organized actions required to allocate water in an adequate way or to maintain the physical system itself.

Although agency-managed irrigation may have some advantages, especially in providing almost free services to farmers who are in some cases poor; the overall performance through hierarchy and bureaucracy reveals there are very often more problems than solutions. Besides poor performance in public irrigation management, another issue that explains weak performance in irrigation management is the low economic value usually attached to water (Ostrom 1990, Easter 1993, Gupta 2004). Aware of the problems (most are mentioned above) leading to inefficiency and ineffectiveness of agency-managed irrigation systems, it is rational for both government and users to encourage institutional change towards more involvement of local people in the management of irrigation schemes (World Bank 1998).

Consequently, several researchers have argued that services related to water governance and management are more easily provided by local communities' organizations. Especially operating rules, rules enforcement, sharing responsibilities among members, matching cost-recovery to relevant provided services have been considered to be more efficient and effective in Farmer-managed irrigation systems (World Bank 1998, Frederiksen and Vissia 1998, Ostrom 1992 & 2002, Bromley 1992, Faysee 2004, Gupta 2004, Pasaribu & Routray 2005, Gopalakrishnan 2005, Janssen and Ostrom 2004). Among others the work of Joshi et al. (1998) and Kumar (2006) has pointed out the successful management of farmers-managed irrigation systems in Nepal. Ostrom (1990) has shown that for almost a century, farmers irrigators in Huerta region in Spain have been meeting among themselves for the purpose of specifying and revising rules they establish to manage their irrigation canals, selecting officials, and determining fines and assessments. Their established institution generates benefits to the farmers and reveals high capacity to survive. This work reports also the historical successful management and governance of irrigation water by small-scale Zanjera communities of irrigators in the Philippines, who determine their own rules, choose their officials, guard their own systems, and maintain their canals.

2.3. - Theories for institutional analysis

The section is devoted to outline some major theories often used in studying institutions and institutional analysis over the management and governance of natural resources

such as water. This section does not aim at presenting in detail every theory, but merely provides some basic theoretical concepts which are relevant to the present study.

2.3.1. - Theory of institutions and institutional change

The neoclassic rational choice approach assumes wealth-maximizing selfish individuals having complete information as well as a defined and quantifiable set of preferences based on which they make their choices. However, this rational choice approach presents several deficiencies; particularly it fails to take into account the potential altruistic behavior and other nonwealth-maximizing values which often enter in the set choices of economic actors. Furthermore, individuals' choices are made under uncertainties. Uncertainties arise both from incomplete information (information search is costly) with respect to the behavior of other individuals participating in the interaction process, as well as from the computational limitations of the interacting individuals to process, organize, and utilize information (North1990, Ostrom et al. 1993). Individuals thus often make choices based on incomplete knowledge of all possible alternatives and their likely outcomes. Therefore rules and procedures evolve to simplify the process. Thus, the consequent institutional framework aimed at structuring human interaction, limits the choice of economic actors. Similarly, Herrera-Samaniego (2005) has stated that "*given that institutions provide the basic structure by which human beings throughout history have created a framework to reduce uncertainty in exchange, it is clear that they determine transaction and transformation costs and hence the profitability and feasibility of engaging in economic activity*" (see also Grief 2002, North and Thomas 17970). Institutions are therefore crafted to achieve efficient outcomes; they play a key role in economic performance. Institutions are dynamic; they change, evolve towards the achievement of more efficient equilibrium.

2.3.2. - Collective action theory and institutional rational choice approach

Both characteristics of public or collective goods, mentioned above (high exclusion cost and non substractability) render it difficult to provide them efficiently in needed quantity. Olson (1965 and 1971) has stated that the provision of public or collective goods is the fundamental function of organizations generally. He argues that a State is the first of all organizations that provide public goods to its citizens; and other types of organizations

similarly provide collective goods to their members. The above characteristics raise the free-rider problem in collective goods provision: driven by self-interests, rational individuals often find it more profitable not to participate in the collective goods provision while benefiting from its yields. Thus, collective action theory attempts, on one hand to explain how optimizing behavior from individuals can result in cooperation, and on the other hand to identify conditions under which cooperation can be achieved (Nabli and Nugent, 1989). They argue that collective choice theory, as well as transactions costs theory, analyzes the state of the world from the view point of individual rationality, including opportunistic behavior to prescribe some dynamic institutional interactions such as establishment, functioning, and evolution of relevant organizations which help to solve free-rider problem and achieve efficient outcomes in the provision of collective goods. In undertaking activities such as establishing rules and institutions, individuals are likely to succeed collectively, overcoming 'Hardin's tragedy of the commons', especially in natural resource use. According to Nabli and Nugent (1989) and North (1990) collective action theory is relevant and capable to explain institutions. According to Meizen-Dick and Knox (1999) programs to devolve natural resources (such as water) management to WUAs are generally based on the assumption that users will take on roles formerly assigned to the state. Therefore, collective action is required to coordinate individuals' activities, develop rules for resource use, monitor compliance with the rules and sanction violators, and to mobilize cash, labor, or material resources. Based on Ostrom (1990), Vermillion (1999) has evoked three basic types of collective actions or decisions to be undertaken with regard to the devolution of irrigation management. The first is 'constitutional actions' referring to the design and establishment of the Association, WUA, itself with its mission and basic structure. The second concerns 'collective choice' which consists in the development of rules and sanctions for operation and maintenance of irrigation systems, financing relevant costs, settlement of disputes and system improvement (see also Ostrom et al. 1993). The third consists of 'operational actions' which concerns the specific actions in the course of implementing operations, maintenance, financing, disputes resolution, and system improvement.

Besides Ostrom et al., (1993) use the concept of "institutional rational choice approach" to tackle the problem of sustainable and efficient provision of collective goods in the management of CPR. According to them the given approach combines two critical elements: i) participating actors are viewed as 'intentionally rational', seeking to

maximize few material goals (see also Colebatch 2005) in a world where they have imperfect information concerning the consequences of alternative behaviors; ii) the approach postulates that the same individuals will behave differently in different decision situations. Institutional rules thus play a critical role in defining those decision situations in order to better influence individual behavior. To alter those decision situations in which individual are behaving, crafting self-governing institutions are necessary.

2.3.3. – Transaction and information costs theory

Similarly to collective action, transaction and information costs theory is a general approach of new institutional economics aimed at studying, among others, the role of transactions costs in economic organizations. The underlying hypothesis of this theory is that institutions are 'transaction cost-minimizing arrangements' which may change and evolve with the changes in both the nature and sources of such costs as well as means for minimizing them (Nabli and Nugent, 1989 and Herrera-Samaniego 2005). For instance, it has been considered that farmers' self-designed institutional arrangements and settings based on local costumes, rules, motivation, and experiences may provide irrigation water related services at lower transaction costs than centralized bureaucracies of government agencies.

2.3.4. - Property rights theory

Property rights relates to formal or informal rules that govern access to and use of either tangible assets such as water, land, or intangible assets such as contracts or patents (Herrera-Samaniego, 2005). According to the economics of property rights, the value of a good is entirely dependent on the rights associated with it, thus the value of two physically identical goods may differ if they are connected with two different rights (Adhena, 2006). Property rights specify the nature of the rights as well as the obligations an individual holds with respect to the use of a resource. Property rights are efficient if they satisfy four basic conditions: ownership, specificity, transferability, and enforceability. Property rights, by their economic function, should create incentives to use resources in their highest value. In this regard, Pearce and Turner (1990) have pointed out that in an economy with well-defined and transferable property rights, individuals and firms have every incentive to use natural resources as efficiently as

possible. Regarding irrigation water management, unfortunately, property rights are very often ill-defined or incomplete; and usually enforcement mechanisms are lacking. This results in inefficient use of water resource. Clearly specified water rights have been one of the major features of irrigation management transfer process in the Americas (Mexico, Columbia, USA…) (Meinzen-Dick, 1997).

Meizen-Dick and Knox (1999) have evoked four main reasons for which property rights are important when addressing natural resource management in the process of institutional change. They argue that i) property rights give incentives for management, ii) they give and specify authorization and control over the resource, iii) they contribute to reinforce collective action by raising the confidence of rights holders, and iv) assigning property rights demonstrates government commitment to the devolution process. Similarly, Vermillion (1999) views in property rights the most important motivating factors, which invoke collective action among users to insure effective and sustainable management of irrigation systems after devolution. Property rights thus determine the will from WUAs to undertake collective action and consequently have impact on the management performance of irrigation schemes transferred to them. In a property rights regime, rights can be private property, common property, state property, or open access. Private property corresponds to the existence of a readily identifiable individual that has exclusive right on a given resource; common property to a finite collective entity that owns the resource; state property to state ownership of resources; and open access to the absence of any entity having decision-making power over resources (see also Crase and Dollery 2006, Herrera-Samaniego 2005, Ostrom 1990).

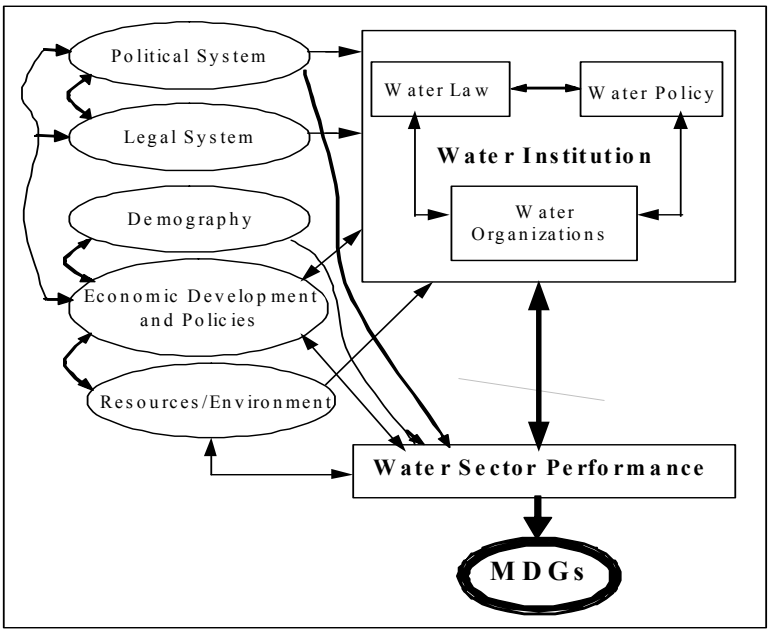
2.4. - Conceptual, analytical, and theoretical frameworks to study Water Institutions

This section is devoted to present the conceptual and analytical framework for the institutional analysis of water governance and management of irrigation schemes in Haiti. Before presenting the adopted conceptual and analytical framework it is first outlined three separate conceptual, analytical and theoretical frameworks on which the one used in this study is based.

2.4.1. - IDA framework

The theoretical and analytical framework to carry out the study is based mainly on the Institutional Decomposition and Analysis (IDA) framework developed by Saleth (2004). The IDA is an analytical approach and theoretical framework which enable to review and analyze water institutions at macro as well as micro levels. It is related to and has many similarities with the Institutional Analysis and Development (IAD) framework developed by Ostrom et al. (1994). The IDA is based on a two-stage decomposition of water institutions. Firstly, water institutions are decomposed in a water institutional environment, (that represents the governance framework) which is determined by the constitutional, historical, economic, social and physical conditions of a given country; and water institutional structure (that represents the governance structure), which is determined by water related law, policy and organizations. In a second stage of decomposition, water institutional structure is decomposed into water law, water policy, and water organizations or administration. According to Bandaragoda (2000), laws, policies and administration constitute the three pillars of institutional analysis in water management sector.

Each of those components of institutional structure is decomposed into simpler, but not less important institutional aspects. Saleth (2004) suggests decomposing: water law in institutional aspects such as water right, accountability; water policy into national water policy, water pricing and cost recovery policies, project selection criteria, user participation or self-responsibility; and organization component into institutional aspects such as organizational framework, financing and management responsibilities, regulatory arrangement, and conflict resolution mechanisms. Figure 2 below presents the IDA framework



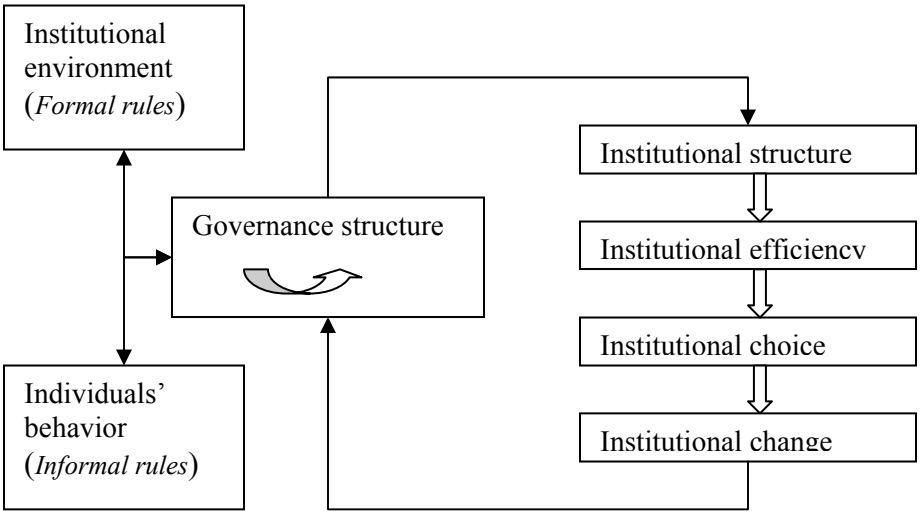
IDA framework developed by Saleth (2004)

Figure 2: IDA framework for the study of the performance of water institutions

2.4.2. – A Four steps methodological framework for institutional analysis

Although the IDA analytical and theoretical framework is a powerful tool which enables to study water institutions one may notice that it does not explicit the dynamic aspect of institutions. In the present study water management institutions are studied in the dynamic of institutional change consisting of irrigation management transfer. Therefore, the analytical and theoretical framework used in the study, is also based on the four steps methodological framework which was adapted by Herrera-Samaniego (2005) from Williamson three-level schemes of institutions. This framework is suitable to undertake institutional analysis in a dynamic of institutional change. The framework, presented in figure 3 below, suggests describing institutional structure which determines the performance or efficiency of institutions, identifying institutional choices which are the institutional settings and arrangements, and analyzing the process according to which given institutions evolve through changes. Such institutional changes are combined with the given institutional environment (here referring to formal rules) and individuals' behavior (referring to informal rules) to determine governance structure. As shown in the figure it is an endless cycled process in which institutions, perceived by the tenant of the framework as equilibriums; are evolving continuously towards more economic

performance or more efficient equilibriums. It is not the aim of this master thesis to study in detail all components and their relationships in this methodology, we rather base a framework on it, to stress the institutional change in analyzing institutions which govern and manage water irrigation in Haiti.



Source: Herrera–Samaniego (2005)

Figure 3: A conceptual framework for institutional analysis

2.4.3. - Principles for robust and long-term enduring institutions governing CPR

The applied analytical and theoretical framework in the study is also based on the design principles for long-term enduring institutions governing common-pool resource (CPR), developed by Ostrom and coworkers. Ostrom (1990); Ostrom et al. (1994); and Anderies et al. (2004) have developed a framework that enables to study the institutional arrangements and the attributes of institutions governing common-pool resources (such as irrigation water), which are likely to lead to their long-term enduring and robustness. The key components of the proposed framework are: the resource itself, the users of the resource, and the organization that provide services to users such as a water user association. The main focus of the framework is to examine the link between resource users and the related service provider through the established set of institutional rules to regulate and control the behavior of resources users. Based on empirical studies as well as theoretical literature the authors of the framework have identified design principles (table 3.1 below) that characterize robust and long-term enduring common-pool resource institutions such as water user association. One underlying assumption of the framework is that, even though common-pool resources institutions are not crafted with those

principles in mind, robust and sustainable institutions governing and managing CPR must incorporate the identified principles. Therefore in our study on institutional analysis of the governance and management of irrigation water it is useful to find out whether or not, those principles are fulfilled for the concerned CPR institutions under study.

Table 2.2: design principles for long-term enduring institutions governing CPR

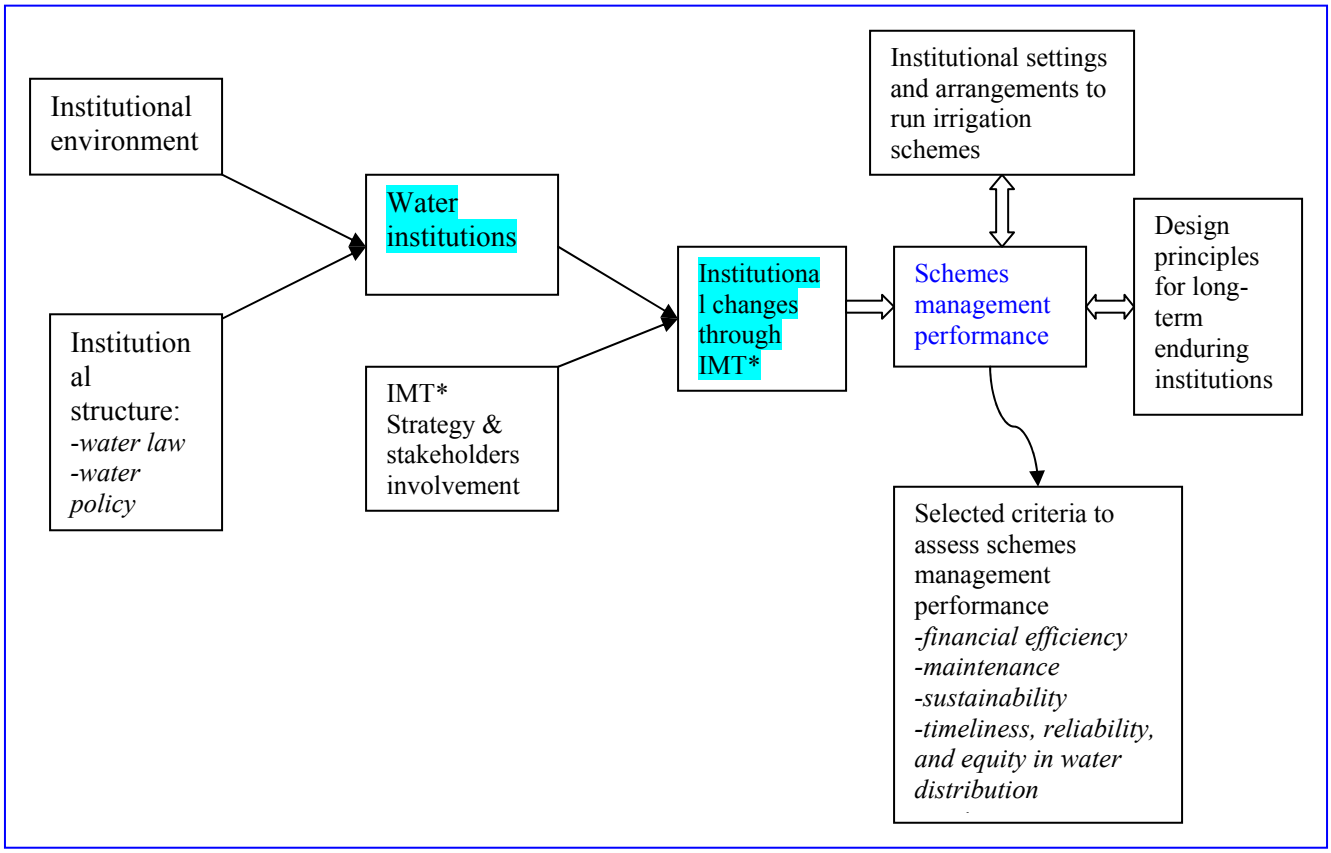
Principles	**Description**
Clearly defined boundaries	The boundaries of the irrigation as well as the users should be clearly defined
Proportional equivalence between benefits and costs	Local conditions and rules requiring labor, material, and money specify the rules for allocating the resource among the users
Collective-choice arrangements	Users can contribute to modify rules that regulate their behavior in using the resource
Monitoring	Monitors of the resource and users behavior are accountable for the users or are users themselves
Graduate sanctions	Users who violate rules-in use are likely to be gradually penalized
Conflict resolution mechanisms	Existence of low-cost and local arenas to resolve conflicts among users, and between users and their official
Minimum recognition of rights to organize	Users have long-term tenure rights to the resource and they have legal rights to devise their own institutions
Nested enterprises	For resources that are part of larger systems; appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

Source: from Ostrom (1990); Anderies et al. (2004)

2.4.4. - Theoretical and analytical framework for the institutional analysis of water governance and irrigated schemes management in Haiti

Based on the frameworks presented above, the hereafter elaborated framework (Figure 4 below) will be used to conduct the study. In applying the following framework it is assumed that efficient water institutions within the country coupled with appropriate methodology and strategy must be very likely to contribute to effective and successful irrigation management transfer (IMT). At the level of the irrigation scheme, the governance and management performance is a function or result of a successful IMT process, the local institutional arrangements and settings that govern and manage the

scheme, the design principles for robust and long-term enduring institutions, and the partnership relationship between users organization and other institutions and/or organizations. In addition to those linkages between the different variables of the framework, relevant criteria and indicators are used to assess the performance of the scheme management.



*: Irrigation management transfer (IMT)

Figure 4: Theoretical and analytical framework to the institutional analysis of water governance and irrigated schemes management in Haiti

In accordance to the above framework secondary information and data are gathered to describe and analyze institutional environment, institutional structure as well as irrigation transfer strategy and methodology. A field survey provides information and data related to institutional change that have occurred with IMT process, institutional settings and arrangements to run irrigation schemes

CHAPTER III

MATERIAL AND METHODS OF INQUIRY

3.1. - Introduction

The study aims to understand and analyze the community-based management of irrigation schemes in the context of the ongoing process of irrigation management transfer, which is quite a complex situation. It thus has been necessary to take a systematic approach and to combine different data collection methods. These methods include: individual interviews with farmers using survey questionnaires; group discussions with different entities within Water Users Associations as well as other local organizations, which have influence on scheme management; review of documents; and the researcher's own observations. Before more detailed information is given about those methods of inquiry, as the field survey has been possible grace to a two months placement in the NGO (Non Governmental Organization) German Agro Action (GAA) which is implementing development projects in the studied area, it is useful and fair first of all to briefly outline its works.

3.2. - Brief outline of GAA program in the North of Haiti

German Agro Action (GAA)[11], as named, is a German NGO created in 1962 to work for the sake of hungry people, working in the field of humanitarian aid and cooperation for development. It has been working in Haiti since 1975. For the last ten years its regional office in Cap-Haitian (North of Haiti) has implemented several irrigation development projects aimed at extending irrigated area, increasing agricultural productivity and profitability for farmers, and strengthening local institutions and organizations to promote self-managed irrigation schemes.

It has two major strategic intervention lines: 1) agricultural development which is mainly about irrigation projects and 2) emergency aid whose interventions concern drinking water for rural communities, agriculture, and communication infrastructure such as roads. The major actions undertaken by AAA in Haiti and especially in the North are:

[11] German name "Deutsche Welthungerhilfe" which stands for German Committee for Fighting against Hunger

- Rehabilitation or construction of irrigation infrastructure;
- Promoting community-based management of constructed or rehabilitated irrigation schemes;
- Training farmers in agricultural production and irrigation management techniques;
- Support the establishment and management aspects of upstream and downstream services to agricultural production;
- Gender promotion by encouraging and supporting women participation and involvement in projects and development activities.

In 2007, the program of GAA Cap-Haitian regional office focuses on the reinforcement of farmers-managed schemes, the rehabilitation of infrastructure, and the improvement of the exploitation of seven irrigation schemes in two departments, the North and North East (see map in annex III).

3.3. - Selection of the study area and schemes

In accordance with the study objective we have selected three irrigation schemes, which have functioning water user association and which are experiencing the process of transferring management responsibilities. All three schemes are located in the same department (North) and, have been benefited project support from the same organization (GAA). Saint-Raphael is located at 45 kilometers from Cap-Haitian, the second city of Haiti, at 350 meters above the sea level. Grison-Garde and Dubre are located in the low plain of the Department at approximately 20 and 15 kilometers from Cap-Haitien at 100 and 80 meters above the sea level respectively. Grison-Garde belongs to the Commune Acul-du-Nord and Dubre to Milot, and Saint-Raphael to the Commune of Saint-Raphael.

3.4. – Methods of information and data collection

3.4.1. - Literature and documents review

Existing documents and literature has been explored intensively to collect secondary data and information. This has enabled to gather background information, design the

study, and write a deep and analytical literature review on the topic. As shown in the conceptual and theoretical framework of the study, information regarding institutional environment and structures must mainly be derived from secondary information.

3.4.2. – Field survey

The field survey consisted of individual interviews with farmers, groups discussions with different entities (committees and users) within the concerned WUA, meetings with other related local groups, open discussions with executives, the Regional Director of GAA and local representatives of the Ministry of Agriculture at Communal level. Furthermore researcher's own observation of irrigation infrastructure was used to examine its state and functional condition to get insight in the level of maintenance works. Finally a meeting was also held with the WUA in Arcahaie, which is another farmer-managed medium scale irrigation scheme in the West Department. The purpose was to gather some cross-sectional information to contrast with the studied schemes. The allocated time to conduct the field survey was roughly two months from February 15th to April 15th 2007, which was quit limited.

3.4.3. – Questionnaire and check list

At the level of the irrigation scheme, information and data relative to local institutions and institutional settings, and partnership relationship (between WUA and other partner institutions and organizations), are collected. A questionnaire has been prepared and used for individual interview to gather information including farmers' characteristics, their willingness to pay the irrigation water fees, their perception on schemes management performance prior and post management transfer. For the group discussions a guide (check list) has been used. Copies of the questionnaire as well as the discussions guide are presented in annexes 1.1 and 1.2, respectively.

3.4.4. – Sampling for groups discussions and individual interviews

Groups discussions have been realized with WUA executive committees, technical or irrigation commissions, hydraulic quarter committees and farmers at the tail, middle, and head of the scheme's command areas. Similarly farmers for the individual interviews

have been chosen by stratified random sampling within those three parts of the schemes. For example groups discussions as well as individual interviews have been realized in the following hydraulic quarters of Saint-Raphael schemes: doors 1, 6, 10A, 10B, 14, 16. Meetings have been organized in this scheme with the executive committee, the irrigation and administration services, and the technicians who work with the WUA; as well as another local group: OD4SS: Organization for the Development of the fourth Section Sanyago, which is the major pressure group influencing the scheme management. Table 3.1 below presents sample sizes in the three schemes.

Table 3.1: Sample sizes in the three irrigated schemes

Schemes	**Saint-Raphael**	**Grison Garde**	**Dubre**
Total numbers of farmers	2500	733	249
Sample size	150	40	19
Sample size as a percentage of total number of farmers in %	6	5.5	7.6
Number of groups discussions and meetings	13	8	3

3.5. - Criteria and indicators to assess the performance of schemes management

Literature presents a large set of criteria to assess the performance of irrigation scheme management. In this study three criteria are used to assess the scheme management performance: Financial efficiency, maintenance, and sustainability. The selected criteria have been recommended by the US Bureau of Reclamation, the International water Management Institute (IWMI), and by FAO. Many authors (Samad and Vermillion 1998, Burton et al. 2000, Malano and Burton 2001, Sam-Amoah and Gowing 2001, Koç 2007, Olubode-Awosola et al. 2006, Nelson…,) have either contributed to develop or used similar criteria and their relevant indicators to assess performance of irrigation schemes.

The performance indicators that we are using to measure those criteria are as follows:

Financial efficiency

Four indicators will be used to measure the financially efficiency in the management of the scheme:

Fee collection performance: FCP = F_C/F_A

F_A: annual amount of water charge collected

F_C: annual amount of water assessed of expected

Personnel cost ratio: PCR = E_P/E_T

E_P: annual expenditures on personnel (wages, fringe benefits…)

E_T: total expenditures

Manpower numbers ratio: MNR = N_S/A_T

N_S: number of staff (full-time equivalent)

A_T: total irrigated area

Cost recovery ratio or Financial self-sufficiency indicator: FSS = I_F/E_T

I_F: income from water users' fees and other local income (not including subsidies)

E_T: total annual expenditures for management, operation and maintenance

Maintenance

For measuring the maintenance the following two closely related indicators will be used:

Poor structure ration: PSR = N_{PC}/N_T

N_{PC}: number of structures in poor* condition

N_T: total number of structures

*Nelson (…) suggests defining poor as a not functioning adequately, or at risk of failing during the coming years

Structures condition index: SCI = N_{WP}/N_T

N_{WP}: number of structures working properly

N_T: total number of structures

Sustainability

The criteria of Sustainability will be measured by the two indicators below:

Sustainability of irrigated area: SIA = A_C/A_I

A_C: current total irrigated area

A_I: total irrigated area when system development was completed

Area infrastructures ratio: AIR = A_T/L_C

A_T: total irrigated area

L_C: total length of canals on the system

Table 3.2: criteria, indicators and needed data for assessing schemes management performance

Criteria	**Indicators**	**Needed data**	**Means and source of data collection**
Financial efficiency	Fee collection performance	Annual amounts of water charge collected and assessed	WUA financial documents and reports
	The optimal value should be close to 1; low value may indicate poor collection program, lack of support from farmers or their inability to pay		
	Personnel cost ratio	Annual total expenditures and on personnel	WUA financial documents and reports from GAA
	It enables to monitor expenditures on personnel. Authors argue that the optimal value must be between 50% and 60%.		
	Manpower ratio	Number of staff, total irrigated area	WUA documents and interview with responsible
	It may widely vary from case to case depending on labor productivity, schemes size, irrigation intensity and so fourth.		
	Cost recovery ratio	Local income and total expenditures of WUA	WUA financial documents and reports from GAA
	It optimal value should be close to 1 or greater; low value can mortgage the sustainability of scheme management.		
Maintenance insuring	Poor structure ratio	Number of irrigation structures in poor condition and total number of structures	Observation of irrigation networks; WUA and AAA documents
	Ideally this ratio should equal to zero; high value can indicate lack of adequate maintenance.		

	Structure condition index	Number of irrigation structures working properly and total number of structures	Observation of irrigation networks; WUA and AAA documents
	Optimally its value should be close to 1		
Sustainability	Sustainability of irrigated area	Current and total irrigated areas	WUA and GAA documents
	Its value should optimally close to 1		
	Area infrastructure ratio	Total irrigated area; total length of canals	WUA and GAA documents; observation and measurement
	It may widely vary from case to case; it indicates how much land is available to support the given irrigation infrastructure		
Service	Timeliness, reliability, and equity in water distribution	Framers' opinions	Field investigation
	Ideally the value of those indicator should be close to 100%		

In addition to these criteria and their related indicators, the opinions of the irrigators collected in the surveys are used, as suggested by Nelson (…) and Vermillion (2001), to evaluate some other performance criteria such as water delivery efficiency, water delivery timeliness and reliability of water supply within the irrigation scheme. Because in the small-scale irrigation schemes dealt with in this study, good water measurements required for numerical calculation of those indicators can not be found.

As mentioned above institutions are crafted over the governance of water and irrigation schemes management to reach better outcomes in decision-making situations where information is often lacking, while rational actors or individuals are exposed to optimistic behavior. And institutional change, transfer of management responsibilities of schemes to WUA, has occurred obviously to reach better performance. Therefore, in addition to optimal value of the given performance indicators it is expected that their values improve with the transfer process which underlines a better and more appropriate institutional settings and arrangement to insure the management of the studied schemes.

CHAPTER IV

REVIEW OF EVIDENCE: MAIN IMT STRATEGIES IMPLEMENTED WORLDWIDE, FACTORS OF SUCCESS OR FAILURE

4.1. - Introduction

Irrigation management transfer is a widespread phenomenon. IMT models and experiences have been transferred from one country to another (Johnson III, 1995). In this study it is meaningful and useful to look at IMT models in other countries in order to not only better perceive and sharpen the analysis of the experience in Haiti, but also to evoke the major challenges such a program is facing. Therefore, the first part of this literature review is devoted to an overview of the main strategies, which have been implemented in several countries worldwide, and a discussion of the main factors which are likely to lead or mortgage IMT programs. Then the IMT process in Haiti is studied, which includes: a brief history of irrigation management and development, the problematic of scheme management prior to the IMT process, the new vision of the state on irrigation water management and governance, and the institutional environment and structure surrounding the process. The chapter is ended by some concluding remarks on the Haitian IMT process.

4.2. - Definition and Objectives of irrigation management transfer

According to Svendsen et al. (1997), irrigation management transfer refers to a process of shifting a number of basic irrigation management functions from a public agency to a private sector, which can be a Non Governmental Organization (NGO), local government, or a local-level organization with farmers at its basis.

Although objectives of irrigation management transfer vary from country to country, as will be seen later on in this chapter, several authors have evoked what should be the target objectives for irrigation management transfer. The most common objectives of irrigation management transfer are: to reduce Government expenditures allocated to O&M of irrigation schemes coupled with an increase of agricultural production and productivity, and to get involvement and participation of users in the management process (.Johnson III 1995, Vermillion 1996, Frederiksen & Vissia 1998, World Bank 1998, Garcès-Respetro 2001, Yercam 2003, Yildirim & Cakmak 2004, Pasaribu &

Routray 2005). According to Johnson III (1995) the meaning of IMT is that farmers should bear the entire O&M costs while substituting expensive contract and management staff with farmers labor in the O&M of irrigation schemes. However, Frederiksen & Vissia (1998) have pointed out that the ultimate suitable objective of the management transfer program should be 'to provide best services at least costs' in managing irrigation schemes. Therefore all stakeholders must act at achieving this objective. Gupta (2004) on the other hand has pointed out two major outcomes that irrigation management transfer should reach: firstly, the empowerment of water users to become organized clients who can determine what irrigation service they do or should receive, and secondly the establishment of a new partnership of accountability between farmers and government.

4.3. – Different Strategies (level of Participation) implemented by countries

Although management transfer programs have been implemented earlier by more developed countries such as USA, France, Japan and so fourth, the trend of transfer programs has evolved, at least across developing countries, since the 1980s, especially with the experiences of Mexico and Turkey. From the 1990s, many countries in Latin America, Asia, Africa and elsewhere in the world have rushed to shift from agency-managed irrigation systems to more involvement of other stakeholders, especially users, in the management of the schemes. The main reason for those institutional changes seems to be the perceived low performance of agency-managed, as we have seen above. Also the non binding international commitments especially the Rio Declaration, the Dublin Statement and so on, signed by national governments, as well as the pressure exerted by International Donors and Funding Organizations on national governments seem to play an important role in activating these changes. However, implemented IMT strategies differ somehow across countries.

4.3.1. - Major points of differences between implemented strategies

First of all there is difference between countries in the view, *the understanding of the reform* in the water management and governance. Meizen-Dick and Knox (1999) similarly to Vermillion (1996) distinguished two main types of reform views adopted by countries. The first view is the irrigation management transfer which consists of replacing government agencies by farmers' organizations or other private entities for the

management of irrigation systems. The second view is the participatory irrigation management that refers to the reinforcement of government management of irrigation schemes with the increased participation of farmers as partners in the management. The former implies a shift in the role of government agencies as well as users organizations, while the latter refers to the strengthening of the involvement of both farmers' organizations and government agencies to jointly manage irrigation systems in order to reach better outcomes. Studies show that governments of countries such as Mexico and Turkey have clear policies to replace government agencies by farmers' organizations in the management of irrigation schemes; while in other countries like Indonesia full control including financial responsibility and eventually ownership of small-scale irrigation are given to users Associations (Vermillion 1996 & 1997). Other Asian countries like India, Philippines, Sri Lanka and Pakistan are more oriented to the participatory management view rather than management transfer.

The second aspect of the different approaches used by countries in carrying out irrigation management reforms is *the time allocated to precede the decentralization and raise the participation of users*. In this regard there are two broad approaches followed by countries. The first one is the short term strategy, named 'big-bang' approach in the literature. It consists of implementing the transfer program within a very limited period of time. Usually within one year users organizations must be ready to take over responsibilities to manage the schemes transferred to them. This approach was followed by Mexico and Turkey. The second approach is to implement a gradual reform, which has the advantage of giving enough time to users' organizations to adapt and take over the new responsibilities (Raby 1997, Svendsen & Nott, 1998). Also government can have sufficient time to make needed reform in its structures, orientation, and staff, which will enable it to change its functions. The participatory irrigation management in the Philippines seems to be a good example of this approach.

Another important pattern that distinguishes one management reform from another is *the level of involvement of users* or in other words the functions and responsibilities transferred to them. In this respect there are no clearly defined types of approaches, but one can easily separate the extreme strategies applied by specific countries. At one extreme, some countries in their reform transfer the operation and maintenance of tertiary or even secondary canals to users' organization. The operation of main canals,

as well as key management functions over the irrigation systems remains government agencies duty. World Bank (1996) qualified such management situation as “government-managed and farmers help”. Countries such as India, Philippines have followed this approach. At the other extreme, some countries have transferred the operation, maintenance, and management of entire irrigation systems or districts to farmers associations. Those countries have given the right, if not the obligation, to their WUA to be financially self-sufficient and responsible for management, operation, and maintenance of water for the use of agriculture. Countries like Mexico, Turkey, and Colombia have adopted this approach. Other issues that differ between implemented strategies across countries are the objectives pursued by decision-makers and the driving forces, which make the appeal for the reform.

4.3.2. - Different strategies

Based on the above points of divergence between countries we outline the following main types of strategies:

Type 1 Strategy: short term transfer leading to autonomous WUA

This strategy consists of implementing management transfer programs quickly, often within one year to replace government agency by Water Users Association over the management of irrigation systems. Commonly the primary objective pursued by governments using this strategy is to reduce their expenditures for operation and maintenance of schemes. Therefore, the most relevant stakeholders engage themselves in a process of institutional changes, which is obviously drastic, to reach an adequate institutional arrangement that can enable the establishment and the functioning of users organizations. Provided such organizations meet some set of criteria, it then engages in some kind of contractual agreement with government to administrate, operate, maintain, and manage the given irrigation facilities for a certain period of time which is renewable. However, Svendsen et al. (1997) has qualified this approach as top-down approach. The best known examples quoted in literature seem to be Mexico, Turkey, and Colombia.

Mexico’s case: in the context of structural adjustments in Latin America and as a response to the problems faced by the economy of countries in that region, especially the difficulties to pay the external debt services, the government of Mexico has implemented its irrigation management transfer, as part of broader economic and

institutional reforms. The primary objective is therefore to reduce government expenditures for operation and maintenance of irrigation schemes. In addition to that, Rap (2006) similarly to Salas and Wilson (2004) has evoked the following objectives of the IMT program in Mexico: insure long-term infrastructure viability by achieving cost recovery and self sufficient WUA to solve the problems lack of funds for required maintenance; improve and sustain system performance and to increase efficiency of water use; bring irrigation districts back to their formerly high levels of productivity by making water users co-responsible for scheme operation and maintenance. According to Palacios (1998) the Mexican government has created a new powerful Water resources Agency that has the responsibility to carry out the transfer program, furthermore a new water law has been enacted and a market for water rights has been created. Government decided to transfer operation, maintenance, and management of the entire irrigation system to Water Users associations with a representative federation of irrigators at country level. Federations of WUA were established as Society of Limited Responsibility (SRL) to be responsible for operation and maintenance of main canals, drains and road networks. At national level, a federation of WUAs, called National Association of WUAs, represents them in negotiations with government agencies. The new responsibilities of the government agency consist of supervising the operation, maintenance, and management of irrigation systems, giving technical assistance to WUAs to carry out operational activities. The responsibilities, duties, and obligations of each party are specified in the concession contract undersigned between government agencies and WUAs and their federations. The most important criteria that must satisfy WUA to undersign the contract was the potentiality of users to become financially self sufficient to cover O&M, and the administrative costs to deliver water to farmers. But it is not clear in the literature, if the undersigned concession contract implies the transfer of ownership of irrigation systems.

Turkey's case: the accelerate program of transferring irrigation management in Turkey is somehow close to the strategy used in Mexico. However, Yildirim and Cakmak, (2004) evoke that in Turkey there exist also cases of transfer leading to joint management, as well as informal management transfer to users. The objectives of the transfer were quite similar to those in Mexico. In this case, an existing agency has implemented the program. According to Svendsen and Nott (1998), the strategy was to shift operation and maintenance of irrigation systems to local administrations or irrigation associations,

which can be the head of village assisted by some other staff if the irrigation system serves only one village (village management); the mayor of a municipality assisted by some necessary staff when irrigation system serves one municipality (Municipality management). Only when schemes serve more than one local administrative unit a new entity, namely Irrigation Association, was established. The duration of the process of transfer is usually 6 to 9 months from initiation to implementation. In undersigning the contract, the Irrigation Management Association becomes responsible for the operation and management of the irrigation facilities and for bearing the costs of providing the related services. According to Svendsen and Nott (1998) water right and ownership of facilities, remaining state property, were not transferred to the Irrigation Management Organization.

Colombia's case: the particularity of this case in comparison with Mexico for example is that the transfer program was demand driven. The farmers started it by asking the government to transfer management of irrigation schemes to their Associations. New laws were also enacted; the federation of WUAs at national level has a seat in the national council. However, in undersigning the contract with the government agency WUA takes control over the management of systems but not the ownership (Quintero-Pinto, 1998). The author also reports that even heavy equipment purchased by a WUA with its own funds remains state property.

Type 2 Strategy: short term or medium term reform leading to jointly managed irrigation schemes

Other countries such as Indonesia, India, and Nepal have implemented management transfers resulting mainly in joint management of irrigation schemes. According to Bruns & Helmil (1996) the objectives aimed for in Indonesia consisted of creating better partnership and division of responsibilities between government and farmers; and also government intended to reduce its expenditures in operation and maintenance of small-scale irrigation and reallocate them to large-scale schemes. The transfer package in Indonesia includes turn management responsibilities over small scale irrigation schemes to farmers, establishment of irrigation fee as well other institutional reforms in the operation and management of large scale schemes.

However, where agency and farmers organizations jointly manage irrigation, as being applied in many countries in Asia, Douglas (1996) has argued that farmers organizations remain legally, financially, and psychologically dependent on government irrigation

agencies. He has qualified such a strategy of cosmetic changes, since farmers' organizations are not autonomous.

Type 3 Strategy: long-term reform leading to participatory irrigation management

In contrast to the above cases, some countries rather target to improve performance in irrigation management by strengthening the involvement of the government agency while gradually promoting participation of users by increasing the sharing of management responsibilities. The typical example of a country, which has applied this strategy, is the Philippines. Raby (1997) has characterized the process of participatory irrigation in the Philippines, as a learning process with gradual, progressive, small-scale, and intensive management. In this case the learning process refers to the participation of farmers in project identification, the design and construction phase, and after construction amortization of costs of construction as well as O&M costs should be handled by irrigation Association. Through this process, users associations have been established to jointly manage irrigation systems with the national agency, to ultimately in the long run lead to 'second levels of the National Irrigation System'. The main duties of those organizations are to take over operation and maintenance responsibilities at lower levels of irrigation systems and improve the collection of irrigation service fees. Svendsen et al. (1997) have stated that this process is a bottom-up approach, because the National Irrigation Administration of the Philippines has capitalized the experiences of farmers' participation in the management of communal systems by transferring the original social design prevailing in communal irrigation systems to national systems. However, Raby (1997) is wondering if the end goal of the government agency is really the complete turn over of the irrigation management. Furthermore, it is often claimed that the established joint management contains asymmetric relationship between agency and Irrigation Associations.

Other types of strategies

According to Svendsen et al. (1997) there is always a certain level of participation of users in every irrigation management system. In some cases one may find irrigation systems, which are totally managed by farmers without any presence of the state agency. Furthermore, not all irrigation management transfer programs belong to the categories mentioned above.

4.3.3. – Discussions / factors of success or failure in management transfer

Based on case studies found in the literature we outline some major factors that are susceptible to generate successful implementation and outcomes of the irrigation management transfer. Of course it is not a set of factors that are fixed for all situations, but in most cases they strongly contribute to make the transfer process itself successful and/or give evidence of better performance of post transfer irrigation management. Where they are missing it may mortgage successful management transfer.

Clear, relevant, and sound objective of the transfer program: Frederiksen & Vissia (1998) as well as many developers of Common Pool Resource governance strategy, argue that the primary objective of management transfer or institutional change in the governance and management of irrigation systems must be to have a better management at lower cost (see also Gupta 2004, World Bank 2006a). Frederiksen & Vissia (1998) even advocate that reducing government expenditures is too narrow to be the secondary objective of management transfer. Nevertheless in many transfer programs (such as in Mexico or Turkey) the primary objective of management transfer programs was to reduce public expenditures in operation and maintenance of schemes. In Mexico for example the first criterion required from WUA to take over the management of the related irrigation systems is its self-sufficient capability; in such a way that the most performing management schemes can be transferred before those which are really in a need for improvements in the management performance. On the other hand, one may agree that government expenditures for the irrigation water management will reduce in the long-run, but in the short run they may even increase. Since, as we will see later that Government should play a key role and implement several activities if transfer process has to be effective, efficient, and sustainable. Most of the transfer programs have failed to have the necessary broader long term view of the process in their narrow objectives. Many transfers happened too quick, while promoting local communities participation aimed at improving performance of irrigation water management is a long term and effort consuming process (See also IFAD, 2003). Thus, the objective of the transfer program must be relevant, suitable to push different stakeholders to engage themselves in a long-term contract to enhance the performance of the irrigation management. Moreover, this objective must be clearly stated and well known by all involved parties.

Cost recovery and financial autonomy of WUA: as we have seen above, some countries, mainly those which pursue the objective of reducing government expenditures in their management transfer programs, give legal authority to their WUA to collect and allocate the relevant fees for the services they provide to farmers. Other countries though transfer some responsibilities to WUA at lower level of irrigation canals without necessary giving them legal right for financial autonomy. Of course, the issue of cost recovery in irrigation water management goes beyond the type of organizational structure, which is responsible to recover and allocate it, but the basic principle is that any transfer of competences should accompany the transfer of relevant means to cover the related expenditures. According to Palacios (1996) financial self-sufficiency of WUA is an essential requirement for successful management transfer. Therefore, water charges must rise up with transfer programs (for example water fees rose up with 400% in the case of Mexico and doubled in the case of Turkey (Yildirim & Cakmak, 2004)). Notwithstanding the fact that water is a scarce and costly production factor; farmers are rarely required to pay the full cost or even any cost for the water they receive (Ostrom 1990, Gupta 2004). Although in most cases transfer programs imply the increase of water charges, self-sufficient WUAs, are rather rare, because the level of water charges generally remains very low. Very often water is not valuated at its right value as important or even indispensable input for agricultural production. In order to achieve sustainability of the WUA, one needs to incorporate in the pricing even more services provided by WUA to their related communities. These include flood control, drainage and sewage facilities and may also, because of the canal networks extend to the road networks available for riparian. Therefore an efficient system of charges should include those extra services, and WUAs must also have legal authority to recover fees for those services. Furthermore, legal financial autonomy of WUA must not be limited to only recover and allocate water fees, but in the case of Colombia, Quintero-Pinto (1998) has shown that a WUA also needs the legal status to be able to contract loans and to do other financial transactions that can help them to build more accurate long term investment plans.

Water Rights system: a clearly defined and enforceable water right system is crucial for successful management transfer. Svendsen et al. (1997) have pointed out that lack of water rights may lead to a number of problems including conflicts between agricultural, municipal and industrial uses. Also when water rights are not clear and enforceable the

incentives of a WUA to make long-term investments, which might lead to improved water supply, may decrease. Cremers et al. (2005) have stressed on one hand the role of water rights analysis in improving policy-making and intervention strategies in irrigation and on the other hand, the importance of the recognition of local and indigenous rights and management rules in national policies and legislative frameworks. Some countries like the Philippines have made efforts to have a proper water rights system. While Tanaka & Sato (2005) have pointed out that because the structures and rules of pre-existing WUAs were taken into account in establishing the actual LIDs in Japan (Land Improvements District), conflicts within those organizations, which are responsible for irrigation water management, have reduced. They have also stated that those informal rules have had strong influence on farmers' behavior and, are consequently crucial for the success of the participatory irrigation management in Japan.

Reform in irrigation agency and long-term role of government: the sustainability of the process of good performance in the governance and management of irrigation depends on the sound contribution of each relevant actor. According to Palacios (1996), there is need for an appropriate legal framework, which defines rights to water, forms of organizations, and responsibilities of each party as well as regulation of their activities (see also Eastern, 2000). There is also need for means and long-term training programs for both WUA and agency's staffs to enable them to carry out new functions on a continuous basis. Experiences in Indonesia have shown that training contributes to make substantial changes in attitudes and skills with regard to irrigation management (Bruns and Helmil, 1996). Government agencies must be reoriented to insure follow-up support and oversight to WUA (Frederiksen & Vissia, 1998) and also monitoring (Ostrom, 1990). Cremers et al. (2005) have argued that even water agencies need to be monitored by independent civil society platforms. A government agency can not indefinitely share the same management functions over the same use of water within the same irrigation systems with WUA; nor can the government withdraw totally and leave the WUA on its own, when it is established in a very short period (often less than 1 year). Svendsen and Nott (1998) have stated that government must very well understand the role it has to play in monitoring and tackling emerging problems in the area of policy, finance, regulation, oversight and supporting services to WUAs. Frederiksen & Vissia (1998), similarly to Meizen-Dick (1997), propose the potential future role of government for successful management transfer. This role includes the following functions:

comprehensive monitoring of rivers, groundwater, and conveyances to determine availability and use; establishment and enforcement of a system of water rights for the use and allocation of water; setting, monitoring, and enforcing compliance with water quality standards; providing technical and organizational training and support to farmers.

Incentives to users and their related association: it is recognized that stakeholders will engage in a process of institutional changes, if incentives are high enough to enable them to reduce or minimize their transaction costs (Samaniego, 2005; Carruthers and Morisson, 1996). To motivate farmers to actively participate in the process of management transfer, at least the end must justify the means. For instance in the case of Colombia, Bruns and Helmil (1998) have proposed to diversify agriculture in order to increase the likelihood for farmers to have better income in the era of management transfer. Since water management transfer implies almost automatically an increase or even establishment of water fees and other related efforts from farmers, the management transfer is challenging to find appropriate incentives to make farmers better off since they have to contribute more. In this regard, World Bank (2005a) seems to give an insight to decision-makers when it defines agricultural water policy as a set of programs that brings all partners into a coherent program for action; such a policy should define institutional relationships and development paths, set the legal agenda, mobilize support for change in the incentives framework, set the investment programs and create a public-private dynamic.

The management transfer process: Svendsen and Nott (1996) have stated that the process of management transfer itself is an important issue to achieve successful management transfer. In this regard several aspects need to be considered. Firstly, *Bottom-up approach*: it is important to take into account farmers' proposals, as well as their traditions and experiences, on case-by-case basis to build local institutional and organizational arrangement, without following a single, externally authorized model to stimulate organization developing by farmers (Ostrom, 1990, Cremers et al., 2005). A number of irrigation transfer programs aims at using farmers' involvement as a mean to improve the existing organization (agency) with the purpose to enhance its management performance. Such strategy can neither establish trust, confidence, and needed mutual reinforcement, nor the recognition and encouragement required for effective participation of local communities. Secondly, *participation of farmers at all levels of irrigation water*

management is necessary. In taking into account the complex relationships that link human to water on the one hand, and human to human on the other, one may agree that an irrigation system is a social construction before being an hydraulic one (Appolin, et al. 1999). Therefore, involving users of a given system at every step of a water management program is a basic condition to identify, plan, design, build, and insure adequate management of agricultural water projects. Similarly to Cremers et (2005) Joshi et al. (1998) have pointed out that social and institutional aspects should be considered at least as important as physical infrastructures in carrying out irrigation projects; and involvement of beneficiaries at all stages of resource management is crucial to be aware of and manage social conflict and grow perception of social inequality around allocation and distribution of water.. Thirdly, *type, nature and extent of WUA*: closely related to the first one, the type and nature of WUA must reflect the traditional or historical institutional and organizational arrangements within local communities. However, Svendsen et al. (1997) have pointed out that the type and nature of WUA depends very much on the structure of the broader economy as well as on the type of irrigation and the tradition of the management prevailing in the country. Furthermore, case studies have shown also that the legal status of the WUA, the extent to which they can legally corporate to build a federation; their legal right to engage transactions with other partners seems to be important factors to be considered in the process. Fourth, *Rehabilitation of irrigation facilities*: although most transfer programs target institutional changes over the management of water, it has been shown that when conditions of the equipments and irrigation facilities are not good, WUA will not be able to replace or repair them at least within a short term after transfer. Therefore parties engaged in the contract transfer must be aware of the state and remaining lifetime of the equipments and facilities. Fifth, The r*ole of the enabling situation driving the institutional change*: It has been shown that when management transfer is part of broader reforms to tackle problems faced by the national economy (such as in the case of IMT program in Mexico), it is somehow favorable in pushing government to make a real transfer. Sixth, d*emand or supply – driven transfer*: literature does not present many cases of demand-driven management transfer programs, but the case of Colombia has shown that farmers have started the transfer program. When a transfer program is demand driven it is more likely to generate better outcome since farmers may be more motivated as a consequence of their choice. The work of Joshi et al. (1998) on irrigation management in Nepal has shown that the demand driven interventions with high level of involvement of

users in irrigation projects generate better performance of systems management comparing to supply-driven interventions with low level of involvement of farmers in irrigation projects.

4.3.4. – Optimal path in transferring responsibilities to WUA

There are several basic management functions which include project identification, planning and design, construction phase, project monitoring and evaluation, and of course operation and management of irrigation facilities after construction. Most researchers advocate that there should be a level of participation for farmers in each function. Furthermore, in water sector responsibilities must be shared over resource development, allocation (within and between different competing uses), management, protection and preservation. One may raise the question: 'which responsibilities should be transferred institutions crafted by local communities and which ones may be optimally provided by governmental bodies'. Such a question doesn't seem to have an optimal solution set, which would fit to all cases. In this regard World Bank (1998) has recommended that government agencies which implement IMT programs should accompany WUA in the definition of all management tasks along with their relevant costs and leave WUA choose which ones they will provide themselves and for which others they prefer to pay government agency to carry out. Nevertheless, Factors which are likely to play an important role in the optimal transfer of responsibilities are the development stage of the country, the broader economy, its legal and global governance framework (and especially over natural resources development and management), and existing social institutional settings. Because water represents a strategic good and resource (see also Meinzen-Dick, 1997) and unavoidably a social commodity (Prasad, 2006), central government has to play somehow a decisive role in its development, overall allocation and management. Prasad (2006) has pointed out that it is estimated that 90% of the world's population is currently supplied with water and sanitation by the public sector; and there would be no clear evidence that water and sanitation related services can be more efficiently provided by the private enterprises than the public sector. For instance, it is quite obvious that multipurpose water sources such as big dams, watersheds, and river channels must be under control and responsibilities of governmental entities. While management, allocation, administration, and related facilities operation for single purpose watercourse such as an irrigation scheme, regardless its size and complexity, are likely to be optimally under more private

institutions and organizations such as WUA and community self design governing institutions. For instance, similarly to Mexico, in Turkey the majority of large-scale irrigation has been transferred to local management (Svendsen, 2001). In Japan, water for agricultural use is managed by LID (Land Improvement District) whereas multiple purpose water channels and reservoirs by government bodies. In contrast in the Philippines farmers organizations are responsible for managing low levels of irrigation canals. It can thus be concluded that rather than a universal single optimum, the optimal solution of sharing or transferring responsibilities over water governance and management is situation-oriented.

4.4. – Irrigation management transfer in Haiti

4.4.1. - Irrigation and irrigation management in Haiti from an historical Point of view

Irrigation has been developed in Haiti since the 17th century during French colonization. From that time to date one can distinguish five major periods with regard to the type of management and development of irrigation in Haiti. *The first one, before 1804,* covers the colonization period. At that time each irrigation scheme was constructed and thus belonged to one or few French settlers on which they produce crops, especially sugar cane, indigo and cotton for the metropolis. Not only was the management of schemes private, the French settlers, to whom the schemes belonged also supported the construction costs (Prophete 1998). Management was quite efficient, making of agriculture in Saint-Domingue very prosperous. However, the irrigated area, estimated at 58 000 ha, was compound of a multitude of production units (MARNDR, 2000a). *The second period* started after the independence in 1804; the irrigation schemes, becoming state property, were managed by Governmental institutions and farmers became users; although an important part of the infrastructure had been destroyed during the Independence war. The neglect of the young state (which had other priorities at that very early period, especially negotiation to make it recognized as an independent state) leaded to mismanagement of the irrigation systems. In addition to that, some lands were given to soldiers as remuneration for their efforts during the Independence war, but they were completely absent on those farms.

The third period constituted the period from 1915 to 1943 representing the period of occupation of Haiti by the USA. That new colonial power had distributed the most fertile

plains, which were also irrigated to some great companies charged to produce industrial crops (sugar cane, sisal, rubber and bananas) to meet the needs of the metropolis. Jean-Noel (2005) has reported that the state management predominated also during that period. Nevertheless water users who were mainly the owners of those companies could significantly influence the management of such irrigation schemes. During that period some systems (totaling around 23 000 ha) had been rehabilitated or constructed (MARNDR, 2000a; Jean-Noel, 2005). In the *fourth period* (from 1943 to 1990s) the irrigated area has increased, especially with the technical and financial assistance of international Organizations and funding agencies. The large scale Artibonite scheme (around 35,411 ha), Saint-Raphael, Croix-Fer, and so fourth are among the systems that have been constructed in that period. Nowadays around 91 502 ha are equipped with irrigation infrastructure while 80 000 ha (representing 11 % of the cultivated area in the country) are irrigated. Small scale schemes (30 to 500 hectares) represent around 20 % of the irrigated area; IFAD (2003) has estimated that 15 000 hectares of the total irrigated area are covered by those small scale schemes. Small, medium or large scale irrigation schemes can be different from one country to another. Table 4.1 below presents the classification of irrigated schemes in Haiti.

Table 4.1: classification of irrigation schemes in Haiti

	Large-scale schemes	**Medium scale schemes**	**Small scale schemes**	**Total**
Characteristics	Area greater the 2,000 ha	Area between 2,000 and 500 ha	Area smaller than 500 ha	-
Number of schemes	1	38	128	167
Irrigated area	35,411	39,237	16,854	91,502

Source: adapted from Joseph, 2001

It is estimated however that in the country 170 000 ha can potentially be irrigated by gravity (MARNDR, 2000a). Furthermore, according to Jean-Noel (2005) by using modern irrigation technologies such as pressure irrigation, Haiti can extend the irrigated area up to 400 000 hectares which would represent 57 % of the total arable lands within the country. Although new systems have been constructed during that period, most of the schemes quickly deteriorated due to, among others, the problems of centralized irrigation management by Government structures. As countermeasure to the

ineffectiveness of the centralized management the state entered *a fifth* period, characterized by the transferring of the management to the water users through their organized structures.

4.4.2. Problematic of irrigated agriculture and scheme management prior to the IMT program in Haiti

There existed prior the IMT "farmers- constructed and managed schemes" and "government bodies constructed and managed schemes". Both were endured mismanagement and inefficiency problems. Farmers-constructed schemes are mostly constituted of diversion works made of wood pieces and unlined canals. Due mainly to inappropriate infrastructure the diversion, conveyance, and water distribution in such systems is very low. In "government bodies constructed and managed schemes" inadequate institutional arrangements and settings are often combined with lack of proper infrastructures leading to ineffective schemes management and inefficient water services provision. That management carried out through the hierarchical public administration (Ministry of public work and later Ministry of Agriculture) where bureaucracy and autocratic leadership predominate has leaded to number of problems and dysfunction. In its pamphlet on irrigation policy, MARNDR (2000a) has identified a number of problems characterizing irrigation water management in Haiti, which justify the envisaged shift in management of schemes. Among such problems we notice:

Institutional problems: problems were located at two levels: on one side, at the state level, there was a lack of coordination, too much bureaucracy and also sometimes several governmental entities[12] used to implement projects without a proper coordination among them. On the other side, the private sector through NGOs was carrying out important activities in the field. However, there was no coordination among them, neither between them and the public sector; in such manner each donor applied his own policy and strategies. In addition to the issues relating to the lack of coordination, too much bureaucracy and ill-defined responsibilities; there is a crucial problem of law regarding the irrigation sector.

Absence of participation of users: in agency-constructed and managed schemes users were not involved in the management. Apart their participation in maintenance work

[12] Including the bureau of prime minister or even the secretariat of the president

when Government officials required it, farmers were not used to be involved in the decision-making process with regard to scheme management.

Irrigation fee recovery: the Ministry of Agriculture as technical Ministry can not collect fees. Water users might pay the symbolic irrigation fee, when applicable, to the Ministry of Finance through a specific agency. There was neither any relationship between irrigation fees and the operation and maintenance costs of the scheme, nor mechanisms to enforce users to pay it. From 1985 no fee has been paid at all.

Infrastructure: irrigation infrastructure had quickly deteriorated since maintenance could not be done; consequently the efficiency of the systems was very low. In addition to that, the degradation of the environment, especially the watersheds contribute to worsen the states of the irrigation systems through erosion - sedimentation and water shortage.

Human resources: the state administration does have neither enough human resources nor means to manage all irrigation systems in the country besides its other responsibilities. Since the years 1980s irrigation service within the ministry of Agriculture has only few professionals and technicians. Lack of competences is a huge problem affecting the sector.

Financial problem: most of the interventions in the sector (80 %) have been financed by loans from aboard. The state contributed for the remaining part of 20 %. Users did not have to contribute in the government projects. However, NGOs often required their participation even in nature on the form of labor work from the target community.

In Addition, it has been revealed that the organizational structure of government bureaucracy for irrigation and schemes management in Haiti prior the management transfer was a top-down approach combined with inadequate institutional rules which lead to poor management performance. This has motivated and justified institutional change through the management transfer process, aimed at reaching a new equilibrium in which farmers' participation and involvement in crafting more appropriate institutional settings and arrangements are intended to improve the management as well as the economic performance of irrigated agriculture.

4.4.3. – New vision – Objectives of the IMT process in Haiti

In the 1990s the government in Haiti has decided to transfer operation, administration and management of the irrigation schemes to Water Users Associations. The process is

intended to go gradually, first transferring the small-scale schemes, and having learnt from that experience step by step the bigger systems. The objective of the management transfer is the increase of the agricultural production and productivity through a better performance of irrigation management. The strategy applied targets to completely transfer management responsibilities to autonomous self-sufficient organizations. However, the state remains owner of the irrigation infrastructure and moreover some responsibilities will be shared with WUA. Figure 5 below illustrates the vision and objectives of the ongoing process in Haiti. WUAs are established on a case to case basis; each one is responsible for operating, administrating, and managing one scheme. However, they can federate to establish larger associations. Arcahaie is an example where four adjacent irrigation schemes are managed by one WUA[13].

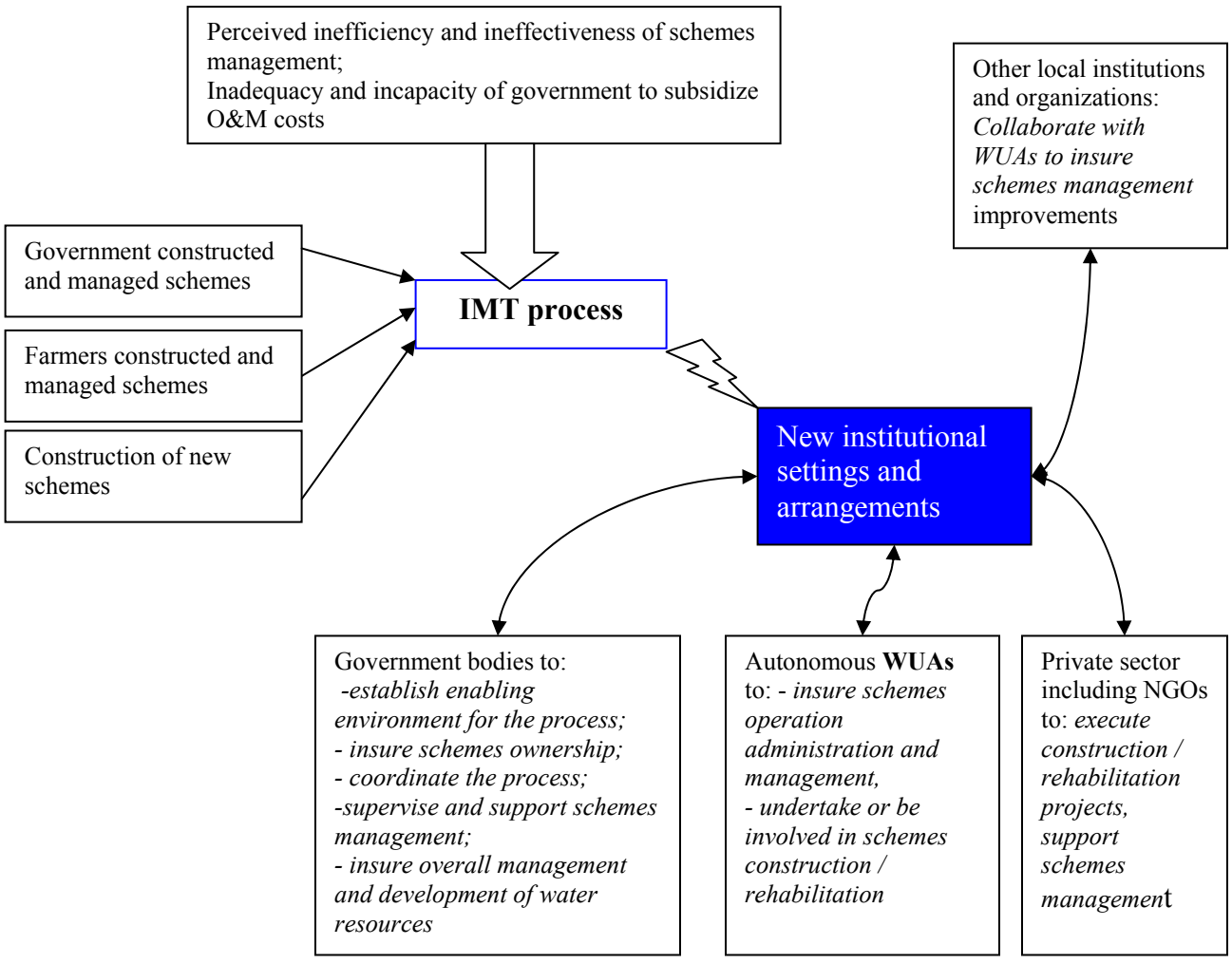


Figure 5: vision and objectives of IMT model in Haiti

[13] AIPA: Irrigators Association in the Arcahaie Plain

4.5. - Institutional structure and environment surroundings the irrigation management transfer in Haiti

4.5.1. - Institutions/organizations interplaying in the management of water in Haiti

Competences concerning the development, utilization, and management of water resources in Haiti, are shared among six ministries. *The Ministry of Agriculture, Natural Resources and Rural Development (MARNDR)* is responsible for the protection, conservation, and rational use of all renewable natural resources including water. In addition, it is the state institution that is in charge of irrigation; thus it must elaborate policies and guidelines, give its appraisal, and play a regulatory role over all projects concerning irrigation and irrigation water management. However, some autonomous and regional public agencies operate sometimes directly with donors support without direct implication of the Ministry of Agriculture. This is for instance the case for the *Organism for the Development of Artibonite Valley (ODVA)* located in the most important region in the country in term of water for irrigation and hydro power generation. The second institution is the *Ministry of Public Works, Transport and Communication (MTPTC)* which is responsible for planning, executing, maintaining and controlling drinking water and drainage infrastructures within the country. Under this Ministry there are some specialized agencies like the *Autonomous Metropolitan Drinking Water Company (CAMEP)*, supplying domestic water to households in the capital city and surrounding areas and the *National Drinking Water Service (SNEP)*, responsible for the rest of the country; and *The Electricity of Haiti* (EDH) which manages water for hydroelectricity generation. The third one is the *Ministry of Public Health and Population (MSPP)*, responsible for water quality control of drinking water and sanitation. The next one is the *Interior Ministry (MDI),* which assists the municipalities in the execution of their drainage projects. The fifth one is the *Ministry of Environment (MDE).* This recently created institution must deal with environmental aspects, especially at the level of watersheds, lakes and coastal areas. It intervenes to insure the preservation and the renewing of water resources. Finally, the M*inistry of Planning and External Cooperation (MPCE)* is in charge for the overall planning and coordination of projects including those related to water in the framework of territorial planning and landscape.

It is important to emphasize that Haiti does currently insure somehow the management of the traditional uses of water (agriculture, domestic, hydropower generation) separately

and individually. There is yet, in the water management framework within the country, neither an integrated management of water as a resource, nor a coordinated management of the different uses in order to develop synergy to rationalize the efforts and avoid waste of resources or/and solve conflicts among the competing uses of water.

4.5.2. - Legislation on water, irrigation water management, and users involvement.

In fact Haiti does not have a specific law on water or irrigation water. Laws related to water issues are relatively very old and scattered within diverse general laws (MARNDR and BID, 1998). The most known references of laws on water are the constitution of 1987, the 'Rural Code' of 1962, and a number of decrees (Binette, 1998 and 2005). However, At the end of the 90s the Ministry of Environment with the support of Interamerican Bank for Development (BID), has elaborated a project law for the water sector in general. There is reference to irrigation water and its management by several sources such as the articles 36.3 and 36.5, as well as the articles 31 and 31.3 of the 1987 constitution. These specify respectively the property right of natural water sources and the right, which every citizen has to freely participate to all types of organizations including those aiming at the management of water. In the articles 519, 521, 522 the constitution clarifies how a riparian can make a personal use of a natural water source.

One of the most quoted references in term of legislation about irrigation and its management, which is still in use somehow, is the 'Rural Code' of 1962. In its chapter 3 and articles 151, 152 that law place the administration and management of all irrigation systems under state authority and responsibility. In article 166 it even specifies that the state service in charge of the administration is not permitted to transfer or delegate such responsibilities to any other entity. Nevertheless and surprisingly, the first transfer contract signed in Haiti between the state and a water user organization dates already from 1953 (a copy of that contract signed between Haitian and "Syndycat Agricole d'Avezac" as well as the given law is presented in annex 2.2). It is important to highlight that the syndicate was responsible for system administration, water distribution and system maintenance and reparation, but the state had to collect the irrigation fees. Following the terms of the contract, 50% of the collected fees was to be given to the syndicate and government also had to provide engineering council through the staff of the Public Works Department. Prior to that contract and the law that sanctioned it, the law of September 25th 1952 in its article 7 already recommended a committee

constituted of one representative from the Department of Agriculture, one from the Department of Public Works (at that time) and 3 to 5 members elected by users, which should have the duty to give advice and suggestions to the managers of each irrigation scheme in order to insure their good functioning. After that backward step (Rural Code of 1962) in legislation towards encouraging users' involvement in the administration and management of irrigation water in the country, the decree of November 15th 1990 constitutes a step forwards. That decree, in addition to the establishment of the actual structure within the Ministry of Agriculture (MARNDR) responsible for irrigation, recommends the formal and legal existence of users association at scheme level to jointly manage their schemes.

In order to launch and implement the irrigation management transfer the state through the Ministry of Agriculture assisted by the private sector working in that field and with the help of International funding agencies have elaborated new texts. The most relevant ones for the transfer process are: framework law on water in general; law on irrigation and drainage of agricultural lands; the law governing the status of professional agricultural organizations in general; the law settling the creation and functioning of irrigation water users associations; and the law on the irrigation management transfer itself. Those laws have been prepared, but they are still waiting to be voted by the parliament.

4.5.3. - State Policy for transferring the management of irrigation schemes to user

Aware of the mismanagement of irrigated schemes, pushed by the pressure of International financial Institutions and Organizations in the context of structural adjustment programs, and having some isolated cases of potential good results of self management by water users promoted by NGOs (systems of Bayonnais, Saint Raphael) and even by the ministry itself through cooperation with international partners (systems of Arcahaie, "Plaine de l'Arbre"), the state has clearly decided to shift to a more efficient management of water irrigation. In its 2000 document on national policy for irrigation, the Haitian state through the Ministry of Agriculture makes the development of irrigation a priority (VSF-CICDA, 2004), as a strategy to intensify agricultural production and increase productivity towards food security achievement. As defined by the Ministry of Agriculture, the management transfer is a kind of jointed responsibility between the state and the users. In the intended process the responsibilities must be shared as follows.

Figure 9 above specifies the most important duties and responsibilities of the different parties involved in the process. For the state, remaining owner of the systems as well as water resources, it must intervene to construct new systems and when necessary rehabilitate old ones. The state is also responsible for giving incentives and help users to build relevant organizations with which it signs a management transfer contract. The Water User Association (WUA) is responsible for both technical and administrative tasks of managing the system and bears the costs of relevant activities through water fees recovery.

4.5.4. - Strategy and methodology for the transfer

As mentioned above to reach the target objectives, the state intends transferring the management through a progressive process because, among others, most of irrigation systems are usually in such poor conditions, that they are not manageable at all. Moreover, the users must be prepared to assume the new responsibilities of managing irrigation water. For those reasons, the state has elaborated a methodology for the transfer. This methodology consists of fourteen steps distributed along, four phases and three levels of progressive contractual agreements with users. First of all, a preliminary phase is conducted to build or strengthen a professional or technical team (step 1) and establish the relationship between the team and the local community.

First phase: Diagnosis and motivation- during this phase the team characterizes the target irrigation system through a diagnosis (step 2). The expected outputs are: a definition of the quantitative and qualitative criteria (technical, social and organizational, operational, and economical) establishing the scheme benchmarking; and also the identification of the problems and the opportunities offered by the concerned system. Then, a motivation campaign (step 3) is carried out to inform the community about the policy of the state for irrigation management, to raise its awareness, and to have a first appraisal of their willingness to take part in the process. A first temporary WUA is build or strengthened (step 4) to be the representative of the users in the process. The results of the diagnosis are presented to the users and a project to support the transfer is formulated (step 5), this project must include three main aspects: rehabilitation of the irrigation infrastructure, strengthening the WUA, and supporting the agricultural intensification and scheme exploitation. A final negotiation is undertaken (step 6) to lead to a first contract indicating reciprocal engagements between state, users and technical partners who execute the project (**first level of contracting**).

Phase 2: implementation of the program supporting the transfer.- Activities are carried out to rehabilitate or construct the infrastructure and to improve the management instruments (step 7); to strengthen WUA and train users (step 8); and to support agricultural intensification and scheme exploitation (step 9). The outcomes of this phase should be the good state of irrigation facilities, a well as an organized and legalized WUA and improvements in the agricultural practices. This second phase ends by a mid-term evaluation of the process.

Phase 3: joint-management of the irrigation system. - A **second contract** is signed between the WUA, the state and technical responsible for the project execution. Within this phase, the project team intensifies training for WUA members (step 10); experiment and adjust with them the rules for operating and maintaining the system, distributing water and solving conflicts (step 11). The economic and financial self management of the WUA is consolidated (step 12). The team and state give support to build a technical unit within the WUA especially for complex schemes (step 13). Then, other types of farmers organizations are promoted (step 14) for providing services upstream (inputs and material selling) and downstream (agricultural products selling and processing) of the production chain. This third phase ends also by a mid-term evaluation.

Phase 4: Self Management by the WUA.- The state signs a contract with the WUA giving it the right over the use of the water and irrigation infrastructure, but also responsibility to take care of the system and to use the system in the most efficient way **(third level of contracting)**. The project technical team is no longer needed, but the regional office of the Ministry supervises and supports the management of scheme. The flow chart of that methodology is presented in annex 2.1.

4.5.5. – Socio-economic and political environment surrounding the IMT process

Haiti has started the IMT process in a context of crisis, characterized by economic stagnation, social and political instability, weak state institutions in a society where rules-of-law is rather an exception. Economically, as mentioned above the country has known a period of consistent decline; high inflation rate, the national currency has drastically devaluated, especially during the last three decades. Agricultural production and productivity have declined due to environmental degradation, to lack of public investment that could provide relevant pubic goods and services in rural areas and this combined with the negative impacts of trade liberalization (World Bank 2005b). Farmers have been incapable to reproduce their production systems. Social inequalities within the Haitian

society are revolting and they represent one of the major factors which sustain the country in its vicious cycle of poverty for 200 years. For instance, 4% of the population owns 66% of the total resources, another 16% has holds 14% of them, while 70% has only 20%, and 10% is even completely deprived (Herard, 2005). Huge inequalities are also present between urban and rural areas, especially regarding access to basic public service such as education, health, communication facilities, and so fourth.

Concerning global governance framework, Haiti has a democratic system with, even theoretically, three separate powers parliament, judiciary, and executive. Nevertheless there is a centralized government. The decentralization recommended by the Constitution is not yet established. Municipalities are still financially dependent on the central government. Politically, after thirty years of strong Authoritarian leadership (the Duvaliers) the last three decades have been characterized by serious political troubles. From 1986 to 2006 only one democratically elected President has accomplished his five years mandate and a whole set of governments have successively held power, ones more 'de facto' than others. As a consequence public institutions have been weaken, legal framework and rules of law almost broken up. In ten years US and UN forces have intervened at least twice*[14] to help governments in establishing peace in the country.

4.6. - Concluding remarks and lessons learned from IMT model in Haiti

The Haitian IMT model is somewhere between the first and second IMT strategies defined above. Indeed the model targets to establish autonomous and financially self sufficient WUAs to take management responsibilities over the entire irrigation schemes, or at least for the small and medium scale irrigation systems. But the implementation process is closer to the second strategy, since the time path for transferring management responsibilities to WUA is quite long in comparison to the Mexican Model for example. Nader (2005) has argued that a period of three to eight years is needed to accompany farmers in that process. The given model considers the transfer itself as an integral part of rehabilitation or construction projects, taking thus into account the deteriorated state of most irrigation infrastructure as well as the required time to train

[14] In 1994 by the United States to bring back on power a president who had been in exile for three years due to a "coup d'Etat" by the army; and in 2004 by USA following UN force to push from the power the same president and establish a UN mission to stabilize the country after fights between rival groups seeking to control the power.

new managers in the context of lack of adequate skills, low educational level, and weak social institutions which often characterize rural communities in Haiti.

The overview of the institutional environment in which and the structure according to which the IMT process in Haiti is being implemented, reveals that the state objectives are clearly defined and convincing. Moreover, the methodology to encourage and support WUAs establishment has been adequately and accurately elaborated. Efforts have been done to improve the legal framework sustaining the process, even though the elaborated laws are not yet voted by the parliament. Awareness has been risen, at least among most of technicians and professional in the field as well as among farmers, on the necessity to a better involvement of different relevant stakeholders, especially irrigation water users in schemes management. However, a real transfer program is not yet elaborated. Neither is the state policy clear, elaborated, and precise enough concerning following issues: 1) no specific deadline for the transfer, 2) it is not undetermined budget, 3) no criteria or indicators have been identified to monitor and evaluate the program implementation? Moreover, how the responsibilities are shared between the stakeholders and shareholders in the project identification, design and implementation is not explicit. Two other concerns, which are crucial for successful management transfer as evoked above: water (and land) rights systems and water pricing systems have not yet been touched by the program. Another critical aspect concerns the reform in the irrigation agency and long term role of government in water resources development and overall management. The failure of not carrying through such reforms is easily perceived by the consistent lack of -if not the absence of- coordination and leadership between actors. Furthermore the IMT process in Haiti has not benefited (positive externalities) from broader economic reforms like it was the case in a country such as Mexico. One can also notice the absence of a political will to support, sustain, and boost the vision of transferring schemes management responsibilities to WUAs.

We conclude in arguing that the IMT dynamic is quite recent in Haiti and the broader institutional environment and structure surrounding has not been favorable enough to enable smooth program design and implementation. The good and clear vision of the state, the established methodology, efforts in elaborating new legislation, the starting dialogue between actors especially the involvement of private sectors, are among the elements which have been already achieved.

CHAPTER V

RESULTS AND DISCUSSIONS FROM FIELD STUDY ON TRANSFER PROCESS AND IRRIGATION SCHEMES MANAGEMENT

The process of transferring operation, administration and management responsibilities to the concerned schemes has already started. In fact these schemes are managed by the established water users associations. This section is devoted to present the results and discussions of the institutions that are established by users to run the schemes. To facilitate the understanding we group together two schemes, Grison Garde and Dubre, which are quite similar in several aspects, and then we present the scheme of Saint-Raphael, which is the most interesting scheme with regard to this study.

5.1. - IMT and management of the irrigated schemes Grison Garde and Dubre

5.1.1 General presentation of the schemes: location, users, and land tenure

Table 5.1 below presents the main descriptors of both Grison-Grade and Dubre irrigation schemes. In terms of climate conditions there are two rainy seasons: September – December and March – June. The annual average temperature is 27^{o}C. Grison has 400 ha of irrigable area[15], while 320 hectares are now more or less irrigated[16], but annually only 170 hectares on average are irrigated or cultivated. A total of 733 farmers exploit the scheme on 978 parcels. Dubre on the other hand has 100 ha of irrigable lands, 82 ha are actually irrigated, and while on average farmers cultivate 77 ha annually. That scheme has 249 users exploiting 333 parcels (parcels map of the scheme is presented in annex V).

Our survey on 5.5 % of farmers in Grison Garde reveals that 22.5% of them are illiterate, 62.5% have primary education, and 15% have reached secondary school. On average their families have between 5 and 6 members who depend in one way or another on the farming activities. In Dubre, our investigation reveals quite similar figures: 15.8% of farmers are illiterate, 68.4% have primary education, and 15.8% have reached the level of secondary education. Table 5.2 below presents the age distribution of the farmers for both systems.

[15] Area that can theoretically be irrigated from topographical point of view
[16] area which is in the rotational plan of the farmers

Table 5.1: Main descriptors of the irrigated scheme Grison Garde

Descriptors	Schemes description	
	Grison Garde	Dubré
Country	Haiti	
Name of the scheme	Grison Garde	Dubre
Climate	Tropical humid	Tropical humid
Water availability (abundance, enough or scarcity)	Abundance in rainy season and shortage in dry season	Abundance in rainy season and shortage in dry season
Irrigable area	400 ha with regard to the topography	100 ha with regard to the topography
Total irrigated area	320 hectares	82 hectares
Annually irrigated area	170 hectares on average	77 hectares
Average annual rainfall	2000 mm	1500 mm
Efficient annual rainfall	1190 mm	1190 mm
Evapotranspiration	1860 mm	1860 mm
Water source (diversion from river, storage barrage, groundwater, combinaison of surface and groundwater)	Diversion weir on river Mornet	Diversion weir on river
Type of irrigation system(gravitary or pumping water supply)	Gravitary	Gravitary
Types of infrastructures (open Channel or pipelines…)	Open channel	Open channel
Type of distribution (on demand, predetermined schedule, anarchic distribution …)	Mixture of predetermined schedule at the level of the main canal and on demand at the level of hydraulic quarter	On demand supply
Irrigation method (predominance of furrow irrigation, basin, submersion….)	Mixture of furrow irrigation and basin depending on the crops	Mixture of furrow irrigation and basin depending on the crops
Main crops and their percentage (% total area)	Rotation rice and black bean/peanuts/maize	Rotation rice and black bean/peanuts/maize
Average farm size		
Management type (state management, farmer-managed, joint management…)	Self management by farmers	Self management by farmers
Total canals length	3 km of main canal and 1695 meters of concrete secondary canals	
Total number of users	733 users	249 users

Source: author

Table 5.2: Age distribution of farmers in Grison-Garde and Dubre

	Grison Garde		Dubre	
Class of age	Number of farmers	percentage	Number of farmers	percentage
Less than 35	5	12.5	5	26.3
35<=age<50	13	32.5	8	42.1
50<=age<60	12	30	4	21.1
60 and plus	10	25	2	10.5
Total	40	100	19	100

Source: author survey

For Grison-Garde the farmers' age lies between 23 and 70 years old and more than half of them are older than 50 years old. While in Dubre their age lies between 25 and 63 years old, 68.4% are less than 50 years old, but more farmers are between 35 and 50 years old.

Results for the studied samples concerning land tenure are presented in the table 5.3. Data further show that in Grison Garde on average each farmer exploits 0.86 hectares while the irrigated area per farmer lies between 0.15 ha and 2.4 ha. Two third of lands are in property regime. In Dubre the average irrigated area per farmer is 0.51 ha, while a great percentage 43.2 % are tenant lands.

Table 5.3: land tenure in Grison Garde and Dubre

Type of tenure	Percentage of lands	
	Grison Garde	Dubre
Property	66.8	49.1
Tenant	23.8	43.5
Rented lands	9.4	7.4

Source: author survey

In conclusion both schemes are characterized by a multitude of smallholders exploiting less than one hectare on average with small size parcels. This does not only lead to high pressure on land resources, but also renders the organization of water distribution difficult. Even though farmers also exploit lands that are not irrigated and have off farm activities, their livelihood must be precarious in such a situation. This will negatively

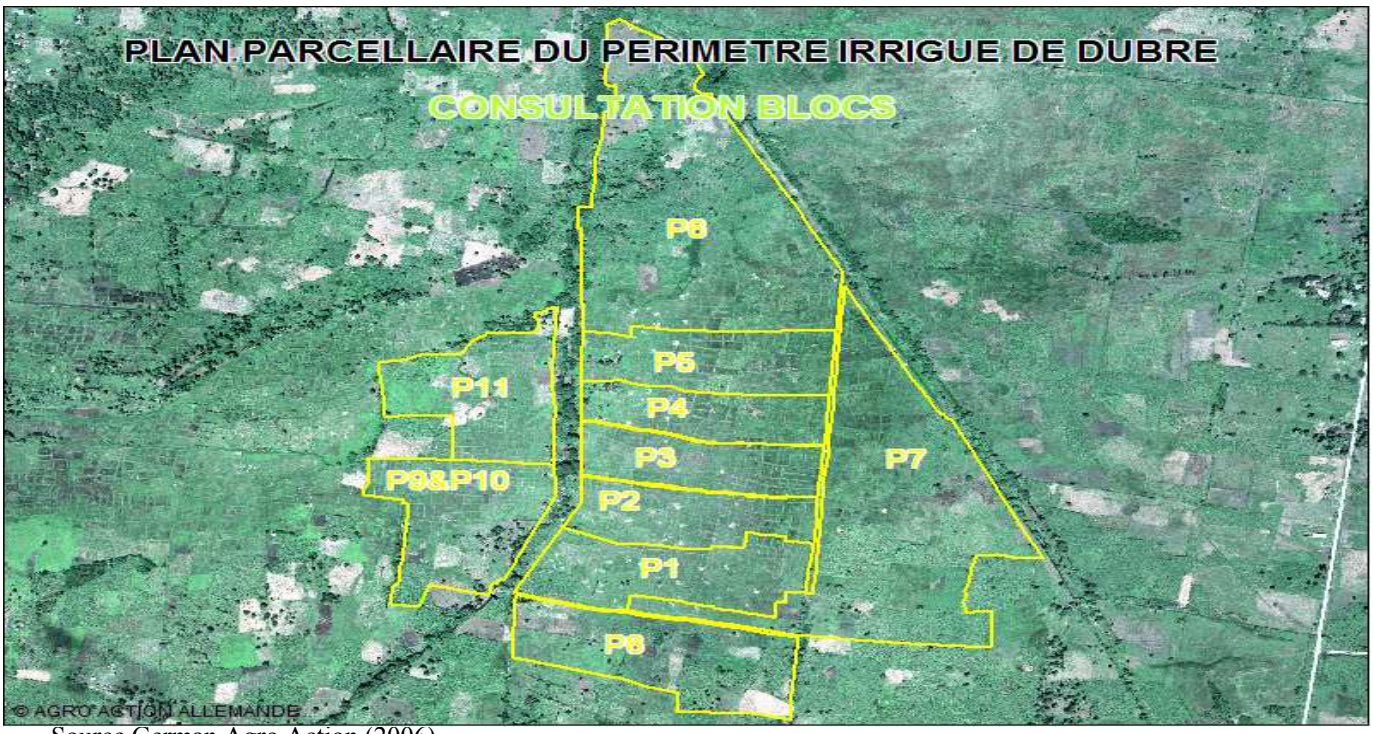
influence the real capacity of the farmers to be financially self sufficient in the management of those schemes.

5.1.2. - Management of the irrigation schemes

5.1.2.1. – Infrastructure and physical management tools

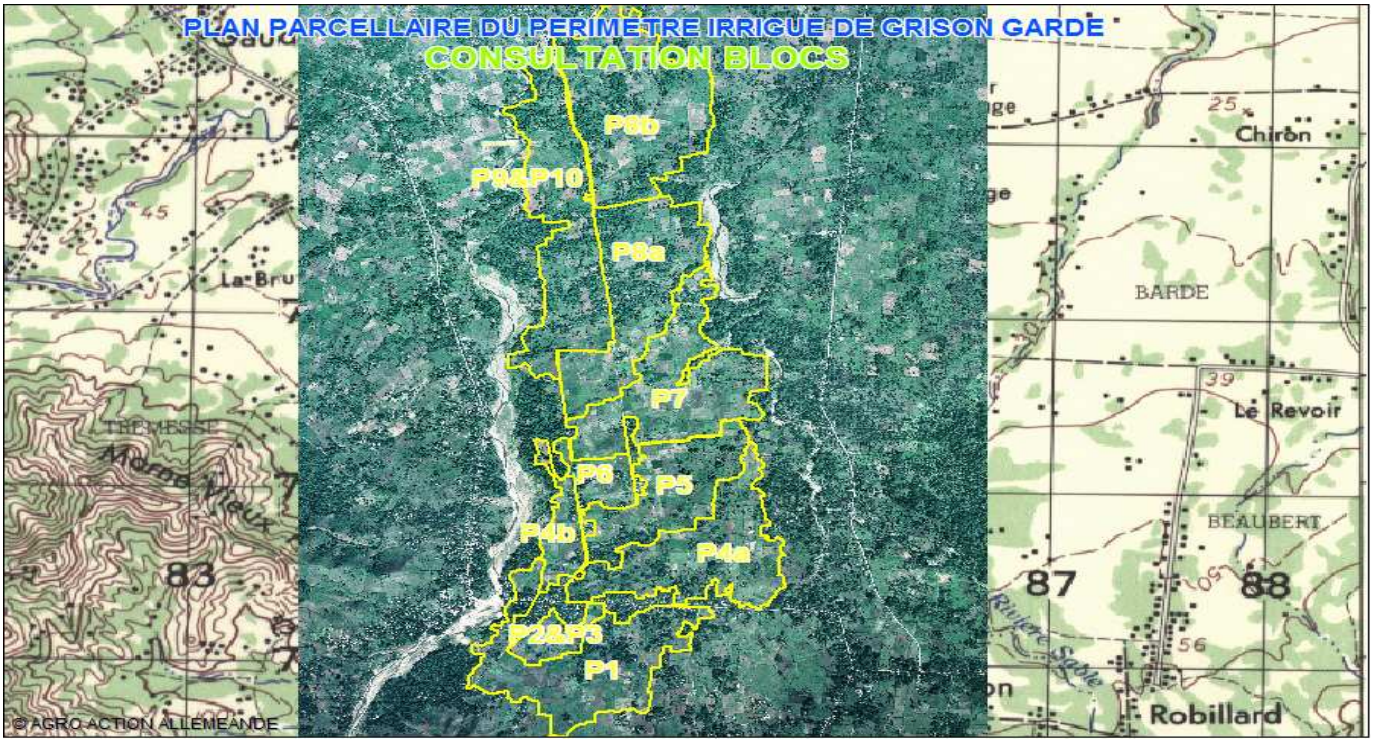
Both irrigation systems have similarities in term of irrigation infrastructure network as shown in the table of main descriptors above. Concerning Grison Garde, water is diverted from the River Mornet, also known as River Grison Garde, by means of a diversion weir. The diverted water flows through a main canal of 3 km length made in concrete. That primary canal supplies water to 10 secondary canals by means of small mechanical hydraulic gates. The secondary canals are partly in concrete; their remaining part as well as the entire tertiary networks consists of earth made canals. However, GAA (German Agro Action) and CCIGG (Central Committee of Irrigation in Grison Garde) have just started a project in April 2007 to cover in masonry 4 km of secondary canals in order to improve irrigation efficiency, facilitate water distribution, and extend the irrigated area.

The scheme is organized in 10 hydraulic quarters according to the number of secondary canals, currently named doors. The maps below (figures 6 and 7) present the hydraulic division of both schemes. In those maps ‘P’ stands for door or secondary canal. This hydraulic division is the basis for organizing the Water Users Association as well as water distribution within the system. Linked to that map, a data base gives the characteristics of each quarter and even each field. The parcels plan constitutes a useful tool for organizing the system management, especially water distribution. Unfortunately the irrigation network is not yet equipped enough to enable to fully use the tool. However, even though it is not ready yet to use it for organizing water scheduling and distribution, it helps the managers to quickly realize the parcel inventory for each seasonal crop and thus to recover water fees. Concerning Dubre the infrastructure network is compound of a concrete diversion weir that diverts water from the river, three canals and a number of small hydraulic gates that allow supplying water to each of the 10 hydraulic quarters.



Source German Agro Action (2006)

Figure 6: Hydraulic division of Grison Garde irrigation scheme



Source German Agro Action (2006)

Figure 7: Hydraulic division of Dubré

5.1.2.2. - Organizational structure of the Water Users Associations managing the schemes

Structures which insure schemes management are organized at two levels. At a first level, that of the hydraulic quarter, all users form a user group that is represented by a committee of three members (1 president, 1 secretariat, and a treasurer). At a second level all presidents of the users groups are jointed to form the CCIGG (Central Irrigation Committee in Grison Garde) or CCID (Central Irrigation Committee in Dubre) which are in charge of the daily management and operation of the schemes. Those ten or eleven members, respectively for Grison-Garde and Dubre, are organized in commissions in order to better share responsibilities to operate, administrate and manage the systems. However, the highest entity of each association remains the General Assembly that theoretically gathers all users but, according to the established rules by the users themselves, each hydraulic quarter must delegate five users in addition to the three committee members to hold the General Assemble. In annex IV the graphs of those organizational structures are presented. In addition, the associations hire employees (one accountant and two gatekeepers for each scheme) to carry out their activities.

Such organizational structures must encourage and facilitate farmers' participation in scheme management. But the everlasting free rider problem and lack of incentives for those voluntary tasks in providing public goods in the commons, still stand as major barriers and challenges faced by those users associations. As a consequence the field study has revealed a lack of communication and participation between the CCID or CCIGG and the users on one hand. One the other hand, most of the hydraulic quarter committees are not really active.

5.1.2.3. - Water distribution organization and norms

The organization and norms to distribute irrigation water to farmers are quite similar for both schemes. At Grison Garde, water distribution is scheduled, especially in dry seasons, at the level of the main canal. The system is divided into two sectors: Sector I (from secondary 1 to 5) receives water from Monday to Wednesday; and Sector II, from secondary 6 to 10 disposes of water for the remaining days of the week. Therefore each field has in principle the possibility for being irrigated once a week. But, in fact water

supply is on demand since the user should ask the gatekeeper whenever he wants to irrigate. Once water reaches the secondary canal users irrigate their field successively under the supervision of the gatekeeper. If no one requests, water will not be made available in the secondary. This strategy helps to control those who do not pay water fees, but also prevents inundation in the farmers' field. In Dubre on the other hand there is no schedule at all, distribution is completely on demand. Farmers ask the gatekeepers who fix appointments for them. Thus farmers can irrigate only during day time; in nighttime doors are closed. Two conditions are required for the farmers to be supplied with water: he must have the payment fee card and he should also clean the tertiary canal to prevent the inundation of riparian fields and waste of time and water. Priority is defined per order of request while often emergency cases are taken into account to prevent that farmers do loose their harvest due to water shortage or non reliable irrigation scheduling. This type of flexible arrangements fits more to the local uses, customs, human relationships than predetermined rigid principles and rules.

5.1.2.4. - Water rights

As mentioned above, there is no specific water right law in Haiti yet. However the existing legislation establishes natural water as state property and specifically as a public good. Furthermore, all irrigation infrastructures belong to the state whenever they supply water to more than one user. By-law, water users associations have a use and management right over the irrigation facilities and water. As a public good each riparian of a water flow including irrigation canals has the same right, under certain conditions, to use water to irrigate his field. In Grison Garde and Dubre, the transfer process is still under way since none of both associations has already signed a formal transfer contract with the state. However, according to the methodology presented above they have signed a temporary contract with the departmental representative of the MARNDR which allows them to carry out their tasks.

By the fact that there is no established water distribution schedule for every field, the associations have all water rights in their hands. At the beginning of each year (formerly at the beginning of each agricultural season) they share the given water rights to farmers against the payment of water fees and the implicit agreement to participate in the maintenance works in the systems. The given water rights are attached to the land,

specifically the cultivated field. However, such a water right is not specific, it allows the farmer only to irrigate his land (as well as beneficiating other advantages such as voting in the organization, buy input for his field from the organization, store his harvested grains in the associations warehouse…), but he does not know how much water he has. The water right is not transferable either; the farmer can not transfer it to another parcel and certainly not to another farmer. But the ownership of the water right is clear, the cultivated field represented by the farmer who is exploiting it. In such conditions the users' associations central committees can sell as much water rights as farmers want to buy.

5.1.2.5. - Maintenance of irrigation Networks

One of the responsibilities of the users associations is to insure the maintenance of irrigation facilities built and transferred to them. In the concerned schemes, those associations, through their Central committee; plan, organize and gather farmers to clean the main canals. The committee of each hydraulic quarter gathers with farmers to maintain the secondary network, while each user is in charge of cleaning the tertiary canals surroundings his plots. At all levels such a service is performed without payment since the financial resources of the associations do not allow them to pay for it. Again the free rider problem constitutes a barrier. However, during the field study, most of the main and secondary canals were in good conditions.

5.1.2.6. - Water charge – cost recovery

Certainly irrigation fee recovery is one of the most important and crucial aspects towards successful management transfer program. The success of the process depends greatly on the possibility to establish long-term financially self-sufficient water users associations. It has to be reminded that cost recovery inefficiency was also a major factor explaining the failure of government agency-managed irrigation schemes. In Grison Garde and Dubre, GAA has introduced at early stages of the rehabilitation project the necessarily irrigation water charge. GAA (2002) has reported that historically only between 1969 and 1977 users of those schemes used to pay 9 HTG[17]/user/year (1.8

[17] HTG stands for 'Haitian Gourde' which is the national currency in Haiti (when the survey was held in March – April 2007, 38 HTG = US$1 and 50HTG = 1 Euro)

$US at that time) regardless the irrigated area. The tentative of ODN to organize the scheme management and reestablish the water fee in the 1980s failed. Since 2003 during the ongoing rehabilitation and transfer process the water charge system has been reintroduced. That fee is fixed, collected and managed by the water users associations to cover the administration and management costs. Actually the fee is 900 HTG/tiles/year for Grison Garde and 200 HTG/tile/seasonal crop in Dubre. Table 5.4 and 5.5 below presents the state of collected fees, expenditures and direct subsidies for the self management period, respectively for Grison Garde and Dubre.

The tables show that the associations have kept wages in the limit of the collected fees; but the actual amount of collected fees are very low and do not enable to cover the management and administration costs of the systems. Throughout the period direct subventions represent 80.75 % of the total amount of collected irrigation water fees for Grison Grade while it represents almost five times the total collected fees for Dubre. In addition to the irrigation fee, both associations generate income from other activities such as the rice husking machine and the agricultural input shop. Those activities however are rather used to offer extra services to farmers than to generate profits to the associations.

Table 5.4: State of collected irrigation fees, expenditures, and direct subsidies from 2003 to 2006 for Grison Garde irrigation scheme

Period	**Irrigated area in ha**	**Collected fees in HTG**	**Collection rate ***	**Direct subsidies in HTG**	**Total expenditures in HTG**	**Wages in HTG**
Rice 2003	219.5	3,350.00	9.81	11,100.00	13,616.00	1,275.00
Vegetable 03/04	219.5	6,459.00	18.97	7,200.00	11,022.70	2,239.70
Rice 04	219.5	9,640.00	13.73	18,400.00	25,681.00	3,856.00
Vegetable 04/05	219.5	12,909.00	25.3	9,200.00	15,670.60	5,163.60
Rice 05	120	15,875.00	51.48	6,900.00	23,496.20	15,521.20
Vegetable 05/06	93.33	6,360.00	29.3	2,300.00	8,339.00	5,179.00
Rice 06	93.33	13,642.00	64.22	0	14,828.00	5,423.00
Total	-	**68,235.00**	**-**	**55,100.00**	**112,653.50**	**38,657.50**

Source: author accordingly to data collected from CCIGG and GAA

*: the collection rate is the fraction of the effective collected fees divided by the expected amount (which depends on the annually cultivated area since farmers pay for the water they use)

Table 5.5: state of collected irrigation fees, expenditures, and direct subsidies from 2003 to 2006 in Dubre irrigation scheme

Period	Collected fees in HTG	Direct subsidies in HTG	Wages in HTG	Total expenditures
2003	3,671.00	10,800.00	0	11,330.00
2003/2004	3290.00	21,600.00	937.50	24,402.50
2004/2005	5,114.00	19,800.00	1,534.40	21,434.4
Total	**12,075.00**	**52,200.00**	**2,471.90**	**57,166.90**

Source: author accordingly to data collected from CCID and GAA

The collected data show that the issue of financial self-sufficiency for running the schemes is not yet relevant for CCIGG or CCID at their present stage. With the actual rate and amount of fees it is obvious that they are far away from being able to support themselves the schemes management and administration costs. That situation, in the hypothesis of any significant improvement, may become worse when the associations will have to repair hydraulic gates and other hard infrastructure in the irrigation network by themselves. Nowadays, the essential maintenance works are practically canals cleaning.

Moreover, it is important to relate that the levels of water fees, respectively 900 HTG/tiles/year and 200 HTG /tiles/season for Grison Garde and Dubre, are among the highest for surface irrigation systems in Haiti. But unfortunately in addition to the very low recovery rate, the payment per season does not fit to the reality. In most cases farmers do not realize more than one crop per year in those systems. And even if they have three harvests, it is not realistic that they will pay the irrigation fees three times a year. Thus, when for example WUA expect three times 200 HTG /tiles per year for the total irrigated area, on which basis it makes its budget; it will fail three times in its prediction. First, only a certain percentage of the irrigated area will be cultivated, thus will suppose to be paid since farmers pay when he cultivates his land. Second, only a part of the cultivated land will effectively pay the fee; by experience it is not higher than 50% on average. Third, for sure each farmer regardless how many crops he realizes for the year he will only pay once and at the seasonal rate.

Furthermore, when considering the production costs and profit margin realizable by farmers, we may conclude that the levels of water charge are very low. According to GAA (2006), the production costs per hectare are on average 29,113.70 HTG and 19,542.00 HTG, respectively in Grison-Garde and Dubre for rice production. And the profit margin for that culture on average lies between 16,582.3 and 42,598.30 HTG per hectare in Grison-Garde and between 50,921.40 HTG and 66,185.40 HTG in Dubre depending on the variety of rice cultivated by farmers. In other words, in addition to be the cheapest input, the actual water charge represents between 1.8 and 0.7 % of the profit margin in Grison-Garde; and between 0.4 and 0.3 % of the profit margin in Dubre. Those figures result from the hypothesis where farmers pay the irrigation fee normally for each crop. Now let us consider the worst and extreme situation for the farmer where he might pay the entire annual water fee while realizing only one season of rice without any other crops for the whole year. They would have paid on average between 4.6 and 2.1 % of their profit margin in Grison Garde; and between 1.6 and 1.2 % in Dubre for irrigation water. Therefore, in the actual condition of scheme exploitation in Grison Garde and Dubre the irrigation water fee recovery to cover the administration and management costs of the schemes is rather a problem of willingness to pay than the farmers' capacity to pay. Water is the second most important production factor after land for farming activities but it mostly is the less valued. To improve or even reverse the situation in the concerned schemes one needs to rise farmers consciousness, willingness and motivation to pay and to reinforce their motivation in order to reach a more reliable valuation of irrigation water; and to improve the transparency and management skills of managers.

5.1.2.7. – Conflict management and resolution

CCIGG and CCID have worked to solve the identified potential conflicts, which mainly concern some sabotage actions done by users in violation of the established distribution rules. The CCIGG has experienced that out of court conflict resolution is better (less costly) than when they are obliged to go to court in order to solve the conflict (opposing CCIGG to users). However when the case requires to go to court, they do it in order to preserve the system on which their economic activities are based.

5.2. - IMT process and community-based management at Saint Raphael irrigation scheme

5.2.1 Introduction

Saint Raphael is one of the most important irrigation schemes in the North Department. Together with Grison-Garde it is responsible for the major part of rice production in the department. Besides it is the most important producer of vegetables in the department. At the same time it constitutes the basis for the economy in the Commune where it is located. The scheme is also one of the pioneers in community-based management of irrigation system starting in the 1990s in Haiti. Today it is considered to be one of the farmer-managed schemes that are more or less functioning well. For about one decade the irrigation scheme has benefited from the interventions from German Agro Action, through a number of projects aiming at rehabilitating physical infrastructure, establishing and strengthening farmers associations to take responsibilities over the management of their scheme, as well as promoting agricultural production through different actions. In this section we will further present the experience with farmer-management in Saint-Raphael.

5.2.2. - Brief presentation of the scheme: main descriptors, users, land tenure, cropping systems

In Saint-Raphael the annual average temperature is 25^{o}C with a minimum of 13.5 ^{o}C and a maximum of 39^{o}C. The average annual rainfall is 1171 mm while the potential evapotranspiration is 1650 mm. According to GAA (2005) the average monthly effective rainfall is less than half of the potential evapotranspiration for all months of the year. Irrigation is therefore indispensable to agricultural production in the region. Table 5.6 below presents the main descriptors of Saint-Raphael irrigation scheme.

Approximately 2500 users are using the irrigation system for their farming activities. Results on a sample of 6% of farmers reveal that 32.7 % are illiterate, 49.3 % have primary education, while 18 % have reached secondary school. Each farmer family has on average between 5 and 6 members, who in one way or another, depend on farming activities. Table 5.7 below presents the age structure of farmers according to the survey

sample. It shows that a high percentage, 40 % of farmers are between 35 and 50 years old, and most of the farmers more than 2/3 are below 50 years old.

Table 5.6: Main descriptors of Saint-Raphael irrigation scheme

Descriptors	Scheme description
Country	Haiti
Name of the scheme	Saint-Raphael
Climate	Tropical humid
Water availability (abundance, enough or scarcity)	Abundance in rainy season and shortage in dry season
Irrigable area	~ 1800 hectares
Total irrigated area	1161 hectares
Annually average irrigated area	790 hectares
Average annual rainfall	1171 mm
Effective annual rainfall	500 mm
Evapotranspiration	1650 mm
Water source (diversion from river, storage barrage, groundwater, combinaison of surface and groundwater)	Diversion weir on river Bouyaha
Type of irrigation system(gravitary or pumping water supply)	Gravitary
Types of infrastructures (open Channel or pipelines…)	Open channel
Type of distribution (on demand, predetermined schedule, anarchic distribution …)	Mixture of predetermined schedule at the level of the main canal and on demand at the level of hydraulic quarters
Irrigation method (predominance of furrow irrigation, basin, submersion….)	Mixture of furrow irrigation and basin depending on the crops
Main crops and their percentage (% total area)	Rotation rice and vegetable (see below for percentage)
Average farm size	0.72 hectare*
Management type (state management, farmer-managed, joint management…)	Self management by farmers
Total canal length	14.5 km of main canal and 25 km of concrete secondary canals
Total number of users	~2500 users

Source: author

*this figure does not take into account lands which are not irrigable

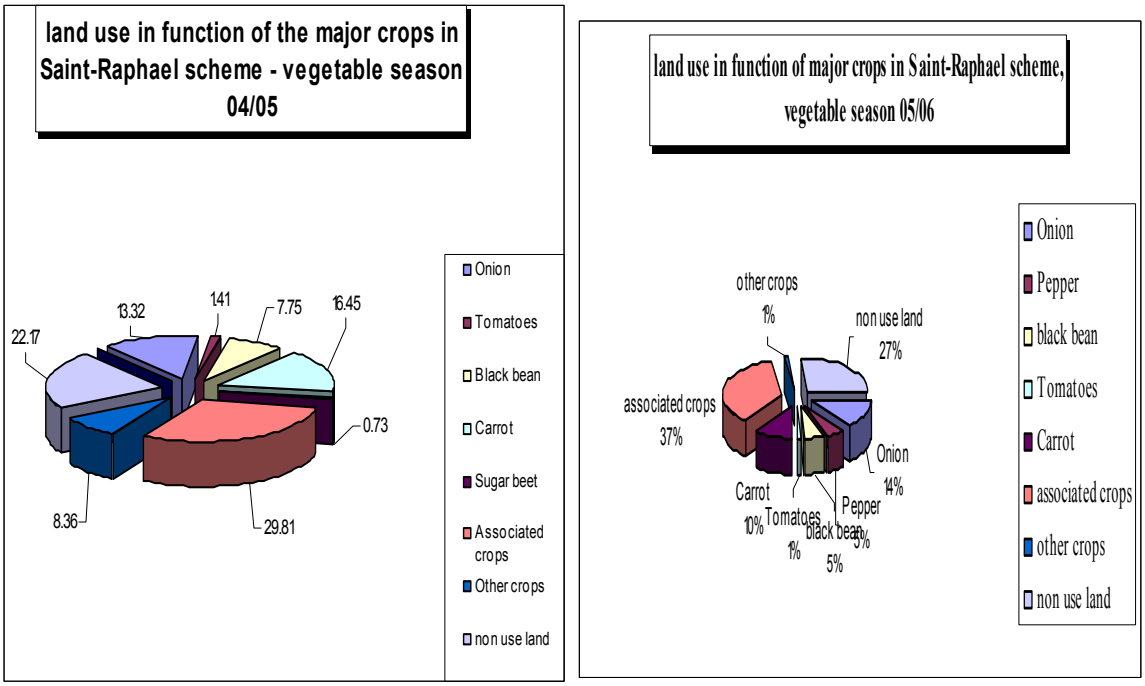
Table 5.7: age structure of farmers in Saint-Raphael irrigation scheme

Class of age	Number of farmers	Percentage
Less than 35	44	29.3
35<=age<50	60	40
50<=age<60	27	18
60 and plus	19	12.7
Total	150	100

Source: author survey

The survey has also shown that each farmer exploits on average 0.66 ha. Regarding land tenure the survey reveals that 73.5 % is landowner, while 26.4 % rents land and only 0.1 % is tenant. It is important to mention also that 95.3 % of the farmers in the sample were male and only 4.5 % female.

Concerning the cultivated crops, there are two agricultural seasons in Saint-Raphael: i) summer corresponding to the rainy season when most of land is cultivated with rice and ii) the vegetable season in winter (dry season) in which several crops are cultivated. Figures 8 and 9 below show the land occupation during two vegetable seasons 04/05 and 05/06. In both vegetable seasons associated crops[18] predominate (37% and 29.81 % of cultivated area respectively). Onion is the second most important crop (14% and 13.2 %), followed by carrot (10% and 16.45 %). Another interesting observation is that a significant part of land (27 and 22.17 %) is not cultivated during the vegetable seasons 04/05 and 05/06.



Source: GAA & CCISR, parcels inventory cropping seasons 04/05 and 05/06

Figure 8 & 9: land occupation during the vegetables seasons 2004/05 & 2005/06 in Saint-Raphael irrigation scheme

[18] form of mixed cropping

5.2.3. - Different actors interplaying in the IMT process and scheme management in Saint-Raphael

There are several actors that have contributed to establish and strengthen farmers association as well as to support somehow scheme management in Saint-Raphael. Among the most active are:

The *NGO German Agro Action*, that has executed four projects since 1995 (Hai 74, hti 1016, hti 1024, hti 1016 or 7PI) which aim to rehabilitate the infrastructure network, to establish the institutional settings and arrangements over the scheme management, to improve farmers knowledge and skills on agricultural techniques as well and processing of agricultural products. It is the main external actor that is responsible to implement the scheme rehabilitation and transfer program there.

The *Ministry of Agriculture (MARNDR)*, through its departmental and communal representative offices, has played the role of adviser, supervisor and also has collaborated with GAA and the users association in the implementation process. In this regard the departmental representative of the Ministry has signed the first and second term contracts of the methodology with the users association.

The *target users group or users association*: as defined (by law) on case to case basis each irrigation scheme must be managed by a unique users association. In the case of Saint-Raphael this is the duty of CCISR (Central Irrigation Committee in Saint-Raphael). Throughout the process of IMT that entity has been established and the structure of the committee will be presented in the next section.

Other local organizations: several other local farmers' organizations exist in the vicinity of the irrigation scheme. They somehow contribute to or influence the management of the system and its exploitation. The most influencing one is OD4SS (Organization for the Development of the 4th communal section Sanyago) that intervenes particularly in agricultural education and extension, agricultural inputs selling, rice husking, soil preparation; mainly for farmers downstream of the irrigation scheme. This organization undertakes actions for the development in its region but has at the same time great influence on the system management.

Furthermore *local collectivities*, the police, the municipality and the court are also interacting with users associations either to help in managing and resolving conflict or in defining long term strategy such as deciding on an important issue regarding the system. For example, when the association had to double the water fee, it firstly searched for the

agreement with other local associations such as the above entities before deciding and voting the decision in the general assembly within the WUA. Given the importance of the irrigation system for the region, a good relationship among different local entities (institutions, organizations, collectivities, even some personalities) is crucial because it enhances successful management of the system.

5.2.4. - Scheme operation, administration, and management.-

5.2.4.1. - Infrastructures

Water supply to the scheme is by means of a diversion weir from the River Bouyaha. The main canal (with a capacity of 2.4 cubic meters) crosses the town of Saint-Raphael by a 200 meters siphon and conveys water for 14.5 kilometers. Along that primary canal 19 secondary canals (currently named doors) divert water from the main canal and supply it to tertiary and quaternary networks. Water is diverted by means of simple mechanical hydraulic gates, which farmers can easily operate without any special skills. Each secondary canal is divided into three sectors that correspond in fact to hydraulic quarters. Therefore there are 57 hydraulic quarters or sectors. The primary canal is in concrete as well as around 25 km of the secondary canals, the remaining part of the secondary network, the tertiary and quaternary networks are earth made canals. The system contains a drainage network. The main problem related to infrastructure are the high water losses in the lower level canals, the lack of distribution facilities such as repartition gates that could facilitate and control water distribution as well as secure water delivery to farmers.

5.2.4.2. - Organizational structure managing the scheme

The organizational structure of CCISR is based on the hydraulic division presented above. As by-law every user of a given irrigation system is systematically member of the WUA, all users of a sector or hydraulic quarter are jointed in a user group, which is represented by a three members committee. In total there are then 9 committee members for each secondary canal. They join together with the users to elect a representative for the secondary canal. The 19 representatives of the 19 secondary canals are assembled to form the CCISR, there they share responsibilities by grouping

into different commissions (three in total: administration, technique and discipline) and elect an executive committee (which has seven members) that is responsible for daily activities of the association. The highest entity remains the general assembly that is open to all users. However rules establish the minimum number of members necessary to hold a general assemble. The organizational structure is presented in annex IV. Such an organizational structure must encourage the participation of all users in the process of decision making provided that it functions. In fact, discussions with farmers reveal that apart from the assembly of representative with its weekly meeting, there is no clear evidence that the other committees are functioning. There is a huge lack of communication means and procedures between the CCISR and the users or even doors committees. The fact that the association has the same name as the assembly of representatives already is a paradox.

Furthermore, dividing each secondary canal in an equal number of hydraulic quarters regardless to their irrigated area and the number of users is too easy an option. For example each of secondary canals 3 and 4 has less than 10 hectares of irrigable lands while secondary 16, 15, and 13 have respectively 156, 126, and 105 hectares of irrigable lands. It is not fair that those six canals are identically represented in the organizational structure and has the same number of hydraulic quarters. Therefore the term of hydraulic quarter does not have a proper meaning in that case. Of course there may be historical or social realities behind but the hydraulic division, basis for the organizational structure, is a matter of water distribution effectiveness and also a means to allow all users or groups of users to proportionally be represented in the organizational structure, and thus in the decision making processes. In the last chapter suggestions are made to improve water distribution, Central committee recognition, and farmers' representativeness through a more comprehensive hydraulic division.

5.2.5. - Organization of water distribution

The CCISR has an irrigation service, compound of seven employees: 5 gatekeepers/syndics, one barrage guard, and one general supervisor; the service also has a brigade of 19 voluntary water policemen. That service is responsible to operate the system, insure water distribution and solve disputes on the scheme. To insure water distribution along the main canal the 19 secondary canals are grouped in five sectors

(sector I: secondary canals 1 to 6; sector II 7 & 9; sector III 10 to 10 B, sector IV 11 to 13; and sector IV secondary 14 to 17). Each gatekeeper is responsible for one sector to insure water distribution and collect water fees from users. The supervisor monitors and supervises the overall distribution for the entire system, adapts the irrigation scheduling according to the available water at the entrance of the main canal. Table 5.8 below indicates the irrigation scheduling in Saint-Raphael. According to the availability of water, three different schedules are applied for planning water distribution.

In the secondary canal water supply is on demand. Water is shared among users by rules of mutual understanding. In principle, with the established schedule a field has to receive water once a week. Furthermore, within a sector, the gatekeeper judges, according to the volume of water available, if it is necessary to establish a sub schedule between the different secondary canals of the sector. To be successful that flexible water distribution programming, found on mutual understanding, requires the help and involvement of hydraulic quarters committees, the users comprehension, as well as supervision, honesty, and seriousness of the gatekeeper, who is the main responsible for water distribution. However, that distribution system seems to function well, since the main problems evoked by users during the field survey are: lack of appropriate infrastructure to control and properly distribute water within the secondary and tertiary canals; and in some secondary canals hydraulic quarters committees do not involve as expected in the water distribution; usually water does not reach the downstream at the planned and expected day and time.

The field survey has revealed that the users in Saint-Raphael through the CCISR, with the technical and financial assistance of GAA, have been able to design norms and rules that govern the organization of water distribution in their scheme. Improvements are still needed especially in terms of infrastructure and equity between upstream and downstream distribution. But, users have recognized and confirmed that the actual distribution is much fairer, reliable, equitable, and organized that it was before the transfer process had started.

5.2.6. – Water rights – rules-in-use

As mentioned above, there is a lack of a general framework of water rights in Haiti. Furthermore, in Saint-Raphael there exists no irrigation scheduling at the level of

hydraulic quarters; neither a water distribution in function of the water flow or volume. Therefore, the concept of water right in real term is almost irrelevant to the scheme. In other words the water rights are neither specified, nor transferable, nor enforceable. However, the principles in use give an equal use right to each farmer proportionally to the area of its farm. CCIRS, as the managing board, has the 'de facto' the property right to allocate all water use rights to farmers. While the ownership right of the water resource as well as irrigation infrastructures including other equipments used by CCISR, remain state property.

Therefore, each year the CCISR distributes water use rights to farmers against the payment of a water fee related to the cultivated area and a tacit agreement to participate in maintenance works of the canal network. A given use right is valid for one year and can be used by the farmer only for the particular field for which it is delivered. The use right will be renewed when the farmer registers for a new cropping year by paying the requested water fee. These rules in-use can be assimilated as an advantage that can be used to further develop more formal water rights even establish a system of water market. In contradiction in most other irrigation systems in Haiti, farmers have an historical water use right specifying the fixed time schedule to irrigate their fields. In such systems it must be more difficult to recover irrigation fees or establish a potential water market system, because users already have the property rights, which can not be withdrawn from them. Managers must in fact motivate them to pay for the right they already have. In Saint-Raphael however, farmers do not have permanent water use rights. This fact must have positively affected the feasibility of the recent water charge adjustment. By the fact that farmers do not have permanent water use right, they may be more willing to negotiate and adjust water fees in order to get the water that is indispensable for their agricultural production. Therefore, further studies targeting the effect of property rights (water use rights) on farmers' behavior, especially willingness to pay irrigation fee should be a useful topic prior the establishment of a property rights system to sustain the ongoing IMT process.

In conclusion, although water use rights are not well specified, nor transferable, or enforceable at the Saint-Raphael irrigation scheme, rules in use establish an interesting basis towards the establishment of a workable water right system in the scheme. CCISR should be aware that it has an important asset constituting all water use rights as

manager of the scheme. Efforts are needed to further study that aspect, to better organize water distribution and improve water fee recovery in the system.

5.2.7. - Maintenance of irrigation infrastructure

One of the core responsibilities assigned to WUA in the IMT process is to organize and bear the relevant costs for maintaining irrigation infrastructures and equipments transferred to them. In Saint-Raphael the identification, planning, execution organization, and monitoring of activities relating to system maintenance are the duties of the technical commission within the delegated assembly. Twice a year the members of that commission carry out activities to clean the 14.5 km of main canals. There does not exist a predetermined maintenance program, it depends on the state of the canals and the trend of water fee recovery, since CCISR pays users to clean the primary canal. Users think that the ideal would be to clean that primary channel four times a year, but the CCISR does not have enough means to afford the related costs. For the secondary canals, it is the responsibilities of the hydraulic quarter's committees to organize it. It is a voluntary work; but most committees and gatekeepers register the list of participants since that participation is also a prerequisite for the farmer to receive water. Farmers who can not participate because of their high opportunity costs pay workers to replace them for the duration of the activities. Farmers individually are responsible to clean tertiary and quaternary canals. However, there are some rules in use to regulate farmers' behavior in doing it. During the vegetables season, each farmer is in charge to clean tertiary and quaternary canals surroundings his plots. Otherwise, the CCISR is not liable for any eventual inundation of the field due to poor canal condition when water is conveyed to be supplied to neighbors. While in rice season, each farmer is responsible to clean the tertiary and quaternary canals that convey water to his field in order to prevent waste of time and water in the distribution. Given the conditions of poor infrastructure such informal and non written rules are crucial to operate and maintain the schemes.

Therefore, we may conclude that the coercing rules in use, when the system was managed by the state agency through one syndic for the entire system, were obviously less efficient and effective to insure the scheme maintenance. Farmers have reported that, at that time, on a daily basis, people were arrested for not participating in

maintenance. Of course after 1986 such practices were no longer possible. Farmers self designed rules and norms, based on mutual understanding and agreement, as well as their self interest. As a consequence the scheme is run much better than with the authoritarian rules of state agency. Formal and informal rules are jointed together to run the system even though the everlasting free rider problem that characterizes every common pool resource is still there.

5.2.8. - Conflicts management and disputes resolution

The CCISR has somehow designed rules that regulate the functioning of the scheme as well as farmers' behavior vis-à-vis water distribution and infrastructures maintenance. The most usual registered conflicts are between the CCISR and the users. They occur when farmers do not pay water fee while they use water flowing in the canal to irrigate their fields. In principle once a farmer cultivates his irrigated land he is systematically indebted to CCISR for the given water fee. When he does not pay, a system of gradual sanctions is applied against him. First he receives a recall letter remembering him to pay the fee; then water is not supplied to his plot; if persisting then he will be arrested. When the latter happens it is more costly for the farmer who is obliged to pay, in addition to the water fees, the relevant transactions costs to solving the conflict through court. Sometimes, it may happen that a farmer breaks the padlock of the hydraulic gate to take water for which he does not have right. When this occurs the farmer is liable to repair the damage and pay a sanction fee. To prevent potential sabotage actions the irrigation service within the CCISR has a voluntary water police brigade (having 19 members who are trained and equipped to voluntarily work to prevent sabotage actions and disputes).

5.2.9. - Water charge – costs recovery – financial management in Saint-Raphael irrigation scheme

The idea to recover the operation and management costs of Saint-Raphael irrigation scheme from farmers dated since the systems' construction in 1951. Literature has reported that a water charge of 27 – 15 HTG (5.4 to 3 $US at that time) was established since that period. But since 1960 farmers did not pay that fee anymore; other actors such as ODN (organism for the development in the North that was a state agency) have tried in 1980s to reestablish water fees after intervening in the system; but each trial

failed after the organism had left. In its intervention GAA, in partnership with the departmental office of MARNDR, has introduced a water charge system since 1998 as principal source of financial means to enable the WUA to cover operation and maintenance costs of the system. In the beginning the water charge was fixed at 200 HTG/tile/seasonal crops, later on it was adjusted to 400 HTG/tile/seasonal crops. In the established system, according to the policy transfer, water charge is fixed by the WUA and should reflect the operation and management costs. The WUA is also responsible to collect and manage the recovered water fee. Table 5.8 below presents the evolution through time of the collected water fees in function of the annual cultivated area.

Table 5.8: Evolution of cultivated area and collected irrigation water fees in Saint-Raphael from 1998 to 2006

Years	**98/99**	**99/00**	**00/01**	**01/02**	**02/03**	**03/04**	**04/05**	**05/06**	**Average**
Total Irrigated area in ha	1161	1161	1161	1161	1161	1161	1161	1161	**1161**
Annual cultivated area in ha	732.72	853.33	783.67	1037.8	775.03	632.1	712.37		**789.57**
Percentage in %	63.1	73.5	67.5	89.4	66.8	54.4	61.4		**68.00**
Amount of collected fee in HTG	25,600	53,600	54,500	52,300	106,935	112,000	160,636	132,389	**87,245**
Collection rate in %	45	41	45	33	44	57	71	67	**50.375**

Source: author accordingly to data collected from GAA and CCISR

The table shows that on average 68 % of the actual total irrigated area is annually cultivated. The main reasons evoked by farmers to explain the difference between irrigated area and cultivated area are: lack of fund since the production costs are quite high; water shortage was evoked mainly by farmers at the tail end of the scheme; and aging landowners. Twice a year CCISR realizes an inventory of the cultivated lands in order to project its expected revenues from water collection fees since farmers pay for the water they use. Data shows also that over the period the fee collection rate is on average 50 % of the projected collection amount. While the yearly collection rates lies

between 33 % in 01/02 and 71 % in 04/05. therefore, around 1/3 of the actual irrigable area is not cultivated annually, thus farmers do not pay for it; from the remaining 2/3 that are cultivated on average less than half pays the water fee over the period, which generates annually a revenue equals to 87,245 HTG on average to CCISR. In fact, based on those data for the last eight years of management, the CCISR annually receives 75 HTG per hectare of total irrigated land while the actual water charge is fixed at 800 HTG / tile/year. Such figures may be useful to motivate farmers who are already aware of the importance and usefulness of the irrigation system that sustains their economic activities.

Nevertheless, out of the 150 farmers we have interviewed on their willingness to pay irrigation water charge, only 11 or 7.3 % of them have answered that the actual irrigation fee is too high. Those farmers precise they are willing to pay between 400 and 500 HTG per tile per year. 133 farmers or 88.7 % have confirmed that the actual level of water charge is acceptable when taking into account the importance of the system for them, the actual management costs, and the value added of water irrigation to their lands. For similar reasons, 4 % of farmers have objected that the actual level of water charge is even too low; it can be higher without giving their maximum willingness to pay. The gap between words and actions, the dilemma of free rider problem, the lack of infrastructures that could enable to better control and regulate water distribution, the traditions and beliefs that water is a free gift given by God, the absence of proper legislation on water and pricing system, and the inexistence of a clearly defined and applicable water rights system, are some potential explanatory factors for such a difference between the willingness to pay expressed by farmers and the actual recovery rate of irrigation water fees.

Besides the irrigation water fee recovery, the CCISR has received direct subsidies from GAA and the departmental office of the Ministry of Agriculture as complementary revenues to cover its expenditures during those first eight years of functioning. Table 5.9 below present annual expenditures, local funds, and subsidies received by CCISR for the last eight years.

Table 5.9: Evolution of annual expenditures, local funds, and direct subsidies received by CCISR from 1998 to 2006

years	**98/99**	**99/00**	**00/01**	**01/02**	**02/03**	**04/05**	**05/06**	**Average**
Annual exp.	156,960	156,960	163,521	115,855	134,753	192,353	167,412	**155,402**
Annual collected fees in HTG	25,600*	53,600	54,500	54,220	109,775	160,636	132,389	**84,389**
Other local funds in HTG	0	0	20,055	1,014	7,102	18,824	4,000	**7,285**
Total annual self funds in HTG	25,600	53,600	74,555	55,234	116,877	179,460	136,389	**91,674**
Percentage of self funding**	16.3*	34.1	45.6	47.7	86.7	93.3	81.5	**59**
Annual direct subsidies in HTG	131,360	103,360	85,846	69,220	21,013	29,150	40,724	**68,668**
Percentage of direct subsidies**	83.7*	65.9	52.5	59.7	15.6	15.2	24.3	**44.2**

Source: author accordingly to data collected from GAA and CCISR

*there was only one agricultural season (vegetable), the rice season could not take place because of the rehabilitation works in the canal network.

**as percentages of annual total expenditures

Such direct subsidies were indispensable during the period corresponding to the establishment of the water fee system. The above table shows that direct subsidies are regressive through time; they vary from 83.7 % of the annual total expenditures of CCISR in the first year to 24.3 % in 2005/06 with a peak minimum of 15.2 % in 2004/05. On average during the establishment period, the direct subsidies represented 44.2 % of the annual expenditures for the CCISR, while local funds represented on average 59 % of such expenditures during the same period. The difference between the two figures can be considered as savings. Self funding has followed more or less the expected progressive trend since its percentage varies from 16.3 % in the first management year to 81.5 % in 2005/06 with a peak maximum of 93.3 % of annual expenditures in 2004/05.

Data shows also that 2004/05 was the best year for CCISR. It is interesting for the CCISR and its partners GAA and MARNDR to further study the explaining factors in order to strengthen the management skills and capability of CCISR. In addition to those direct subsidies, other expenditures such as repairing and constructing hydraulic gates, buying equipments for CCISR office and its irrigation service staff (bicycles, boots…) have been directly covered by GAA. In 2004/05 such expenditures totaled 237,454 HTG, which are much higher than the annual expenditures of CCISR. But those expenditures can be accounted to the establishment and placement of the CCISR rather than being considered as operation and management costs.

In addition to water charge recovery, the CCISR owns and runs other activities that are likely to generate extra revenues. The most important ones are: the rice husking machine; a maize mill; a shop selling agricultural inputs such as seeds, pesticides, and fertilizers; a warehouse to store agricultural products, especially grains. The input shop has generated a net profit of 32,746.75 HTG and 39,000.00 HTG, respectively for fiscal exercise 2004/05 and for the first half of the exercise 2005/06. The warehouse has generated a profit of 18,874.00 HTG during the fiscal year 2004/05. In annex 6.2 it is presented the cash flow of those activities for the given dates. Such activities are useful not only as means to generate revenues but especially to offer a variety of services to farmers while facilitating the exploitation of the irrigation scheme. Thus they are accounted to give them more incentives to pay water charge and to participate in the association activities.

Nevertheless, the budget of the CCISR for operating and managing the irrigation system is based exclusively on water charge recovery. Table 5.10 below presents how the annual expenditures of CCISR have been sharing out among the different budgetary headings.

We will further analyze the data presented in that table in the next section, which will treat the management performance of the concerned farmer-managed irrigation schemes. However, the table shows that wages represent the most important part of the annual expenditures with on average two third of the average annual expenditures, followed by maintenance works with 16.8 % and functioning costs with 13.5 % on average of the annual expenditures. Especially in 2001/2002 wages represented 90 % of

the annual expenditures. Meanwhile, according to established administrative rules wages has to be not higher than be 48 % of the annual collected fees (8 % for the water distribution supervisor, 35 % for the five gatekeepers and 5 % for the barrage guard). Only the accountant has a fixed salary. The remaining seven employees hired by the CCISR must be remunerated according to the collected water fees. The CCISR adopts that waging system not only as a means to give incentives to its employees, especially the syndics who are responsible to collect the water fee from farmers, but also and specifically to keep its expenditures in the limit of its financial resources.

Table 5.10: Repartition of the annual expenditures (in HTG) of CCISR among the different budgetary headings from 2001 to 2006

Periods	**00/01**	**01/02**	**02/03**	**04/05**	**05/06**	**Average**
Total expenditures	163,521	115,855	134,753	192,353	167,412	**155,402**
Wages (% of total expend.)	129,200 (79%)	104,240 (90%)	89,011 (66.1%)	109,0953 (56.6)	84,626 (50.5%)	**103,226 (66.4%)**
Functioning (% of total expend.)	13,058 (8%)	8,095 (7%)	13,,701 (10.2%)	14,337 (7.5%)	55,532 (33.2%)	**20,945 (13.5%)**
Maintenance of infrastructures (% of total expend.)	5,560 (3.4%)	3,165 (2.7%)	31,339 (23.3%)	68,963 (35.9%)	21,704 (13%)	**26,146 (16.8%)**
Other expenditures (% of total expend.)	15,703 (9.6%)	375 (0.3%)	702 (0.5%)	0 (0%)	5,550 (3.3%)	**4,466 (2.9%)**

Source: author survey, accordingly to collected data from CCISR and GAA

In conclusion, for the first eight years of functioning the CCISR with the assistance of its partners has worked to establish the basis on which further efforts must be done to reach the sustainable financially self-sufficient farmer-managed scheme. The estimated budget of CCISR in 2006 totals roughly 700,000.00 HTG, which represent almost six times the amount of collected fees in 2005/06. in taken into account the annually average irrigated area for the last seven years that is 789.57 ha; with the actual water fee level, 800.00 HTG /tile/year; 100 % collection rate will give 489,656.00 HTG that

represent 70 % of the estimated operation and management costs. Thus, realistic scenarios must be elaborated in with CCISR as well as its partners, especially MARNDR, should engage in order to reach financial self sufficiency.

5.3. - Concluding remarks on schemes management and design principles fulfillment

All three schemes are characterized by smallholders having on average less than one hectare. They also have similar organizational structures. The ongoing process has shown its potential positive effects on schemes management. The state of infrastructures has significantly improved, in the sense that there are now better and much more irrigation facilities than in the era of government management. There exist organized bodies: CCISR, CCIGG or CCID, respectively for Saint-Raphael, Grison Garde, and Dubre, which are in charge of administrating, maintaining, operating, and managing the schemes. Users can participate in the decision making process of these organizations. With the financial and technical support of GAA those WUAs assume the management of their schemes including: infrastructures maintenance, water distribution, conflicts resolution, collection and management of irrigation fees, as well as management of the association itself. In addition they act at offering in the limit of their budget some upstream and downstream services to agricultural production such as selling inputs (seeds, pesticides, fertilizers...) and agricultural products processing and conditioning for storage. With the implementation of rehabilitation and transfer projects the irrigated areas have increased (from 220 to 320 ha in Grison-Garde), and both agricultural productivity and production has improved for the three schemes. According to GAA (2006) average yields have increased, especially in Grison-Garde, from 4.2 to 6.5 t/ha and from 0.6 to 1.4 t/ha on average, respectively for paddy rice and black beans. Moreover, other more profitable crops such as cabbage, carrot, onions and peppers have been introduced in Grison-Grade and Dubre. In Saint-Raphael the scheme exploitation has improved significantly, especially during vegetables season.

However, efforts are still needed to improve water distribution (more infrastructure at the levels of secondary and tertiary networks as well as irrigation scheduling), to intensify agricultural production. The most important problem, evoked it at each meeting or interview their first problem remains the non availability of a credit system that could

support agricultural production; then followed by the problematic of inputs availability and affordability. Then come problems of trading of their agricultural products and irrigation water.

This chapter is ended by some conclusions regarding the degree of fulfillment of Ostrom's eight principles for long-term enduring of institutions managing the schemes under study:

Design principle 1: Clearly defined boundaries. Both WUAs in Grison Garde and Dubre hold exhaustible records of all farmlands, which are irrigated. They have parcel plans in which relevant information for each field is registered. While in Saint-Raphael the WUA, with the assistance and support of GAA, realizes on seasonal cropping basis an inventory of cultivated lands. Thus, with regard to water users we may argue that boundaries are, at a certain level, clearly defined. However, with regard to the resource itself, boundaries are ill-defined for all three schemes since managers are not able to accurately measure and predict the quantity of water that will be available in the irrigation canals per period.

Design principle 2: Proportional equivalence between benefits and costs. As mentioned above, WUAs are unable to quantify the water they supply to farmers. However, according to rules-in-use users should pay irrigation fees proportionally to the area of irrigated land in addition to their participation in maintenance work. Currently such fees are intended to cover operation, maintenance, and administration costs of the systems. As seen above, collected fees are not able to cover such costs while construction costs of systems are subsidized. Even though we can not quantify the real benefits nor the total costs for farmers in the provision of irrigation water, the study reveals, based on cost-recovery for providing water to them, that farmers do not bear the full costs for benefiting from irrigation. Furthermore, the problem of free-riding (roughly 50% of them does not pay the established water fee) contributes to worsen the disequilibrium between benefits and costs for appropriating the water resource.

Design principle 3: Collective choice action. As explain above, at lower canals level (secondary and tertiary) water distribution as well as maintenance work is carried out by user groups of hydraulic quarters. Informal and non-written rules are combined with

formal ones to better control opportunistic behaviors. Primary canals are operated and maintained by users' elected representatives with the help of their employees. Formal operating rules are elaborated by or with the farmers' participation; and they sanction them in General Assembly. Managers are thus either farmers themselves or people who are accountable for them such as their representatives and the persons they hire. Therefore this third design principle is fulfilled for the studied schemes.

Design principle 4: Monitoring. At a certain level users monitor each other's behavior, especially in water distribution and rules enforcement. The monitoring of the overall scheme management is done by the Central Committee of each WUA. The field survey reveals a general conscientiousness from users to control and maintain irrigation canals on which their economic activities are based. They recognize and argue that their endogenous and self-enforcing institutional rules are far more effective than the exogenous imposed ones, existing before. However, weaknesses lie firstly in the lack or even absence of mutual trust among users, the existence of which is crucial for overcoming the free-rider problem; and secondly the overall monitoring of WUAs activities by government agency is lacking, especially in Grison and Dubre. Furthermore, none of the three WUA does have a control committee as required by their functioning rules.

Design principle 5: *Graduated sanctions*. Although the existence of rules-in-use and self-imposed constraints to control opportunistic behaviors, rules violations can easily be observed in all three schemes. A core explanation as stated by Ostrom (1998) (as quoted in Sarker and Itoh, 2001) lies in the links between the trust individuals have in each other, the investment others make in trustworthy reputations, and the probability that the irrigators will use reciprocity norms. As this reciprocal trust is rather an exception in the studied schemes, violations of the established rules are common cases. Therefore, explicit graduate sanctions are elaborated. For instance, in Saint-Raphael nonpayer of irrigation fees is subjected to gradual sanctions from sending recall letter to him to being arrested and detention. Systems of gradual sanctions exist for all three schemes, but the problem remains their enforcement, which is often difficult and costly.

Design principle 6: Conflicts resolution. All three schemes lack explicit internal conflict resolution mechanisms. Consequently for some minor conflicts users refer to court. For

instance in Saint-Raphael, during this data collection, a farmer went to court with the WUA because his onion field was flooded due to the misbehavior of another farmer. Such disputes might have been solved through internal mechanisms inside the WUA if appropriate institutional rules, settings, and enforcement mechanisms would have been established.

Design principle 7: *Minimal recognition of rights to organize*. One of the major implications of the new vision over scheme management in Haiti is the efforts to give rights and empower local communities and their organizations to take responsibilities over the management of irrigation infrastructure they use collectively. Farmers in the given schemes are free, if not obliged, to organize among themselves to participate in projects implementation and further insure the management of facilities they benefit from. Nevertheless, such rights to organize, in order to participate in the provision of public goods is quite recent, dating in Haiti from only 1987. And still now appropriate legislation is not yet fully settled to secure those rights. In the studied schemes such rights 'de facto' exist and water users are encouraged, helped, and supported to undertake all kinds of actions, which can enable them to strengthen their organizations to better carry out their tasks.

Design principle 8: nested enterprises. At the level of irrigation schemes there exist different stages of organizations from user groups to WUAs, which are responsible for the entire irrigation scheme. But, as water diverted from rivers is part of the available water resource (at the level of watershed), there is not yet any kind of institutional arrangements beyond the irrigation schemes to tackle issues relating to resource allocation and development.

CHAPTER VI

FINDINGS AND DISCUSSIONS FROM FIELD STUDY ON SCHEMES MANAGEMENT PERFORMANCE

This chapter is devoted to present and analyze the results on the selected performance criteria (as defined in the methodology). They are calculated as much as possible for each irrigation scheme. Analyses are based on comparison among those schemes as well as between them and other schemes having similar conditions. Three main criteria are used: financial efficiency, maintenance, and sustainability. For each criterion some indicators are calculated. In addition to those criteria, equity, timeliness and reliability in water distribution are assessed through farmers' opinions.

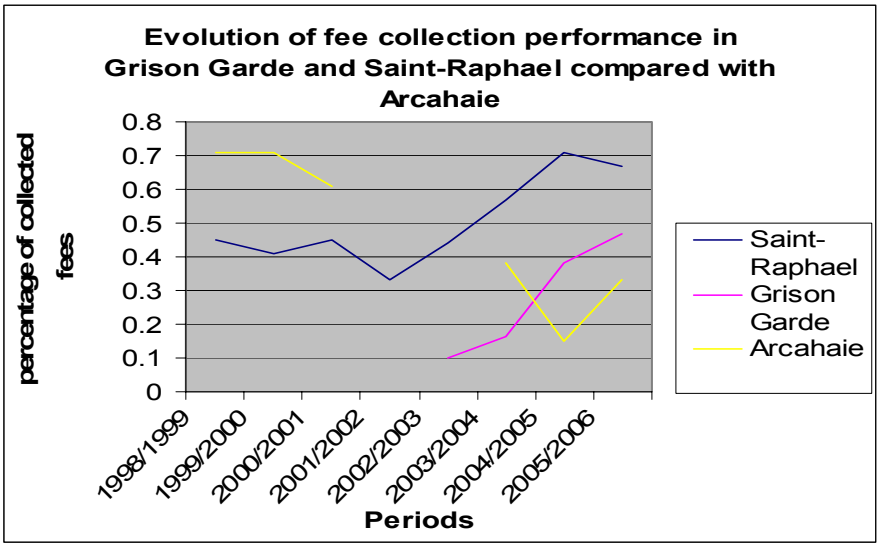
6.1. - Financial efficiency

Four indicators are used to measure the financial efficiency of scheme management. Those are calculated not only for the concerned three schemes, but also for other schemes in order to compare the schemes performance with others.

6.1.1. - Fee collection performance, FCP

Figure 10 below presents the fee collection performance of Saint-Raphael and Grison-Garde, compared with Arcahaie. The latter is a surface irrigation scheme of 6000 hectares in Haiti, which is managed by a federation of water users association. Saint-Raphael has on average a higher and a more consistent fee collection performance over the studied period. Grison-Garde has a relatively poor collection performance, less than 0.5 throughout the self-management period. Regarding Dubre the value of this indicator is too low to be relevant. Figure 10 highlights the difficulties that face WUAs to collect irrigation water fees, which are essential and indispensable for successful community-based management of the irrigation schemes. However, such figures are ranked among the best ones for surface irrigation systems in Haiti. Table 6.1 below presents the fee collection performance of five other irrigation schemes in Haiti according to work of Herard (2005) and Mac-Aleese and Harrivel (2003). The data shows that in addition to lower water charges, apart from Ti Carenage which is a pumping irrigation system, only

Croix-Fer scheme achieves a FCP of 0.6. The other schemes realize a FCP varying from less than 0.2 to negligible values.



Source: Author survey

Figure 10: Evolution of fee collection performance in Grison Garde and Saint-Raphael compared with Arcahaie irrigation schemes from 1998 to 2006

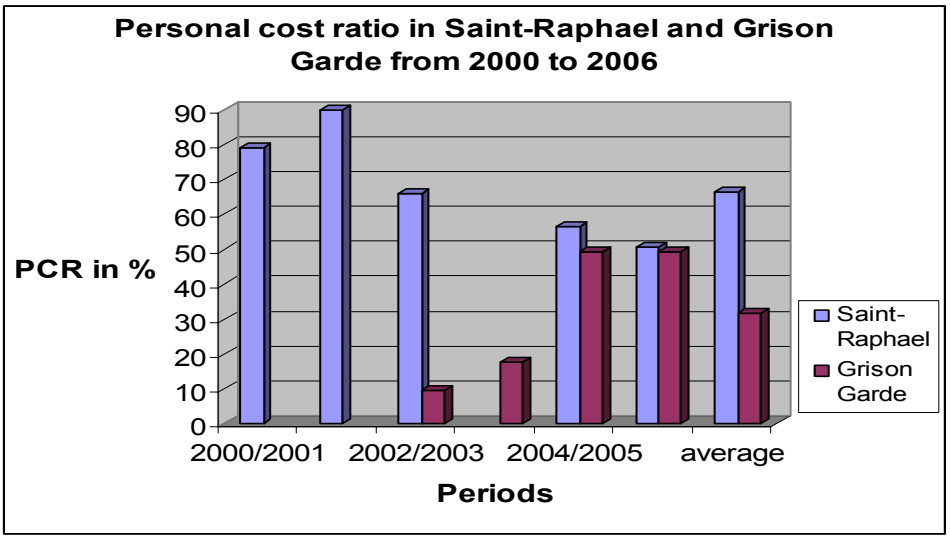
Table 6.1: Fees collection performance in five irrigation schemes in Haiti

Schemes	Ti Carenage	Bayonnais	Jean David	Croix-Fer	Fauché
Schemes characteristics	Pumping system	Surface system -	500 ha surface irrigation	Surface system	200 ha surface irrigation
Amount of irrigation water fees	265 HTG per hour	100 HTG per tile per year	542 HTG per tile per year	500 HTG per ha per year	387 HTG per ha per year
FCP	0.95	Lower than 0.05	Negligible	Around 0.6 + significant voluntary local contributions	Lower than 0.2 + significant voluntary local contributions

Source: according to work of Herard (2005) and Mac-Aleese and Harrivel (2003)

6.1.2. - Personal cost ratio, PCR

Figure 11 below presents the personal cost ratio in Saint-Raphael and Grison-Garde from 2000 to 2006 depending on the available data in each scheme. Data show that on average the personal cost ratio is equal to 66% in Saint-Raphael throughout the period. In Grison-Garde, due to very low collection fees, at the beginning the PCR was small, but from 2004 to 2006 when collection fees had improved the PCR went up also to reach 49% during the fiscal year 2005/2006. In Dubre such a figure is not really relevant. For instance, due to non-significant fees collection rate the PCR equals only 4.3% on average from 2003 to 2005. The PCR in Arcahaie was equal to 25% and 32%, in 2004/2005 and 2005/2006 respectively. In Buenabite, which is another 125 hectares surface irrigation scheme located in the vicinity of Saint-Raphael, the value of PCR was 86% in 2005/2006, while the fee collection rate was 37% in the same period. But that scheme did not receive subsidies for that fiscal year. The conclusion in the studied schemes is that wages constitute the most important expenditures and that they are paid mainly from the collected fees. When collection fees are low and the schemes receive subsidies, the PCR tends to be small, because in principle the WUA is not allowed to pay wages with the received subsidies.



Source: author survey

Figure 11: Personnel cost ratio in Saint-Raphael and Grison-Garde from 2000 to 2006

6.1.3. - Manpower numbers ratio, MNR

Table 6.2 below presents the Manpower numbers ratio for the three studied schemes in comparison with other schemes in Haiti. Data shows that Saint-Raphael has the lowest MPR among the three studied schemes, Dubre has the highest value. The comparison with the other two schemes confirmed that for the concerned schemes the smallest the scheme is, the lower the MPR value is. Dube is using one equivalent full time staff over 41 hectares of irrigated land while in Saint-Raphael the WUA uses one equivalent full-time staff over 228 hectares.

Table 6.2: Manpower numbers ratio in Saint-Raphael, Grison Garde, and Dubre compared with other schemes

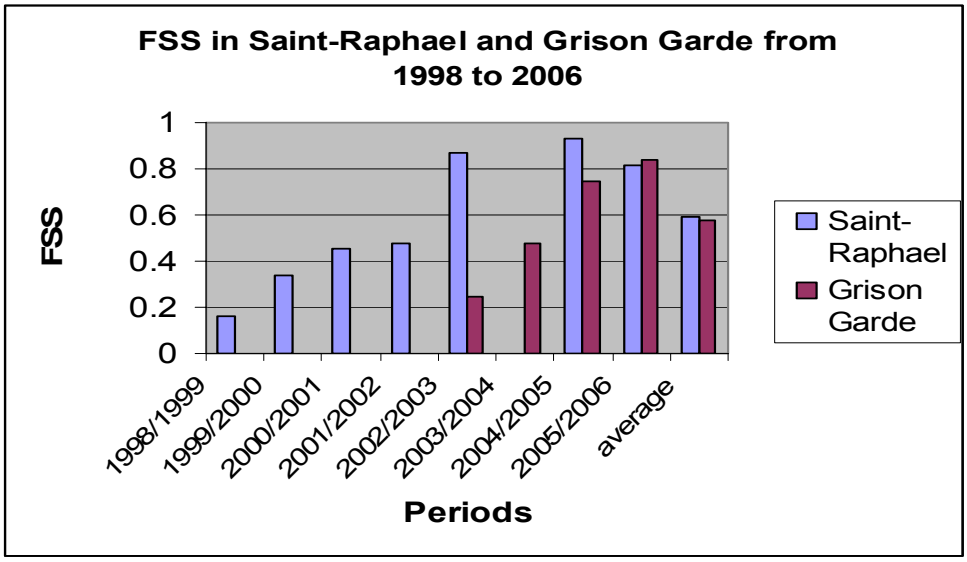
Schemes	Irrigated Area in ha	Number of staff in equivalent-full time	**MNR in equivalent full time employee/ha**	Reverse in ha per equivalent full time staff
Saint-Raphael	1161	8	**0.00689**	145
Grison Garde	320	3	**0.00937**	107
Dubre	82	2	**0.02439**	41
Arcahaie	4800	21	**0.00437**	228.6
Buenabite	125	2	**0.016**	62.5

Source: Author survey

6.1.4. – Cost recovery ratio or financial self-sufficiency, FSS

As mentioned above, the financial independency is irrelevant for Dubre in its current situation. Figure 12 below shows the evolution of the FSS for Saint-Raphael and Grison-Garde. On average the financial self-sufficiency equals 0.6 for both schemes over their self-management periods. Ideally, the value of FSS should be at least equal to 1.0; in 2004/2005 CCISR had reached 0.9. For instance, in Arcahaie this ratio equals 3.7, 0.88, and 1.5 in 97/98, 99/00, and 04/05 respectively. The first value was due to the low maintenance expenditures in the beginning, because of the good condition of irrigation network. Furthermore, in the schemes concerned by this study as subsidies are mainly given by a NGO in projects framework, it is indispensable to develop appropriate

strategies aiming at improving FSS, if self-management has to be sustainable after such projects.



Source: author survey

Figure 12: Financial self sufficiency in Saint-Raphael and Grison Garde from 1998 to 2006

6.2. – Maintenance

Two indicators are used to assess schemes performance regarding maintenance of irrigation infrastructure. Closely related, the poor structure ratio (PSR) and the structure condition index (SCI) are presented in table 6.3 below. Data shows that the structure condition index in Dubre is higher with 0.9 then in in Grison Garde, with 0.86. On average in April 2007 90% and 71% of hydraulic infrastructure worked properly in Dubre and Saint-Raphael, respectively.

Table 6.3: Poor structure ratio and structure condition index in Dubre, Grison Garde, and Saint-Raphael in April 2007

Schemes	**N_T**	**N_{PC}**	**PSR**	**N_{WP}**	**SCI**
Dubre	41	4	**0.1**	37	**0.9**
Grison Garde	169	23	**0.14**	146	**0.86**
Saint-Raphael	684	196	**0.286**	488	**0.71**

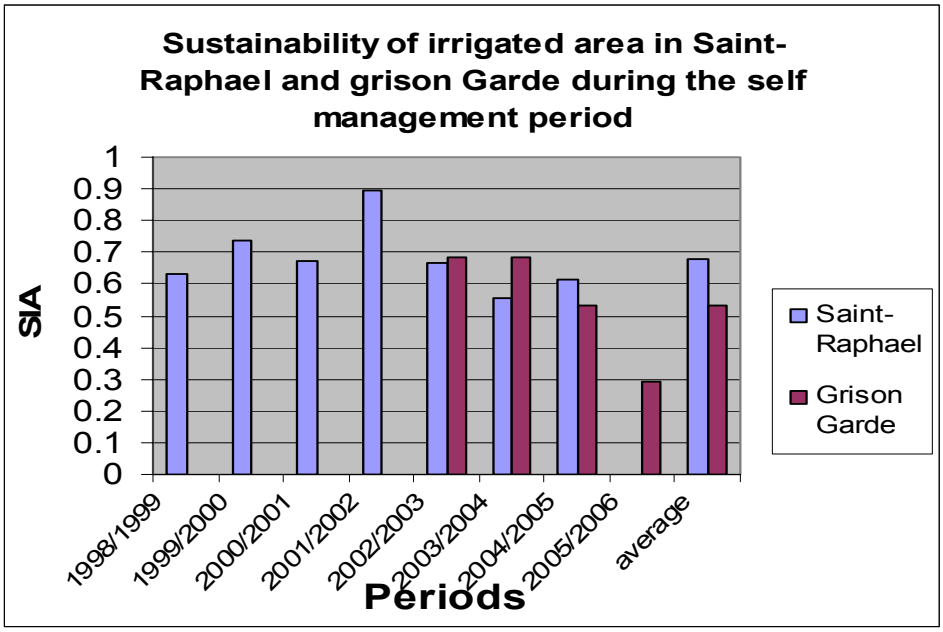
Source: author survey

In the table above N_T: total number of structures, N_{PC}: number of structures in poor condition; N_{WP}: number of structures working properly

6.3. - Sustainability

Two indicators are measured to assess the scheme management sustainability, the sustainability of irrigated area (SIA) and the area structure ratio (AIR). Figure 13 and table 6.4 below respectively give the evolution of the SIA ratio through time in Saint-Raphael and Grison Garde, and the value of AIR for the three studied schemes.

Data shows that, throughout the self-management period, on average half and two third of the total irrigated areas are annually cultivated in Grison Garde and Saint-Raphael, respectively. Moreover, Saint-Raphael has a lower area structure ratio (0.029 ha/canal meter or 34.45 meters of concrete canals per hectare) compared to the other schemes. It is important to notice that in addition to the concrete canal network, the schemes contain unlined canals as well as a drainage canal network.



Source: author survey

Figure 13: Sustainability of irrigated area in Saint-Raphael and Grison Garde during the self management period

Table 6.4: Area structure ratio in Saint-Raphael, Grison Garde, and Dubre in April 2007

Schemes	Total irrigated area in ha	Total canals length in meter	AIR in ha/meter	Reverse of AIR in meter/ha
Saint-Raphael	1,161	40,000	**0.029**	34.45
Grison-Garde	320	4,695	**0.068**	14.67
Dubre	82	1,545	**0.053**	18.84

Source: author survey

6.4. - Farmers' perception on schemes management performance

6.4.1. - Farmers' self evaluation of overall management of schemes by WUAs

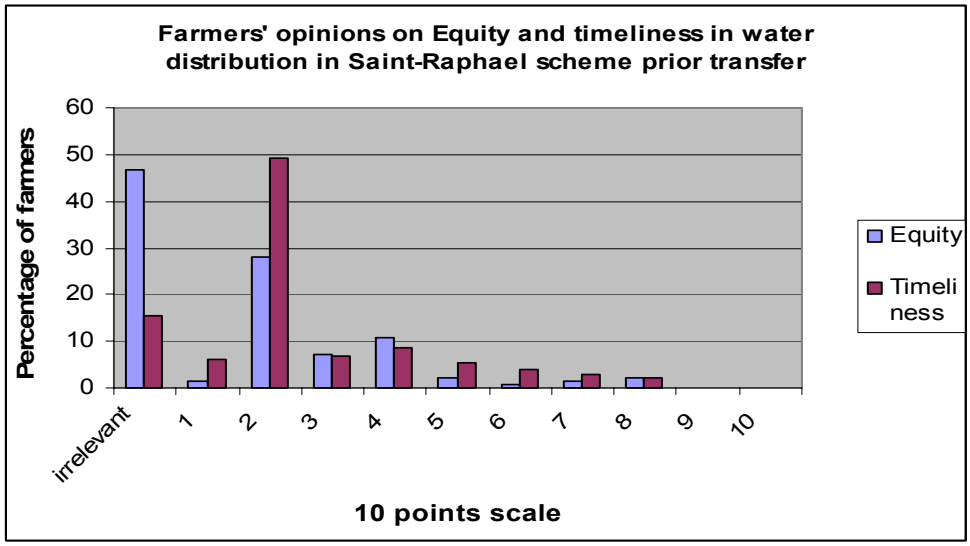
In Grison-Garde 50% of farmers interviewed thinks that scheme management by the WUA is done well, 47.5% argues that it is satisfactory, and 2.5% objects it is badly done. Concerning the performance of their representatives in doing their tasks 2.5%, 32.5%, 57.5%, and 7.5% are respectively very satisfied, satisfied, more or less satisfied, and not satisfied at all. In Dubre 36.8% of the farmers objects that scheme self management by the WUA is going well, the remaining 62.2% thinks that it is rather satisfactory. While 10.5% is satisfied with the work of their representatives, 84.2% is more or less satisfied, and 5.3% is not satisfied at all. In Saint-Raphael 1.3%, 60%, 32.7%, and 6% of farmers respectively argue that the overall scheme management by the WUA is very well, well, satisfactorily, and badly done. Concerning their satisfaction of the work of their representative in the Association 23.3%, 63.4%, and 5.3% are satisfied, more or less satisfied, not satisfied at all; respectively; while 8% does not have any objection of their representatives' performance.

On average the majority of farmers argue that the given irrigation schemes are satisfactorily managed by their Association. However, figures are quite different from one scheme to another. On average farmers are more or less satisfied with the performance of their representatives and the functioning of WUAs' committees.

6.4.2. - Equity, timeliness, and reliability of water distribution

In both Dubre and Grison-Garde because of the lack of infrastructure, the inexistence of a water distribution schedule and the mismanagement, the concepts of equity and

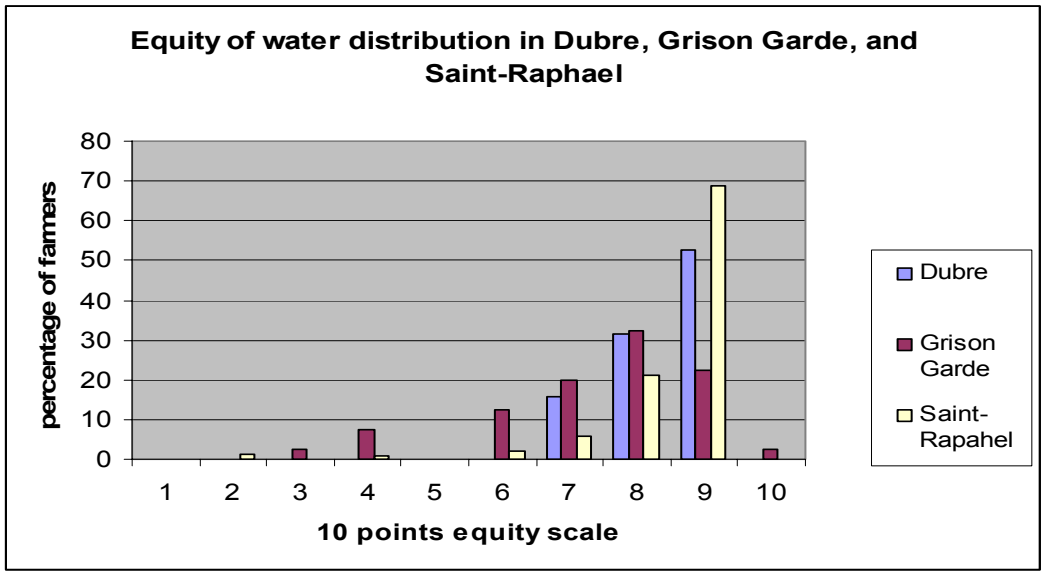
timeliness, in supplying irrigation water to farmers were rather irrelevant before the transfer process had started. The situation of equity and timeliness in water distribution before transfer for Saint-Raphael is presented in figure 14 below. The data show that almost 50 % of the farmers perceive, on one hand that the equity concept was irrelevant to the situation of water distribution in their scheme prior to the IMT process, and on the other hand that they used to receive water on time only in 20% of cases.



Source: author survey

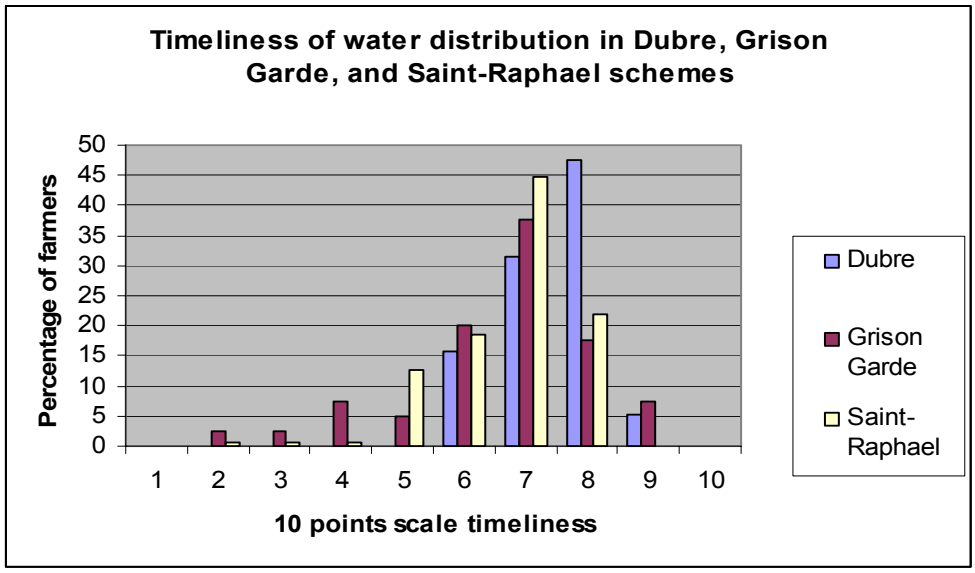
Figure 14: Farmers' opinions on equity and timeliness in water distribution in Saint-Raphael scheme prior transfer

With regards to equity, timeliness, and reliability of water distribution (assessed by farmers' opinions as mentioned above) data reveal that they have significantly improved with irrigation management transfer process. Figures 15 and 16 below present the opinions of farmers on current situations of equity and timeliness, respectively, in the three schemes under study.



Source: author survey

Figure 15: Farmers' perception of equity and water distribution in Dubre, Grison Garde, and Saint-Raphael



Source: author survey

Figure 16: Farmers' perception of timeliness in water distribution in Dubre, Grison Garde, and Saint-Raphael

Data shows that respectively 52.6%, 22.5%, and 68.7% of the farmers in Dubre, Grison Garde, and Saint-Raphael, believe that water is currently equitably distributed at 90% (or in 9 cases out of 10). Regarding timeliness, in Dubre 47.4% of farmers realizes that they

receive water in time at 80% (or in 8 cases out of 10); while in Grison Garde and Saint-Raphael 37.5% and 44.6% of farmers respectively object that they currently receive water in time at 70% (or in 7 cases out of 10). Therefore, water distribution is currently more equitable in Saint-Raphael in comparison with both other schemes. While the delivering in due time is better in Dubre which has also the shortest irrigation network of the three.

Concerning the reliability of water distribution, in all three schemes a large majority was not satisfied at all with the quantity of water they used to receive before the transfer had occurred. The before transfer and current situations of water distribution reliability assessed by farmers' opinions are presented in table 6.5 and 6.5 below, respectively.

Table 6.5: Framers' opinions on the quantity of water received before transfer in Dubre, Grison Garde, and Saint-Raphael

Farmers self Appreciation of quantity of water received	**Dubre**		**Grison Garde**		**Saint-Raphael**	
	# of farmers	percentage	# of farmers	percentage	# of farmers	percentage
Sufficient	1	**5.3**	2	**5**	9	**6**
More or less sufficient	7	**36.8**	21	**52.5**	73	**48.7**
Not sufficient	11	**57.9**	17	**42.5**	54	**36**
Irrelevant	0	**0**	0	**0**	14	**6**
Total	19	100	40	100	150	100

Source: author survey

Table 6.6: Framers' opinions on the quantity of water currently received in Dubre, Grison Garde, and Saint-Raphael

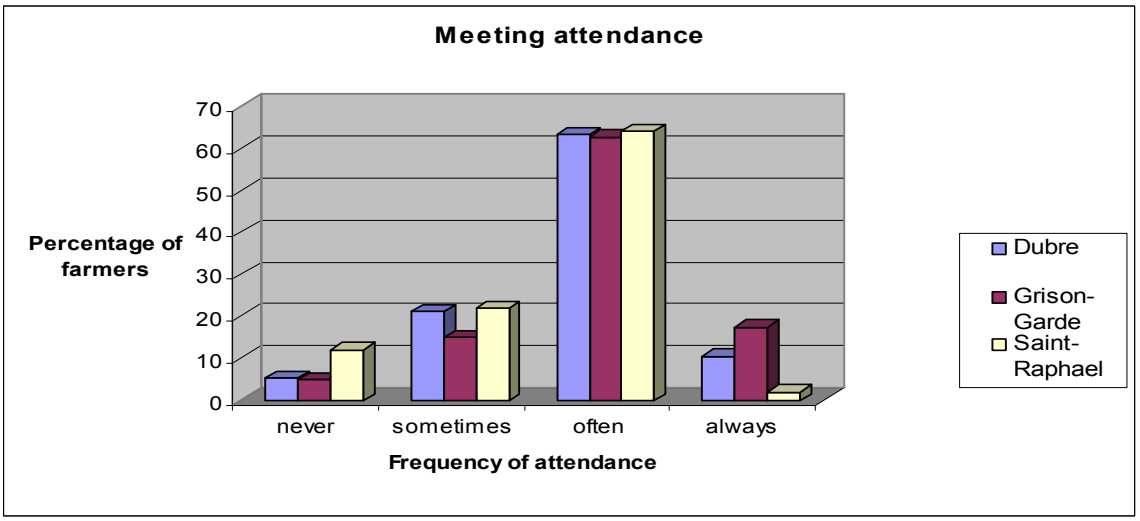
Farmers self Appreciation of quantity of water received	**Dubre**		**Grison Garde**		**Saint-Raphael**	
	# of farmers	percentage	# of farmers	percentage	# of farmers	percentage
Sufficient	15	**79**	27	**67.5**	103	**68.7**
More or less sufficient	4	**21**	11	**27.5**	44	**29.3**
Not sufficient	0	**0**	2	**5**	3	**2**
Total	19	100	40	100	150	100

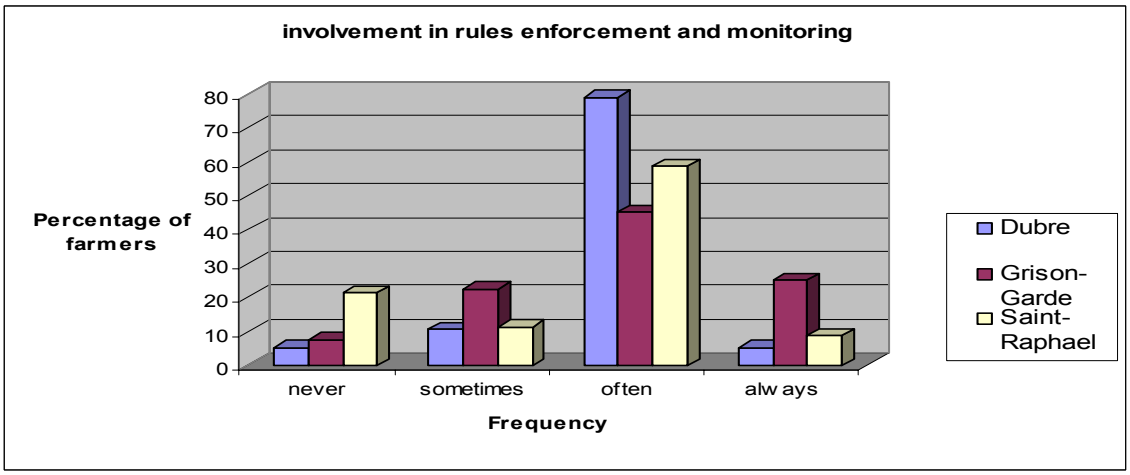
Source: author survey

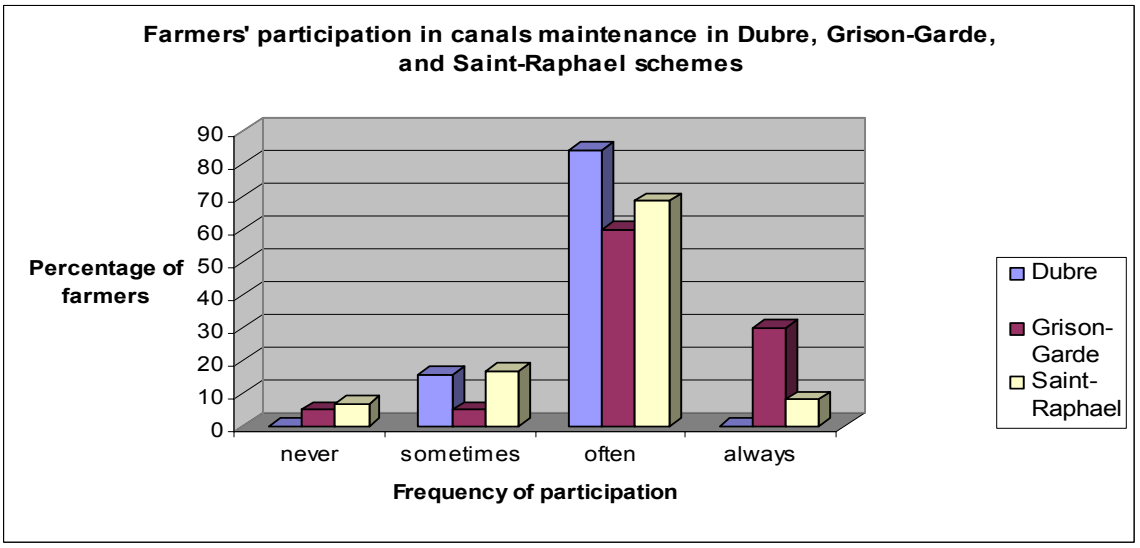
The survey reveals that between two third and 80% of farmers, depending on the scheme, states that they currently receive enough water whenever they cultivate their crops. Data show that there is a significant improvement in the reliability of water supply. The percentage of farmers who perceive receiving sufficient water has significantly increased while the percentage of those who perceive receiving too little water has decreased for all three schemes with the transfer. However such figures are based on farmers' perceptions, they do not take into account the trade off between crop water requirements and supplied water, which would have been impossible to measure in the current state of irrigation equipments available on the given schemes. Furthermore, one should notice also that, for instance in Grison-Garde and Dubre significant parts of irrigated land are not cultivated during the dry season. In spite of the available irrigation infrastructure, farmers continue to have a climatic risk aversion, waiting for the rainy season to cultivate their lands. Even in Saint-Raphael, as shown above, no more than two third of irrigated land, on average, is yearly cultivated. Therefore, in a perspective of agricultural intensification to better exploit and value the available irrigation water, improvements are still needed to further organize water distribution and consequently increase water distribution equity, timeliness, and reliability.

6.5. - Farmers' participation in schemes management related activities

Framer-managed irrigation schemes are based not only the duties and responsibilities assigned by themselves to their representatives inside WUA but also and especially on farmers' participation in schemes management related activities. Their participation is often viewed as a means and ways to assess their perception on scheme management performance as well as the recognition by them of the established institutional settings to run irrigation schemes. In this regard we have interviewed them on their degree of participation in three main activities: canal maintenance, meeting attendance and their involvement in rules enforcement and monitoring. Results are presented in figures 17, 18 and 19 below.







Source: author survey

Figures 17, 18 and 19: farmers' participation in canals maintenance works, meeting attendance, and rules enforcement and monitoring within WUAs, respectively

The survey reveals that most of the users often participate in those three key activities. On average for all three schemes more than two third of the farmers either often or always takes part to voluntarily canal maintenance as well as attending meetings. On average 79 %, 58 %, and 45 % of users are often involved in enforcing established rules and monitoring in Dubre, Grison-Garde, and Saint-Raphael, respectively. In Saint-Raphael 25 % argue that they are always involved in rules enforcement and monitoring in order to preserve the irrigation canals.

Another key finding is in Saint-Raphael for instance, farmers participate more in canals maintenance than they do in meeting attendance or rules enforcement and monitoring. Potential explanation may be either the relative great number of users who are using the system or the incentives they find in canal clearing which is indispensable to get water arrived to their fields. In Grison-Garde the participation in canals maintenance and meeting attendance is also higher than that in rules enforcement and monitoring.

CHAPTER VII

CONCLUSIONS AND SUGGESTIONS FOR THE IMPROVEMENT OF IMT PROCESS AND IRRIGATION SCHEMES MANAGEMENT

7.1. - General conclusions

In this study we have used a conceptual and analytical framework to study the water governance and irrigation schemes management in Haiti. The adopted framework was based on the IAD conceptual and analytical framework of Saleth (2004), on the four steps methodology for institutional analysis, as well as Ostrom and co-workers' eight design principles for long term enduring institutions governing CPR. A field survey combined with relevant information gathered from literature has enabled us to answer the research questions and test the hypotheses we have formulated. Throughout the study we get insight in the ongoing IMT process in the local institutions crafted by or with users participation to insure the operation, management, and administration of three irrigated schemes. Using some relevant criteria management performance of the given schemes have been assessed and discussed.

Since IMT, one of the major concerns of the present study is a widespread phenomenon an extensive literature review was used to evoke the main IMT strategies implemented worldwide and the most important and relevant factors that are likely to explain differences in success between different IMT programs were synthesized. The most important of those factors are: Identification of a clear, relevant, and sound objective of the transfer program; Cost recovery and financial autonomy of the WUA; Reform of the irrigation agency and the long term role of government; Incentives to users and their related association and finally the management transfer process itself. The latter includes issues such as bottom-up approach, participation of farmers at all levels of irrigation water management, type, nature and level of integration of the WUA, rehabilitation of irrigation facilities, role of the enabling situation driving the institutional change, and demand or supply – driven transfer.

With regard to the IMT process in Haiti, findings of the study have shown that the Government has a clear vision and objectives, which consists of transferring day-to-day scheme management to autonomous WUAs having duties to insure operation,

administration, and management of irrigation systems as well as rights to recover required funds from users by imposing irrigation water fees to them. A comprehensive methodology has been elaborated to establish such WUAs and boost local institutions governing the schemes, including the construction or/and rehabilitation of physical irrigation infrastructures. However the current social, political, and economic environment of irrigated agriculture is not so favorable to smooth management transfer. The underlying legal framework over resources management in general and irrigation water especially represents also a major impediment, which mortgage the success of the process. Furthermore, water governance structure is problematic: there is neither an appropriate organizational body which is capable to plan, design, and implement a transfer program, nor such a program has been elaborated yet. In addition to the perceived organizational deficiency, relevant institutional tools and measures such as a water pricing system, water rights, a comprehensive water allocation policy and framework are still neglected. Finally, the necessary political will, which is needed to mobilize required (financial, human, legal and so fourth) resources to conduct a successful program and achieve the target objectives, is still missing. Therefore, we conclude that the first hypothesis is confirmed.

Notwithstanding the unfavorable socio-economic conditions and legal framework deficiency, farmers in the three concerned irrigation systems, with the financial and technical support of GAA, have somehow succeeded to craft local institutions to govern, manage and run their schemes. The given irrigation systems are operated and administrated by a combination of formal written rules possessed by WUA and informal rules, norms, and customs that are established or in-use to monitor, influence, control, and constrain human behaviors in appropriating irrigation water . In all three schemes the established institutional settings and arrangements have enabled farmers' organizations to run the schemes, while increasing users' participation.

In Saint Raphael the institutional rules governing the irrigation scheme are more likely to sustain in comparison with both other schemes. As Koç (2006) has argued with regard to the size of a given irrigation system and the sustainability of community self management, the WUA in Saint-Raphael scheme is quite large enough to accomplish the designated management tasks by collective action and to be financially viable by advantages of scale. In addition to operational and administrative rules crafted to run the

scheme, the CCISR in Saint-Raphael benefits from a relatively good partnership, which exist between the Association and other local institutions such as police, court/justice, municipality administration, as well as other local organizations to reinforce its leadership and particularly insure rules enforcement. That scheme has also benefited, for around ten years, of continuous assistantship by GAA and somehow from the quite close partnership with local and departmental offices of the Ministry of Agriculture. From economic point of view, scheme exploitation is rather intensive in Saint-Raphael, particularly with the profitable vegetables cropping season, which obviously enhances farmers' ability to pay irrigation fees. In addition to collecting the water fees, as we have seen the CCISR undertakes other profitable economic activities (upstream and downstream services to agricultural production). From organizational point of view the WUA has its central committee having a weekly meeting, (among members of that central committee responsibilities are shared between an executive committee and three commissions), the yearly General assembly, as well as bi-monthly meetings with relevant partners and other local institutions. Even though most of the committees at the level of hydraulic quarters are not very active, the field study reveals that farmers are considerably involved in main management tasks such as water distribution, canals maintenance, meetings attendance and thus decision making processes, as well as rules enforcement and monitoring. The CCISR hires its own employees whose wages have been kept within the collected water fees. For the calculated performance indicators, in most cases Saint-Raphael scheme is ranked among best.

After Saint-Raphael, the findings show that in Grison-Garde there is evidence that the institutional settings and arrangements established by farmers to govern and manage their irrigation system generate better outcomes than the former centralized government agency management scheme. Presently, the established WUA takes decisions over scheme operation and management, plans and executes relevant management tasks such as water distribution, canal maintenance, conflict resolution and rules enforcement. Data reveal that a significant number of farmers participates in those voluntary tasks. The principle of water charge is established even though it is hardly collected. In addition, with the transfer process irrigated area has increased and yields of major crops have improved. But significant improvements are still needed if farmers, institutions governing and managing the scheme have to be sustainable and financially viable.

In Dubre the transfer process has generated significant improvements in physical infrastructures of the scheme and has raised farmers' responsibility and involvement in the system operation and management. The WUA has been established and is responsible to run the scheme.

Therefore we conclude that the second hypothesis: 'community-based management improves management performance of schemes' is also confirmed. Concerning the third and last hypothesis, the study has revealed that, over the period of users self management the fees collection performance is on average 0.5, less than 0.3, and irrelevant in Saint-Raphael, Grison-Garde, and Dubré, respectively. The financial self-sufficiency is on average less than 0.6 for both Saint-Raphael and Grison-Garde while irrelevant for Dubré. Both water fees and collection rate are low and consequently do not enable WUA to cover their real expenditures and less their estimated budget even at this early management stage where maintenance costs are normally low. Since the rehabilitation is still continuing in both schemes, one may logically expect that the cost-recovery situation becomes worse when WUA will no longer receive support and assistance from external entities, as it is now, while maintenance costs will probably increase with time. Regarding Dubré one is wondering to which extend these schemes of less than 100 hectares can have a financially viable WUA in the current conditions of scheme exploitation. Thus we conclude also the confirmation of the third and last hypothesis.

The gathered information and data have confirmed the hypotheses we have elaborated to guide the study. However throughout the dissertation we have evoked some deficiencies at both levels of the ongoing IMT process and irrigation schemes management. The section below is devoted to advocate some suggestions that are likely to bring improvements in the implementation as well as outcomes of the process.

7.2. - Suggestions

7.2.1. - At National level

At national level the most critical deficiency is that there still exists no public entity having responsibility, duty, and means to carry out the target IMT program. Although the state,

through the Ministry of Agriculture, has clarified its vision in the 2000 policy for irrigation no significant specific organizational measures have been taken to implement the management transfer. The irrigation service within that Ministry has lost during the recent decades almost its entire staff. This is striking, considering the important role that irrigated agriculture can play in agricultural production and productivity towards food security and poverty reduction in Haiti. Moreover, the Ministry targets the improvement of scheme management through users' involvement as the major strategy to achieve that goal. Therefore, here we are proposing an organizational structure to realize a smooth transfer.

We suggest the creation of a "**National Unit for Irrigation Management and Development**", which should be an autonomous and financially independent entity, but administratively[19] dependent on the Ministry of Agriculture. The primary duty of the Unit is to build and implement an IMT program. In the short and mid-terms its main activities[20] would be:

i) Update and complete the diagnosis of all (at least small and medium scale) irrigation schemes within the country. The tangible outputs of such a diagnosis should be the creation of a data base (electronic and paper) of the state, potentialities, as well as needs for rehabilitation for those systems from the points of view of physical infrastructure, management (technical and organizational aspects), exploitation (cropping systems, agricultural techniques, trade organization, and so fourth), and environment. Another output of the diagnosis is the classification of the given schemes accordingly to some relevant criteria such as: costs for scheme rehabilitation and transferring management to WUA; potentiality of schemes to contribute to increasing agricultural production and thus improve farmers' livelihood; potentiality of schemes to produce agricultural production that can stimulate

[19] The General Director of the Unit must be nominated similarly as the General Director of the ministries or other autonomous public agencies such the Electricity Company. However the highest authority for strategic decision making within the Unit should be a Board of Directors. We suggest the composition of that Board of Directors as follows: Chairman: The Minister of Agriculture; General Secretary: the General Director of the given Unit; Members: one representative of the Ministry of the Environment, one Representative of the Ministry of Finance, and one Representative of Water Users Associations. This implies that much effort (including the update of the legal framework for the functioning of WUAs) is needed to further encourage and support the federation of WUAs until the achievement of a National Federation of WUAs whose chairman will be automatically that Representative of WUAs in the Board of Directors. In the mid-time presidents of all WUAs can meet to vote that representative.

[20] The way that the activities are presented does not refer to any chronological order to realize them.

the development of agro industries and so forth. Indeed feasibility studies must be undertaken to make suggestions for the construction of infrastructure to irrigate the remaining 50% of irrigable area within the country.

ii) Secondly, the Unit must have the responsibilities to design a reasonable and comprehensive transfer program, which fits to the reality of irrigated agriculture while stimulating the development and modernization of the sector as well as rural development in the surroundings of irrigation schemes. Details on deadlines, mechanisms and procedures to implement the program as well as periodic evaluation must be specified in the program document. The unit is also responsible for implementing the program after its approval by concerned authorities.

iii) The Irrigation Unit should also have the duty to insure coordination and supervision of all activities related to irrigation which will be implemented by different relevant actors. For doing it, it must beforehand elaborate administrative and technical norms and standards for the construction of hydraulic infrastructure and rural facilities, which still represent a real handicap in the country. It is obvious that building and strengthening a strong partnership and cooperation with all relevant stakeholders (especially private sector working in the field, farmers organizations, donors and funding agencies) is crucial. But it is also critical that all activities are integrated in the logic of the transfer while encouraging synergy and cooperation in actions.

iv) Once created, the Unit must act to review, update, and complete the legislation under accomplishment to submit to concerned instance for approval and vote.

v) Another activity is to elaborate (along with other actors) relevant tools and techniques, which are needed to support, sustain and enable efficient scheme management and exploitation. They include: parcels plan for the schemes, water rights and pricing system[21], administrative tools to standardize accounting systems of new managers, and so fourth.

vi) In cooperation and with the help of the state university and other institutions, the Unit has to identify and implement training and/or formation programs for

[21] It is critical and urgent for the state, in the context of IMT process, to elaborate an appropriate water pricing system on which WUAs can refer and base water charges. It is also important to enact new water rights law, as well as establish more secure land rights, especially irrigated lands.

professionals, technicians, and WUAs representatives in topics related to irrigation management and schemes exploitation. That partnership Irrigation Unit – University- Agricultural schools must carry out research – and extension projects in order to assist and boost farmer-managed schemes by making available more and accurate knowledge and skills relating to schemes management and exploitation.

vii) In cooperation with the national Service of Water Resources, the Irrigation Unit must create a database where hydrologic data can be found, updated, and monitored in relation with irrigation water management. A global strategy to develop and preserve water resources may also result from this partnership.

viii) During its mandate the Irrigation Unit must help the Ministry of Agriculture and other relevant entities (such as Ministries of planning, Ministry of Public Works, Ministry of Environment, local collectivities,….) to elaborate rural global development plans for the irrigated areas which would include not only irrigated agriculture but also other needed rural public infrastructure and services.

ix) Once the transfer program is achieved and all target schemes being managed by viable WUAs, the Irrigation Unit with its heritage must be incorporated in a broader organizational structure such a "**National Integrated Water Management Unit or even a Ministry of Integrated Water Management"**[22] which will be responsible for the overall water (as a resource) management, allocation, and development. Within that entity a service would be kept to advice WUAs and their federations, insure overall monitoring of their activities, manage and update the relevant databases, and carry out research in order to provide means and strategies to continually adapt schemes management to potential and significant (environmental, institutional, economic, social, political, and cultural) changes.

Although that suggestion to enhance the IMT process in Haiti may appear ambitious, we think it is achievable in the arena of the country reconstruction after almost half century

[22] In this regard we make the implicit hypothesis that if things will evolve to such extend in irrigation water management, improvements will also occur in the management of other uses (especially domestic, industrial uses) of water resource within the country.

of economic decline and two decades of socio-political instability. For that, a global awareness and motivation from professionals and actors working in that field, including farmers, and the political will are required. In addition, as investments in irrigated agriculture are currently financed for 80% by external loans, the appraisal of those main donors and funding agencies is also a prerequisite to the short-term achievement of such suggestions.

7.2.2. - Suggestions for improving schemes management

In order to improve scheme management performance, to strengthen and to render viable local institutions governing and managing irrigation schemes in Saint-Raphael we make the following achievable suggestions. These include organizational settings and arrangements, technical aspects of scheme management, financial and economic management, managerial aspect, monitoring and evaluation of scheme management.

Organizational settings and arrangements.- In order to improve water distribution, enhance legitimacy and recognition of the Central Committee, as well as to render the committees at the level of hydraulic quarters[23] more dynamic we propose to review the hydraulic division and thus the organizational structure of the WUA (see annex VII). Similarly to the actual situation each hydraulic quarter must be led by a 3-5 members committee, but each secondary canal will delegate representatives to the central committee, so that the number of representatives which better reflects its irrigated area and the number of users it contains. For instance, in accordance to the suggested hydraulic division secondary canals which have between 1 to 3 hydraulic quarters may send one representative, those which have 4-5 must send 2, and those having 6-7 must be represented by 3 members to the central committee. Thus, instead of 19 members the central committee will have 27 members who represent the 53 hydraulic quarters. All members of the 53 committees, reinforced with additional farmers should play an important role in the yearly General Assembly as well as any special Assembly. Furthermore, we propose to adapt the name of the WUA to the transfer central idea. Thus, instead of “Central Committee of Irrigation in Saint-Raphael”, the Association must be called for example “Association of Irrigators in Saint-Raphael irrigation scheme”; and

[23] In Haitian spelling a hydraulic quarter consists of an area of 20-30 hectares which receives periodically a water flow that is shared among the farmers exploiting that area.

the former will remain an entity within the users association. It is necessary to emphasize this suggestions related to adapt the name of the association is very important. Although most of the farmers do participate in the scheme management related activities, discussion with them reveals that there is no clear difference between the CCISR which supposes to be a committee within the organizational structure and the WUA itself (constituted of all water users).

Physical infrastructure and technical aspect.- The WUA along with their partner (GAA, MARNDR…) must continue to rehabilitate (secondary and tertiary) the canal network by increasing the actual concrete canal length, by the construction of water control and measurement devices such as hydraulic gates. It is important to place water measurement devices at least along the main canals to measure and monitor water flow, which is distributed to secondary canals as well as managing water shortage during dry season. Water distribution scheduling can also be reinforced by encouraging farmers to irrigate at nighttime, especially in the dry season, when there usually is water shortage. Furthermore, a parcels plan of the scheme should be realized. Such plan should include the hydraulic network in order to facilitate its utilization for improving water distribution. It is also important that GAA assists and helps the WUA to realize a complete inventory and draw the map of the given irrigation facilities (canals length, hydraulic devices…) they are managing. The network map must be a useful tool, which the technical commission can use to regularly assess the state of infrastructure, plan and execute needed maintenance works, as well as further network extension. It is also advisable that the technical commission prepares and presents a yearly technical report on scheme management and maintenance activities at each General Assembly. So, such a report, along with the financial one can better inform users not only on the use of the water charge they pay but also and especially on the realizations resulting from its utilization.

Financial aspect.- As it is demonstrated above the WUA can hardly achieve financially self-sufficiency with the actual water charge system. The given irrigation infrastructure must be maintained and repaired on a regular basis regardless of how intensive the scheme exploitation is. Moreover, given the situation of irrigation facilities in Saint-Raphael, it is unrealistic that volumetric water fees can be established, which would more accurately reflect water consumption by farmers. Thus, we postulate that farmers

should contribute to infrastructure maintenance regardless of their water consumption for a given cropping year. Therefore, we propose, to strengthen financial viability of farmer-managed-scheme in Saint-Raphael, to apply a two levels water fees. At a first level, the total irrigated area should be charged at a certain level of water fees, which should enable to cover fixed costs for maintaining the system (canals maintenance as well as minimum functioning of the WUA). That charge should take into account variables of the broader economy such inflation rate, exchange rate, required irrigation tax that the WUA should pay to the government and so on. Farmers should thus be indebted for that first level of water charge, regardless of what they cultivate on their land during a given cropping period. The second and additional water fee level corresponds to a payment for water delivery related services. It is important to notice that both levels constitute a unique water charging system, which will be expressed similarly to the current situation in HTG/ha or tile per year. The only difference is that farmers who cultivate their land for a given cropping year will pay the second level (which is higher), and those who do not, will only pay the first level. It is as easy to implement as the current situation. As the WUA currently realizes a seasonally inventory of land use, land which is used for any of both cropping season within a year is charged at the second level and for land that is not, farmers pay the first level. Obviously, farmers who do pay for a particular year because they do not cultivate their land are automatically indebted to pay both the first and the second levels for the next cropping year. The only challenge is the determination of both the first and second levels of water fees for the scheme, this requires a specific study to assess the above mentioned long term fixed costs as well as variable costs related to water delivery service. Such a study would provide relevant and accurate information to the WUA, on which it can base the levels of the water fees.

Economic aspect.- More efforts need to be done, especially the establishment of a research – extension unit working on main cultivated crops to assist WUA, in order to enhance the exploitation of the scheme and thus farmers' ability to pay water fees and ultimately their livelihood. As mentioned above farmers witness that they receive training but there is a huge lack of advice. For instance they grow vegetables, onion in particular, which is supposed to be a profitable crop but they complain that they randomly choose varieties; they do not have any guarantee of the seeds they buy. In this regard we think a proper institutional arrangement from the Ministry of Agriculture is crucial to assist farmers.

Managerial aspect.-- Community-based management is a matter of technical, financial, economic, but also and especially organizational management. In line with the organizational and financial aspects, improvements are needed to render scheme management more transparent. The WUA in Saint-Raphael should reinforce communication channels and mechanisms between its leaders and farmers. Administratively they need to improve (especially financial) information registration, book keeping, as well as the communication process in order to make farmers more confident since its management is accountable for them.

Monitoring and evaluation.- The WUA should establish a control committee as prescribed in their functioning rules. The Ministry of Agriculture might better reinforce the overall monitoring of the WUA's activities and also insure periodic evaluation of scheme management.

The above suggestions, except for the organizational settings and arrangements (which need to be moderated), are also valid to both Grison-Garde and Dubré. Furthermore, efforts are needed to encourage intensification of schemes exploitation and to motivate and raise farmers' willingness to pay irrigation water fees in both schemes.

7.2.3. - Issue for further research Study

Finally, we suggest undertaking further research to tackle issues related to a water pricing system aimed at establishing a basis for water charge fixation by WUAs, water and land rights on irrigated lands. Research must also be conducted to evaluate, at both schemes and farms levels, costs and benefits implications of IMT programs in Haiti and to ultimately propose an accurate economic framework for evaluating the incremental benefits and costs of such programs for farmers and their livelihood. Long term financial and economic viability of small or even micro scales irrigation schemes self managed by poor farmers associations in the Haitian context need also to be tackled by further research in order to boost the ongoing IMT process while providing alternative scenarios to decision makers.

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INSTITUTIONAL ANALYSIS OF WATER GOVERNANCE AND MANAGEMENT OF IRRIGATION SCHEMES IN HAITI

(ANNEXES)

Michelet, Boyer

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Thesis submitted in partial fulfilment of the requirements
for the joint academic degree of International Master of Science in Rural Development from Ghent University (Belgium), Agrocampus Rennes (France), Humboldt University of Berlin (Germany) and University of Cordoba (Spain) in collaboration with Wageningen University (The Netherlands), Slovak University of Agriculture in Nitra (Slovakia) and the University of Pisa (Italy).

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INSTITUTIONAL ANALYSIS OF WATER GOVERNANCE AND MANAGEMENT OF IRRIGATION SCHEMES IN HAITI

(ANNEXES)

The jury to evaluate this dissertation is composed of:

- Prof. Dr. ir G. Van Huylenbroeck (Gent University, Belgium)
- Prof. J.H. Beuret (Agrocampus Rennes, France)
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Liste des annexes

ANNEX I: Questionnaires d'enquêtes

ANNEXE 1.1 : Questionnaire d'entrevue individuelle avec les usagers de l'eau d'irrigation sur les périmètres irrigués

Objectifs: pour évaluer la perception des usagers sur l'autogestion paysanne du système d'irrigation et évaluer le coût per capita de cette forme de gestion pour l'usager.

1.- **Caractéristiques de l'usager**

Nom et prénom :……..genre……. Age…….
Niveau d'éducation : □analphabète □primaire □secondaire □université
Nombre de membres de la famille dépendant de l'exploitation :……

2.- superficie et tenure des terres

Superficie totale des terres irrigables…….ha
Superficie irriguée par saison d'irrigation…….ha
Raisons de la différence :…….
Pouvez-vous dire quel pourcentage de vos terres sont en :
Propriété…. …% fermage……..% métayage……. % indivision…..%

3.- coûts de l'eau d'irrigation pour l'usager

Redevances d'irrigation	Montant en gourdes/ha…….	Superficie en ha	Montant total en gdes....	
	Nombre de jours par année	Salaire d'un journalier	Montant total	
	# de jours	En gourdes	En gourdes	En US$
Travaux d'entretien et de maintenance				
Autres (par exemple : contributions financière ou en travail, extra dépenses pour sécuriser droit d'eau…)				
Coût total				

A votre avis le montant des redevances est-il convenable ? Oui □ non□

Sinon combien êtes-vous disposé à payer ?.....gourdes/ha US$/ha

4.- perception de l'usager sur la performance de l'autogestion paysanne du système

i) Comment percevez-vous la gestion du système par l'association d'irrigants ?.....

Très mal□ mal□ satisfaisant□ bon□ très bon□

ii) Comment vous évaluez l'équité* dans la distribution de l'eau ? (Sur une note maximale de 10)

10 très équitable……0 très inéquitable

*N.B. équité signifie chaque parcelle reçoit la quantité d'eau correspondant à sa superficie et le type de culture qui y est pratiquée indépendamment de sa localisation et du statut ou position de son propriétaire ou tenant

iii) comment vous évaluer le respect de l'horaire d'arrosage sur le périmètre (sur 10)

10 très respecté……0 pas respecté du tout

iv) sur un total de 10 arrosages combien de fois l'eau arrive à temps sur votre parcelle ?

……fois/10

v) la quantité d'eau que vous recevez est-elle suffisante pour satisfaire les besoins de vos cultures ?

Pas suffisante du tout□ plus ou moins suffisante□ suffisante□ très suffisante□

vi) est ce que vous participez au choix des dirigeants de l'Association : oui□ non□

vii) êtes vous satisfait de la façon dont ces dirigeants vous représentent au sein de l'association

Satisfait□ plus ou moins satisfait □ pas du tout satisfait□

viii) est ce que chaque usager est libre de participer ou de se faire représenter à la prise de décision au sein de l'association : oui □ non □

5.- Motivation à participer dans les activités de l'association

Participez- vous aux activités de l'association ? Oui □ non□

Si oui,

Types d'activités	**fréquence**			
Entretien du système	□jamais	□parfois	□souvent	□toujours
Réunions	□jamais	□parfois	□souvent	□toujours
Contrôle du respect des règles établies	□jamais	□parfois	□souvent	□toujours
Autres (préciser)	□jamais	□parfois	□souvent	□toujours
Autres (préciser)	□jamais	□parfois	□souvent	□toujours

Si non, pourquoi vous n'y participez pas**:**

7.- Perception de l'usager sur la performance du système avant le transfert

Avant la gestion du système par l'association d'irrigants :

Combien vous avez l'habitude de payer comme ?

- redevances d'irrigation :

- autres frais :

Comment vous estimez l'équité de la distribution de l'eau à cette époque

10 (très équitable) 0 (très inéquitable)

Comment vous évaluez le respect de l'horaire d'irrigation à cette époque ?

10 (toujours respecté) 0 (jamais respecté)

Etiez vous satisfait de la quantité d'eau que vous receviez ?

Satisfait□ plus ou moins satisfait □ pas du tout satisfait□

Selon votre jugement quels sont les changements que l'Association d'irrigant apporte dans la gestion du système

6.- qu'est ce qu'il faut faire pour améliorer la gestion du périmètre d'irrigation ?

Merci beaucoup pour votre coopération !

ANNEXE 1.2:- Check liste pour la conduite de groupe discussions avec les entités (comites, groupements d'usagers….) de l'Association d'irrigant

0.- Pouvez retracer l'histoire de la gestion du périmètre en spécifiant les grands moments de changements de structure de cette gestion

1.- Comment l'Association perçoit la prise en charge des responsabilités d'assurer la gestion du système d'irrigation ?

2.- Quels sont les principaux problèmes confrontés par l'Association qui peuvent constituer des obstacles à sa bonne performance dans la gestion du système ?

3.- Comment peut-on caractériser les **droits de l'Association** :

Droit sur la ressource eau ?

Droit sur les infrastructures physique d'irrigation ?

Autres (à préciser) ?

4.- Durée et conditions du mandat de l'Association pour assurer la gestion du périmètre :

5.- Comment peut-on caractériser les **droits des usagers** :

Droits d'eau (conditions d'acquisition, ces droits d'eau sont rattachés a qui ou à quoi ? sont-ils interchangeables entre les parcelles et/ou entre les détenteurs ; et sous quelles conditions, qui octroie ces droits d'eau, les ayants droits peuvent-ils perdre ces droits…..)

Quelles sont les mesures mises en place par l'association, le détenteur et/ou autres instances pour protéger et sécuriser les droits d'eau des usagers ?

Autres droits ou autres services offerts aux usagers (à préciser)

6.- Quels sont les **devoirs de l'usager** :

Redevances d'irrigation (montant) :

Autres formes de contributions financières :

Participation aux travaux de maintenance : nombre de jours par période et coût journalier de la main-d'œuvre dans la région

Autres devoirs des usagers (à préciser) :

7.- surveillance et contrôle (monitoring)

Qui assure la surveillance journalière et du respect des règles de distribution de l'eau et la protection du système d'irrigation ?

Qui assure le suivi et le contrôle périodique de l'état de fonctionnement du système d'irrigation et des activités de l'association

8.- Quels sont les bénéfices et avantages supplémentaires des usagers qui peuvent être attribués à l'autogestion paysanne du système (quantifier au mieux possible)

9.- quels sont dans la pratique les procédures et modalités de résolution de conflits :

Conflits entre deux usagers

Conflits entre usagers et l'Association

Conflits entre l'Association et d'autres organisations ou institutions

Conflits entre l'Association et une tierce entité

10.- quelles sont les principales fonctions, responsabilités et activités de l'Association ?

11.- quelles sont les modifications/changements que le transfert de gestion apporte dans :

La productivité agricole (rendements des cultures) – évolution des rendements au cours du temps :

Choix de cultures plus rentables (de quelles cultures à quelles cultures) :

Superficie irriguée (de combien à combien) :

L'organisation de la distribution de l'eau (équité, temps, adéquation par rapport aux besoins …) :

L'intensification des saisons culturales et/ou dans l'occupation du sol (spécifier) :

Autres :….

12.- relations avec d'autres organisations et/ou institutions

Nom de l'org. partenaire	Types of relations	Description	Bénéfices et/ou coûts pour l'organisation

13.- relation entre le mode de tenure des terres - droit d'eau - paiement de redevances d'irrigation – productivité agricole

14.- Procédures d'élaboration et/ou de modification des règles et normes de gestion du système – qui y participe

15.- qui sont les membres de l'Association (le propriétaire foncier, l'exploitant agricole, les deux)? Combien sont-ils? Y a t-il une différence entre membres de l'Association et ayants droit à l'eau

16.- quels sont les mécanismes et procédures mis en place au sein de l'Association pour favoriser et faciliter la communication entre les usagers et leurs représentants

17.- nombre de structures en mauvaise condition (ou en condition de dysfonctionnement) au sein du réseau d'irrigation

18.- nombre total de structures sur le réseau d'irrigation

19.- nombre total de structures fonctionnement normalement sur le réseau

ANNEXE 1.3 : Etude de terrain (système d'irrigation): Collecte des informations et données sur la gestion du périmètre irrigué

Information et données secondaires à collecter sur le système d'irrigation dans les documents des Associations d'Usagers ou d'autres organismes concernés

Tableau 1. – fiche de collecte d'information sur la description du périmètre d'irrigation

Descripteurs	Description du système d'irrigation
Pays	
Nom du système d'irrigation	
Climat	
Disponibilité en eau (abondante, suffisante ou rareté)	
Superficie irrigable	
Superficie totale irriguée	
Superficie annuelle irriguée	
Precipitation moyenne annuelle	
Pluie efficace annuelle	
Evapotranspiration	
source d'eau (prise sur rivière, barrage réservoir, eau souterraine, combinaison de l'eau de rivière et de l'eau souterraine)	
Type de système d'irrigation (provision d'eau par pompage ou gravitaire)	
Types d'infrastructures (canaux à ciel ouvert ou tuyauteries…)	
Type de distribution (à la demande, tour d'eau, distribution anarchique…)	
Méthode prédominante d'application de l'eau à la parcelle (irrigation par sillon, par bassin, par crue….)	
Cultures principales et leurs pourcentages d'occupation du sol (%superficie totale)	
Average farm size	
Type de gestion (gestion étatique, autogestion paysanne, gestion conjointe…)	
Longueur totale de canaux	
Nombre total d'usagers	

2.- superficies annuelles irriguées? Volume annuel d'eaux distribuées aux usagers?

3.- Evolution des rendements et de la production pour les différentes cultures pratiquées

4. – pourcentage de collecte de redevances au cours des années de l'autogestion

5. – les règles opérationnelles: plan (ou horaire) de distribution, programme d'entretien et de maintenance de réseau), plan d'investissement…..

6.- les règles administratives et légales: reconnaissance et statut légal de l'Association, règlements internes, ses relations contractuelles avec d'autres instances……

7.- dépenses annuelles de maintenance au cours de la période de l'autogestion

8.- dépenses annuelles en entretien, maintenance et opération du système au cours de la période de prise en charge

9.- dépenses annuelles en salaire (personnel) au cours le période de l'autogestion

10.- dépenses annuelles totales au cours de la période de l'autogestion (spécifier les grandes composantes)

11.- budget annuel de l'Association

12.- critères de fixation du montant des redevances d'irrigation – comment l'organisation peut ajuster ce montant, quelles en sont les procédures

13.- stratégie et méthodologie de mise en place de l'Association

14.- nombre total de staff (équivalent plein temps) travaillant dans la gestion du système

15.- montant total annuel des subventions (argent qui ne provient pas des redevances d'irrigation ni d'autres formes de cotisations des usagers).

16.- montant total annuel des revenus provenant des redevances d'irrigation et d'autres sources locales de revenus pour l'association

ANNEXE 1.4: Collecte d'information sur les aspects institutionnels de la gestion de l'eau d'irrigation et du processus de transfert de gestion en cours en Haïti.

Objective: Comprendre et analyser les outils institutionnels de gouvernance et de gestion de l'eau d'irrigation en Haïti dans le contexte de la dynamique de transfert en cours dans le pays.

Les données et informations relatives aux aspects suivants sont recherchées :

- L'Environnement institutionnel aux niveaux micro (agriculture irriguée) et macro (l'économie du pays en général) du point de vue des figures statistiques pour mieux cerner le contexte politico socio-économique dans le lequel la dynamique de transfert de gestion des périmètres irrigués est entrepris.

- L'histoire de l'agriculture irriguée et son développement en Haïti.

- L'état de la législation sur l'eau et l'irrigation en particulier

- La politique de l'état en matière d'irrigation et de sa gestion

- Les principales organisations ou organismes intéressés à cette gestion de l'eau

- La stratégie et méthodologie utilisées pour transférer les responsabilités en matière de gestion de l'eau d'irrigation aux associations d'usagers.

- Les informations relatives à la politique et/ou pratiques de tarification de l'eau utilisée à des fins de production agricole, ainsi les réglementations et/ou pratiques en vigueur en ce qui concerne les droits d'eau dans le pays.

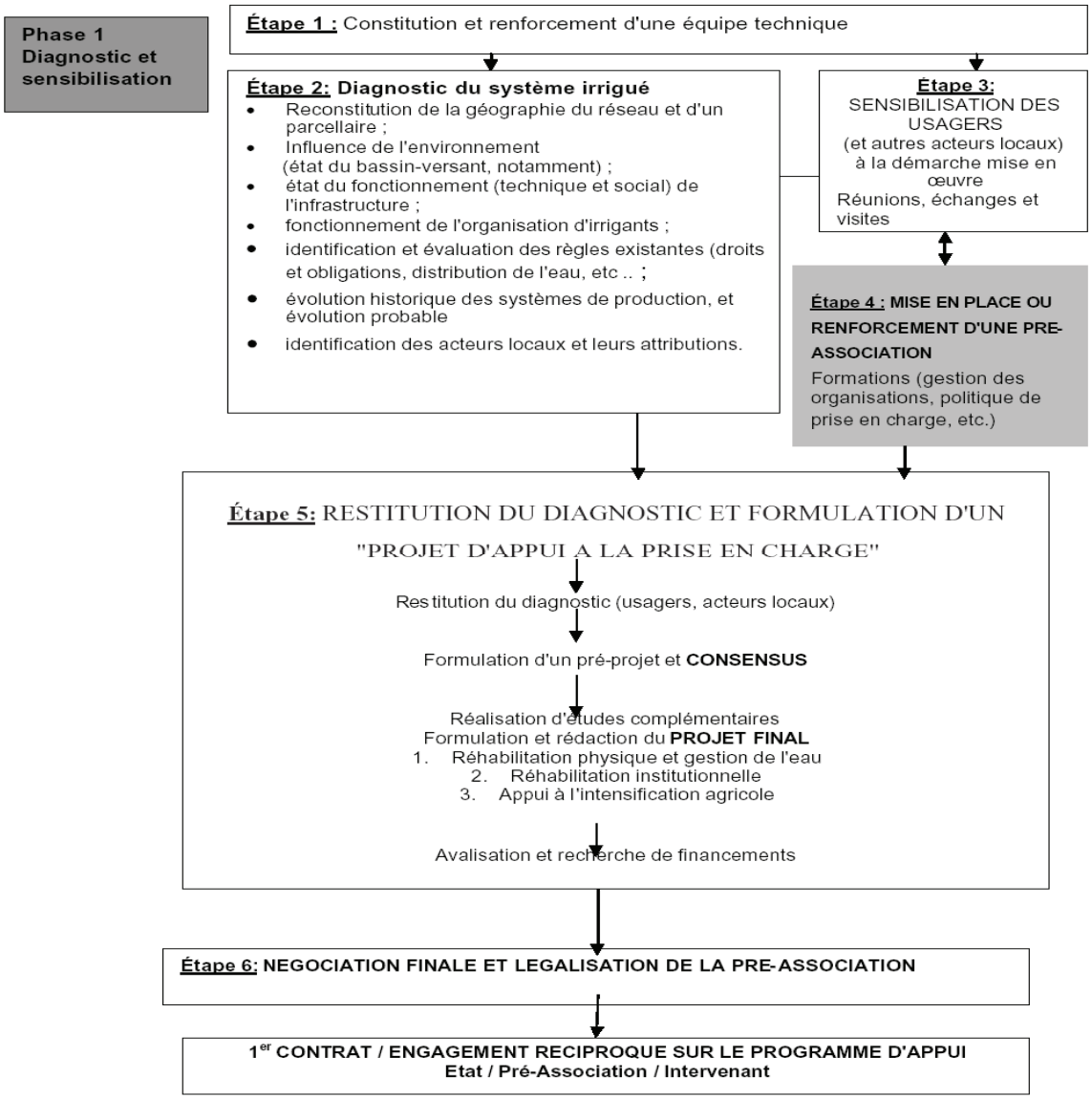
Sources potentielles d'informations: les Ministères, en particulier le Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural; Les Organisations non gouvernementales et internationales telles FAO, Banque Mondiale etc.…

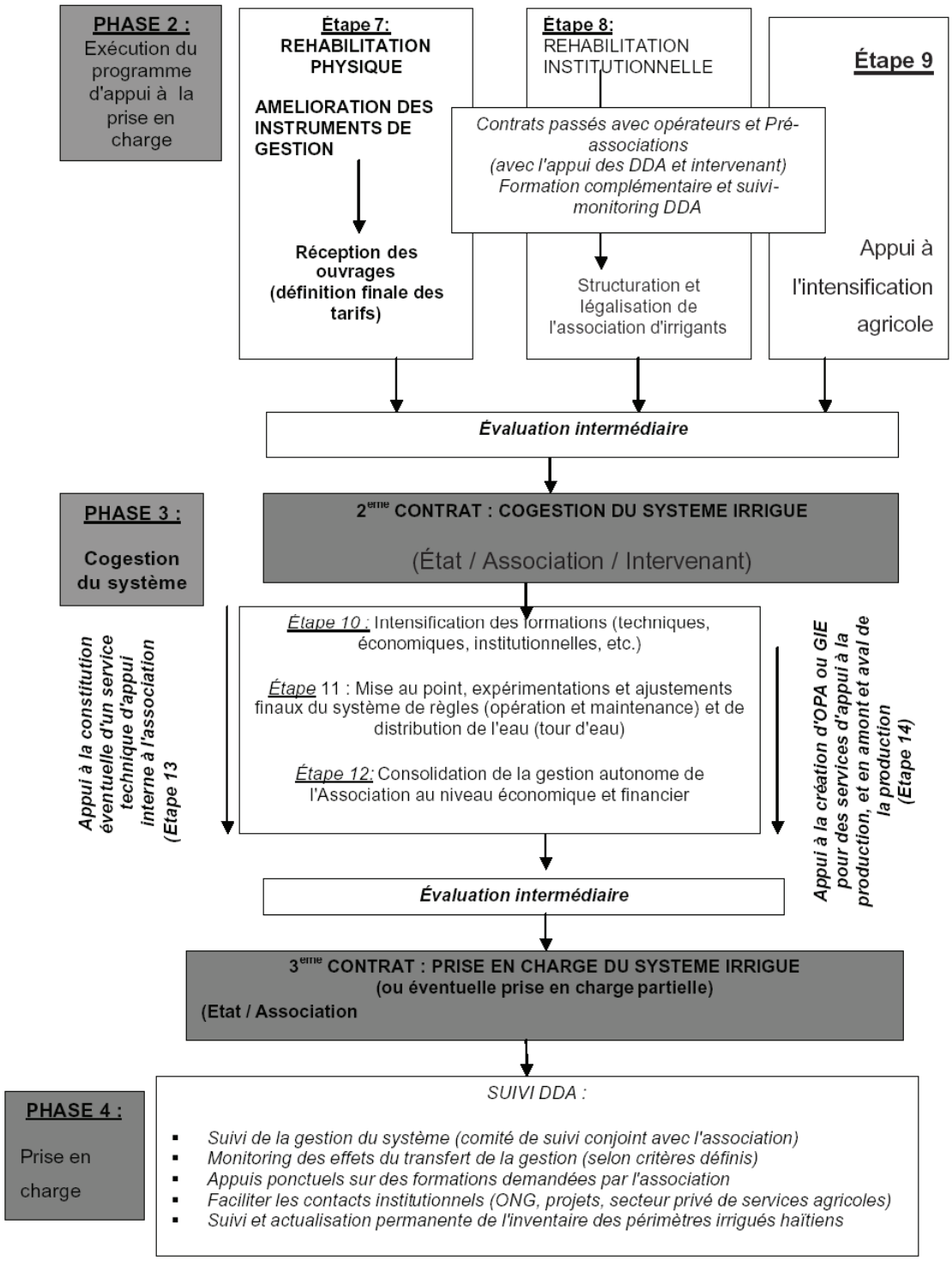
ANNEXE II: Le transfert de la gestion des systèmes d'irrigation en Haïti

ANNEXE 2.1: Schéma de la méthodologie de transfert

Comme indiqué dans le corps de la dissertation une méthodologie comprenant quatorze (14) étapes, quatre (4) phases et trois (3) niveaux de contractualisation est élaborée par le Ministère de l'Agriculture (en partenariat avec les autres partenaires concernés) pour réaliser le transfert des responsabilités relatives à la gestion des systèmes d'irrigation aux associations d'usagers de l'eau. La figure suivante (tirée de Herard, 2005) présente le schéma de cette méthodologie.

Figure 1: méthodologie du MARNDR pour le transfert de gestion des périmètres d'irrigation en Haïti





Source: Hérard (2005) selon MARNDR (2000)

ANNEXE 2.2: Contrat Avezac et le décret loi le sanctionnant

La première tentative d'implication effective des usagers dans la gestion des systèmes d'irrigation en Haïti date de 1953. Le Secrétaire d'Etat des Finances d'alors avait signé un contrat avec le Syndicat Agricole d'Avezac lui concédant l'administration du système d'irrigation d'Avezac. Une copie de ce contrat, ainsi que celle de la loi du 21 septembre 1953 sanctionnant ce contrat, est ci-dessous présentée

Contrat entre:
1)le Secrétaire d'Etat des Finances, M. Lucien Hibbert, identifié su No 3902-OO et le Secrétaire d'Etat des Travaux Publics, M. Georges Cauvin, identifié au No 3816-PP pour l'exercice en cours, agissant en vertu d'une décision du Conseil des Secrétaires d'Etat en date du…….1953, d'une part ;

ET

2) Le Syndicat Agricole d'Avezac, ci-après dénommé «Le Syndicat» ayant son siège à Sovo, Commune de Camp-Perrin, Arrondissement des Cayes, représenté par le Président du Comité de Direction M. Duvier Georges, propriétaire demeurant et domicilié à Camp-Perrin, identifié au No 3-AA, dûment autorisé aux fins des présentes par décision du dit comité en date du ……, d'autre part ;
Il a été convenu ce qui suit:
Article 1.- L'Etat Haïtien concède au Syndicat Agricole d'Avezac, l'administration du système d'irrigation d'Avezac et lui octroie 50% des recettes brutes provenant de la perception de la taxe d'irrigation afférente à ce système.
Article 2.- En retour le Syndicat s'engage:
1) à faire entre les usagers du système une répartition de l'eau conformément à la loi et à établir un horaire d'irrigation pour chaque porte d'eau ;
2) à entretenir convenablement tous les éléments du barrage de dérivation ainsi que les ouvrages d'art ;
3) à maintenir en bon état les deux coursiers du système en faisant au besoin et au moins une fois l'an, le curage des dits coursiers, le déboisement de ses talus et celui des pistes d'inspection ;
4) à faire l'éducation des usagers en ce qui concerne l'utilisation rationnelle de l'eau et les méthodes d'irrigation ;
5) à nommer des syndics pour le contrôle du barrage, des bassins de répartition et de canaux;
6) à préparer chaque année, le rôle des usagers soumis à la taxe d'irrigation ;
7) à utiliser les fonds provenant de l'article premier exclusivement à l'entretien et au fonctionnement du système, a l'éducation des usagers du dit système, a la formation des coopératives agricoles de vente et d'achat, a l'acquisition d'outils agricoles, a l'ensilage des denrées, etc.…
Article 3.- Le Syndicat embauche les employés préposés à l'entretien et au fonctionnement du système, avec l'agrément du Département des Travaux Publics.
Article 4.- Pour les avis et devis relatifs aux travaux d'art à réaliser, le Département des Travaux publics fournira au syndicat les services gratuits d'un de ses ingénieurs qualifiés. Il est entendu que le syndicat ne pourra faire aucune modification, entreprendre aucun travail d'art dans le système sans l'approbation du dit Département.

Article 5.- L'administration des contributions est chargée de la perception de la taxe d'irrigation, à la fin de chaque mis, 50% des recettes brutes seront déposées à la BNRH, à l'ordre du syndicat agricole d'Avezac et le reste ira au trésor public.
Article 6.- La perception de la taxe se fera comme cela est prévu dans les lois et arrêtés en vigueur selon le rôle préparé avec la collaboration du syndicat.
Article 7.- Le syndicat est tenu de prêter ses bons offices aux agents des contributions, en vue de la perception de la taxe d'irrigation.
Article 8.- les valeurs accumulées au compte prévu en l'article 5 ci-dessus seront dépensées par le syndicat agricole d'Avezac, pour des fins de développement agricole et pour assurer le progrès social de ses membres et des usagers du Canal d'Avezac, selon les stipulations de l'article 2.
Article 9.- Les dépenses seront approuvées et contrôlées par un comité de surveillance composé d'un représentant élu du syndicat, d'un représentant du bureau du travail, d'un représentant du Département de l'Agriculture et d'un représentant du Département des Travaux Publics.
Article 10.- A la fin de chaque exercice budgétaire, les valeurs non employées feront retour au Trésor Public. A la même époque les pièces justificatives des dépenses effectuées au cours de l'année seront expédiées au Département des Finances avec un rapport du comité de surveillance.
Article 11.- Le syndicat est le seul responsable du système, il devra aider à l'observance des lois et arrêtés en vigueur et porter ses membres à les respecter loyalement.
Article 12.- Les Départements des Travaux Publics exercera un droit de contrôle sur les activités du syndicat, en ce qui concerne l'exécution du présent contrat.
Article 13.- Ce contrat est valable pour une période d'une année, à compter de la date de sa signature, et est renouvelable par tacite reconduction. Dans le cas ou l'une des parties contractantes désire y mettre fin, elle devra en avertir l'autre par lettre recommandée avec avis de réception au moins 30 jours francs avant l'expiration du dit contrat.
Article 14.- A l'expiration de ce contrat, le syndicat devra remettre à l'Etat Haïtien le système concédé sauf cas de force majeure, en parfait état de fonctionnement.
Article 15.- En cas de non observance par l'une des parties contractantes des clauses stipulées ci-dessus, le contrat pourra être déclaré nul de plein droit.

Fait en double original, à Port-au-Prince, le 12 septembre 1953, an 150eme de l'Indépendance.

Pour l'Etat Haïtien: Lucien Hibbert, Secrétaire d'Etat des Finances
Georges Cauvin, Secrétaire d'Etat des Travaux Publics

Pour le Syndicat: Duvivier Georges, Président de son conseil d'administration

Pour copie conforme: Le secrétaire Général du Sénat, Dr Paul Nicolas

Loi du 21 septembre 1953 sanctionnant le contrat ente l'Etat Haïtien et le Syndicat Agricole d'Avezac.
Moniteur No 91 du 28 septembre 1953.

Loi Paul E. Magloire, Président de la République

Vu les articles 57 et 79 de la Constitution

Considérant qu'il y a lieu de sanctionner le contrat passé à Port-au-Prince, le 12 septembre 1953 entre

1)le Secrétaire d'Etat des Finances, M. Lucien Hibbert, identifié su No 3902-OO et le Secrétaire d'Etat des Travaux Publics, M. Georges Cauvin, identifié au No 3816-PP pour l'exercice en cours, agissant en vertu d'une décision du Conseil des Secrétaires d'Etat en date du…….1953, d'une part ;

ET

2) Le Syndicat Agricole d'Avezac, ci-après dénommé «Le Syndicat» ayant son siège à Sovo, Commune de Camp-Perrin, Arrondissement des Cayes, représenté par le Président du Comité de Direction M. Duvier Georges, identifié au No 3-AA, pour l'exercice, d'autre part;

Sur le rapport des Secrétaires d'Etat des Finances et des Travaux Publics;

Apres délibération en Conseil des Secrétaires d'Etat

A PROPOSÉ ET LE CORPS LEGISLATIF A VOTÉ LA LOI SUIVANTE:

Art. 1.- Est et demeure sanctionné, pour sortir son plein et entier effet avec une modification de l'article 10, le contrat en date du 12 septembre 1953, intervenu entre l'Etat Haïtien, représenté par le Secrétaire d'Etat des Finances M. Lucien Hibbert, et le Secrétaire d'Etat des Travaux Publics, M Georges Cauvin, agissant pour le gouvernement haïtien d'une part; et l Syndicat Agricole d'Avezac, ayant son siege Sovo, Commune de Camp-Perrin, Arrondissement des Cayes, représenté par son Président M. Duvier Georges.

Le dit contrat se rapporte à l'administration du système du canal d'Avezac par le Syndicat Agricole d'Avezac.

«Art. 10.- A la fin de chaque exercice budgétaire les pièces justificatives des dépenses effectuées au cours de l'année seront expédiées au Département des Finances avec un rapport du comité de surveillance».

Art. 2.- La présente loi abroge toute loi ou disposition de loi, tout décret-loi ou disposition de décret-loi qui lui sont contraires et sera publiée et exécutée à la diligence des Secrétaires d'Etat des Finances et des Travaux Publics, chacun en ce qui le concerne.

Fait à la Chambre des Députés, à Port-au-Prince, le 16 septembre 1953, an 150eme de l'Indépendance

Le president: Adelphin Telson

Les Secrétaires:L. Jean, D. B. Lamothe

Donné à la Maison Nationale à Port-au-Prince, le 17 septembre 1953, an 150eme de l'Indépendance

Le President: Charles Fombrun

Les Secrétaires:W. Sansaricq, E. Jonassaint

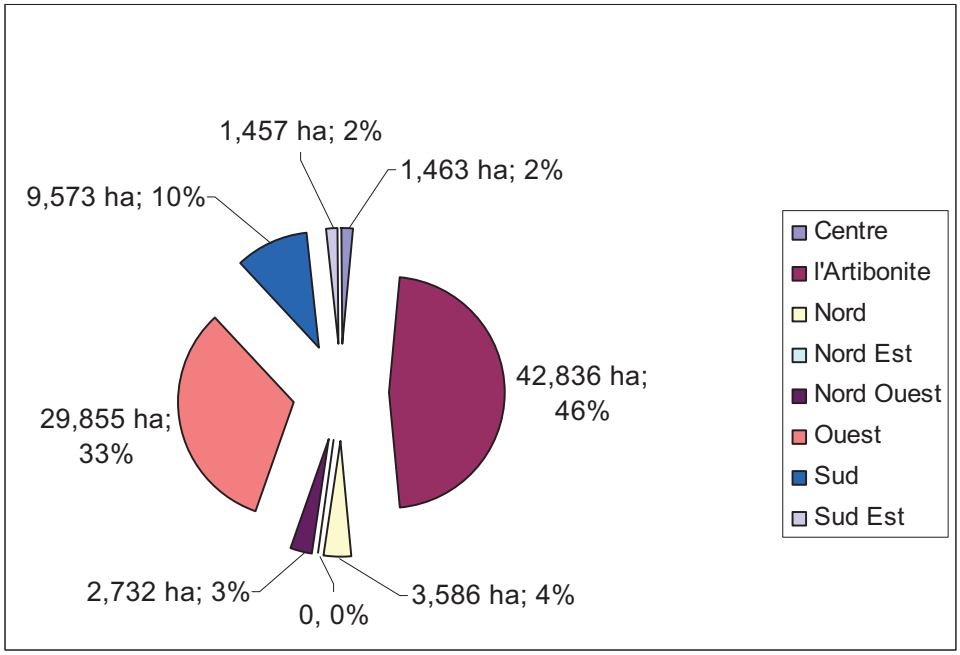
Au nom de la République

Le Président de la République ordonne que la loi ci-dessus soit revêtue du sceau de la République, imprimée, publiée et exécutée.

Donné au Palais National à Port-au-Prince, le 21 septembre 1953, an 150eme de l'Indépendance.

Par Le Président: Paul E. Magloire
Le Secrétaire d'Etat des Finances et de l'Economie Nationale: Lucien Hibbert
Le Secrétaire d'Etat des Travaux Publics: Georges Cauvin
Le Secrétaire d'Etat à la Présidence et des Cultes: Monclair Zépherin
Le Secrétaire d'Etat à l'Agriculture et au Commerce: Daniel Heurtelou
Le Secrétaire d'Etat de l'Intérieur et de la Défense Nationale et de la Justice: Ducasse Jumelle
Le Secrétaire d'Etat des Relations Extérieures et de l'Education Nationale: Pierre Liautaud
Le Secrétaire d'Etat de la Santé Publique et du Travail: Roger Dorsinville

Annexe 2.3: répartition géographique de la superficie équipée pour l'irrigation en Haïti



Source: auteur, selon les données de la FAO AQUASTAT

Figure 2: répartition géographique de la superficie équipée pour l'irrigation en Haïti

ANNEXE III: Localisation et histoire des trois systèmes d'irrigation étudiés

La carte suivante de la figure 3 et les tableaux 2, 3 et 4 qui suivent présentent respectivement la localisation et l'histoire des périmètres irrigués de Saint-Raphaël, Dubré et Grison Garde.

Source: German Agro Action

Figure 3: Carte de localisation des trios périmètres étudiés, ainsi que d'autres systèmes d'irrigation qui bénéficient des actions de l'Agro Action Allemande

Tableau 2: Bref historique du système d'irrigation de Saint-Raphaël

Période	Les faits saillants
Coloniale	Des cultures vivrières étaient produites le long de la rivière Bouyaha
1925	Première tentative d'implantation du système d'irrigation
1930	Introduction de la culture du tabac dans la région par les Jamaïcains et les Italiens; en conséquence deux petits systèmes (Merlaine et Buenabite) furent construits par les promoteurs de cette culture
1945-1948	Construction du barrage de dérivation sur la rivière Bouyaha pour alimenter le système d'irrigation de Saint-Raphaël
1951-1956	Le SCIPA* avait réalisé une campagne de vulgarisation agricole et introduit la culture du riz ainsi que des cultures maraîchères
1965	La gestion du système fut transférée a l'administration haïtienne – par manque d'entretien il fut vite dégradé à un tel état que seulement moins de 200 hectares pouvaient être irriguées pendant une partie de l'année
1970	Un cyclone a sérieusement endommagé le système le rendant non fonctionnel
1977	Le Conseil Communautaire et l'Organisme de Développement du Nord (ODN) avaient exécuté des travaux qui permettaient la remise en fonction du canal principal jusqu'à la porte 25. une campagne de vulgarisation agricole visant la promotion de la culture du riz avait aussi été organisée
1979	En plus des travaux d'aménagement au niveau du canal principal sur le tronçon allant des portes 8 10, l'ODN a construit des canaux secondaires et des drains
1989-1991	La GTZ (Organisme de Coopération Technique Allemande) a entrepris des travaux de bétonnage de tronçons de canaux et a été l'instigateur de la mise en place du Comité Central d'Irrigation de Saint-Raphaël (CCISR)
1994	La Fondation Panaméricaine pour le Développement (PADF) a organisé des travaux de curage à haute intensité de main-d'œuvre qui visait à créer des emplois dans la zone. Reprise des activités du CCISR après des années d'interruption due a la crise politique qu'a connue le pays
1996	L'Agro Action Allemande (GAA) a patronné la réalisation des travaux de curage de canaux
A partir de 1998	Le GAA a exécuté plusieurs projets qui visent la réhabilitation – extension du réseau d'irrigation, le renforcement des capacités institutionnelles pour assurer la gestion efficace du système par les usagers, ainsi que l'accompagnement des agriculteurs pour une meilleure exploitation et valorisation des potentialités agricoles au niveau du périmètre irrigué. Le CCISR est autorisé par les autorités régionales du MARNDR à collecter et à gérer la redevance d'irrigation

Tableau 3: Histoire du périmètre irrigué de Dubré

Période	Intervention d'agents externes	Évolution de l'infrastructure	Évolution de la gestion de l'eau	Évolution sociale de l'organisation d'irrigants	Évolution des Systèmes de Production
Avant 1995		**Construction d'une prise sur berge droite de la rivière** (*batardeaux en bois, construits par les usagers d'eau et souvent écrasés par les crues*)	**Gestion étatique, distribution non organisée** - l'eau circule difficilement de parcelle en parcelle, pas de canaux secondaires - irrigation en condition difficile	Pas d'organisation sociale	Production de riz patate douce, pois inconnu
1995	CARITAS	**Réhabilitation de la prise** : - Construction du barrage en béton non armé - Fouille canal principal + construction de quelques mètres linéaires en maçonnerie	**Gestion étatique, distribution non organisée** - barrage détruit avant d'être inauguré	Pas d'organisation sociale	Riz, patate douce, maïs, pois inconnu
1995 - 2001		Retour à l'ancienne pratique d'avant 1995			
2002 à nos jours	Agro Action allemande	**Nouvelle réhabilitation**: - Prise sur les deux berges de la rivière - Fouille des canaux (princ. /sec. /tertiaires) - Maçonnerie des canaux primaires et construction des ouvrages de distribution - Installations des vannettes	**Distribution organisée** - Promotion pour la gestion autonome du système - Mise en place d'un système de gestion : budget, redevances, horaire. - Présence de deux vanniers - Réseau de distribution sécurisé par des cadenas	Mise en place des structures de gestion : association et comités d'irrigants Mise en place de statuts, règlements internes Accompagnement de l'association par des formations	Riz (en été) Cultures maraîchères introduites et pratiquées en hiver

Source: GAA (2006)

Tableau 4: Histoire du périmètre irrigué de Grison-Garde

PERIODE	INTERVENTION	EVOLUTION DE L'INFRASTRUCTURE	ORGANISATION DU PERIMETRE (Evolution de la gestion de l'eau et organisation sociale)	SYSTEME DE CULTURE
1937 - 1940	J. J. WHITE	• Construction du système d'irrigation de Grison-Garde • Prise sur berge droite de la rivière	Distribution de l'eau non organisée	Patate douce, maïs
1941 - 1943	SHADA	------	-------	Plantation de **hevea** vulgairement appelé " **kòn kabwit**" sur une superficie de plus de 150 carreaux
15 novembre 1963	INONDATION (causée par un cyclone)	Système quasiment détruit		
1970 - 1977	IDAI	• Installation des vannes • Construction du mur de protection entre 1ère et 2ème vanne de chasse	Distribution partiellement organisée : • Présence d'un syndic d'irrigation • Introduction taxe d'irrigation • Existence d'un programme de crédits agricoles	Patate douce, maïs, manioc
1977 - 1986	ODN (phase I)	Réhabilitation du système d'irrigation : • Construction du barrage • Réparation (porte 1 à porte 6) • Protection berges de la rivière	Distribution partiellement organisée : - Sanction pour vol d'eau - Usage de l'eau sans taxe d'irrigation	• Patate douce, maïs • Introduction de nouvelles variétés de riz et de manioc
1986 - 1990	ODN (phase II)	Réhabilitation du système d'irrigation : • Réparation (porte 6 à porte 8) • Installation des vannettes	Distribution organisée : ▪ Horaire en période d'étiage ▪ Présence de 2 syndics	- Riz, patate douce, maïs, manioc - Labourage à traction animale
1995	AAGETO (PADF)	Curage des canaux (projet de création d'emploi)		Idem
Novembre 1995 - avril 1996	MARNDR	Réparation des dommages causés par cyclone GEORGES		Idem
Septembre 2001 - mai 2002	MARNDR	**1- Travaux de maçonnerie** - 734 mètres linéaires sur canal principal (de porte 7 à porte10) - 100 mètres linéaires de canal secondaire à la porte 7 **2- Gabionnage et bétonnage du barrage**		Idem
2002 à nos jours	AAA MARNDR	Projet ZAK 1003 BMZ	Distribution mieux organisée : - présence de 2 vanniers policiers - prélèvement des redevances d'irrigation - Application règlement interne et sanctions	Riz, haricot, arachide (pistache), maïs, manioc

Source: GAA (2006)

ANNEXE IV: Organigramme des structures de gestion : CCIGG, CCID et CCISR

Les figures 2, 3 et 4 ci-dessous présentent respectivement l'organigramme de l'association d'irrigant de Grison Garde, Dubré et Saint-Raphaël (selon les dossiers des associations en question et l'Agro Action Allemande).

Figure 2: structure organisationnelle de la gestion du périmètre irrigué de Saint-Raphaël

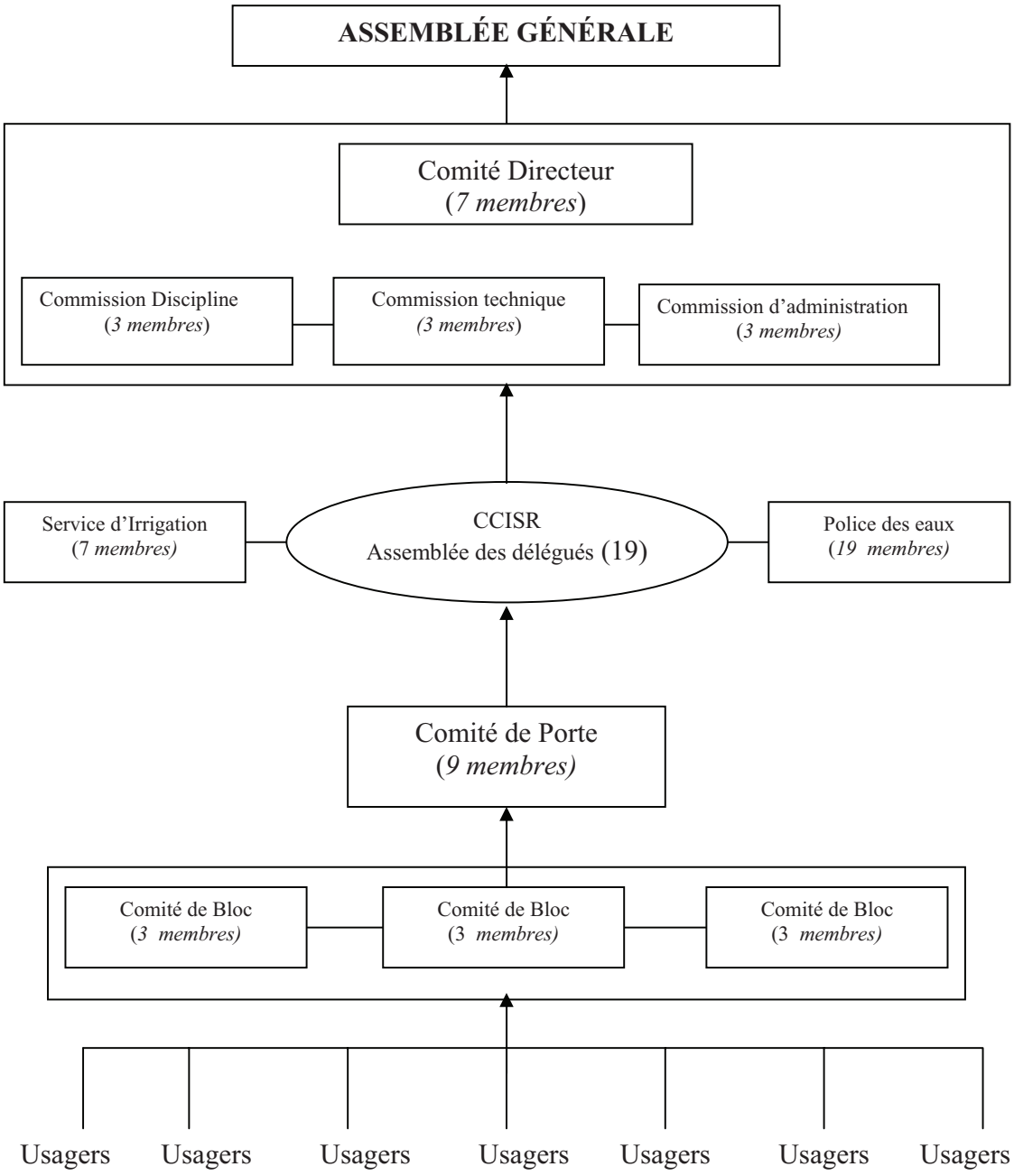


Figure 3: structure organisationnelle de la gestion du périmètre irrigué de Grison-Garde

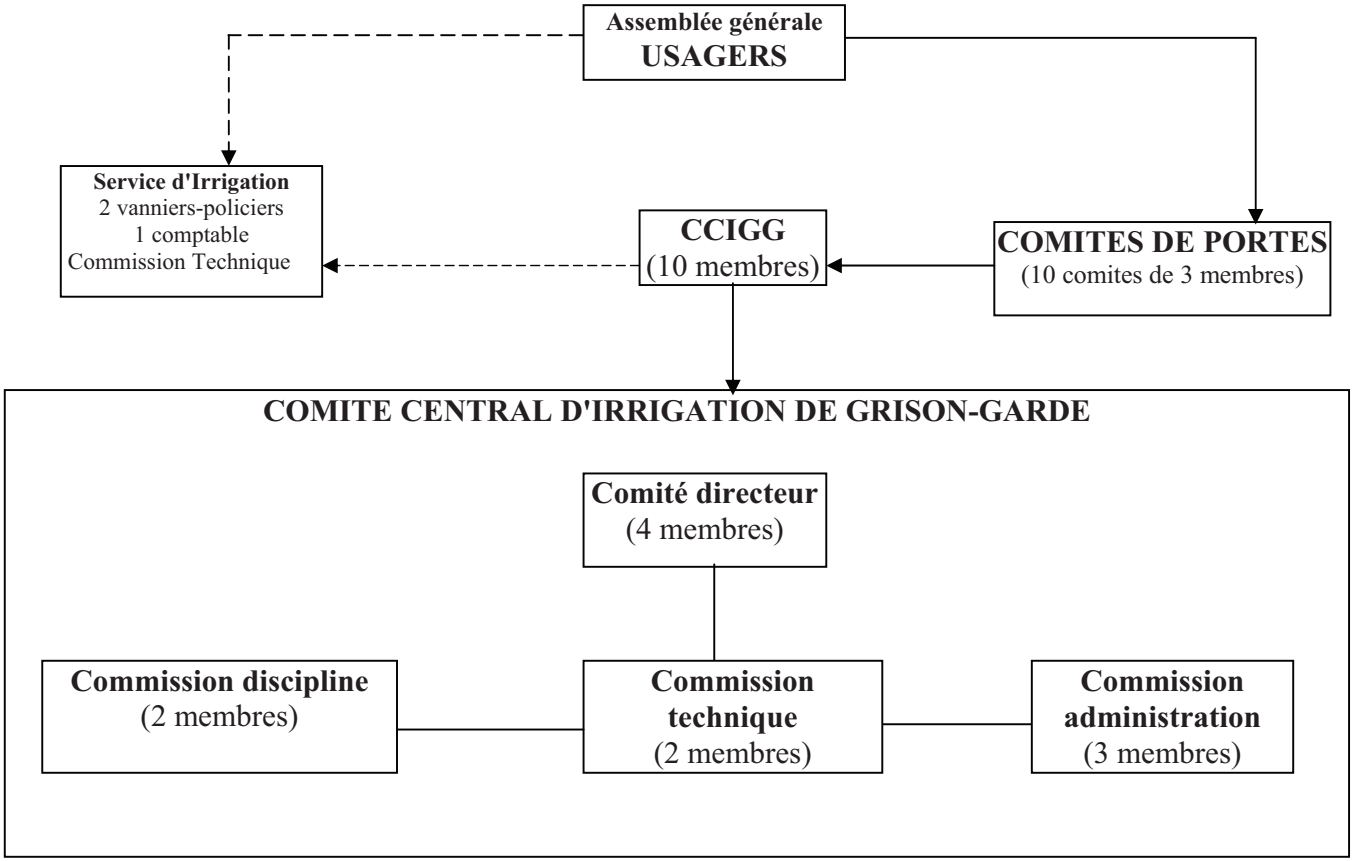
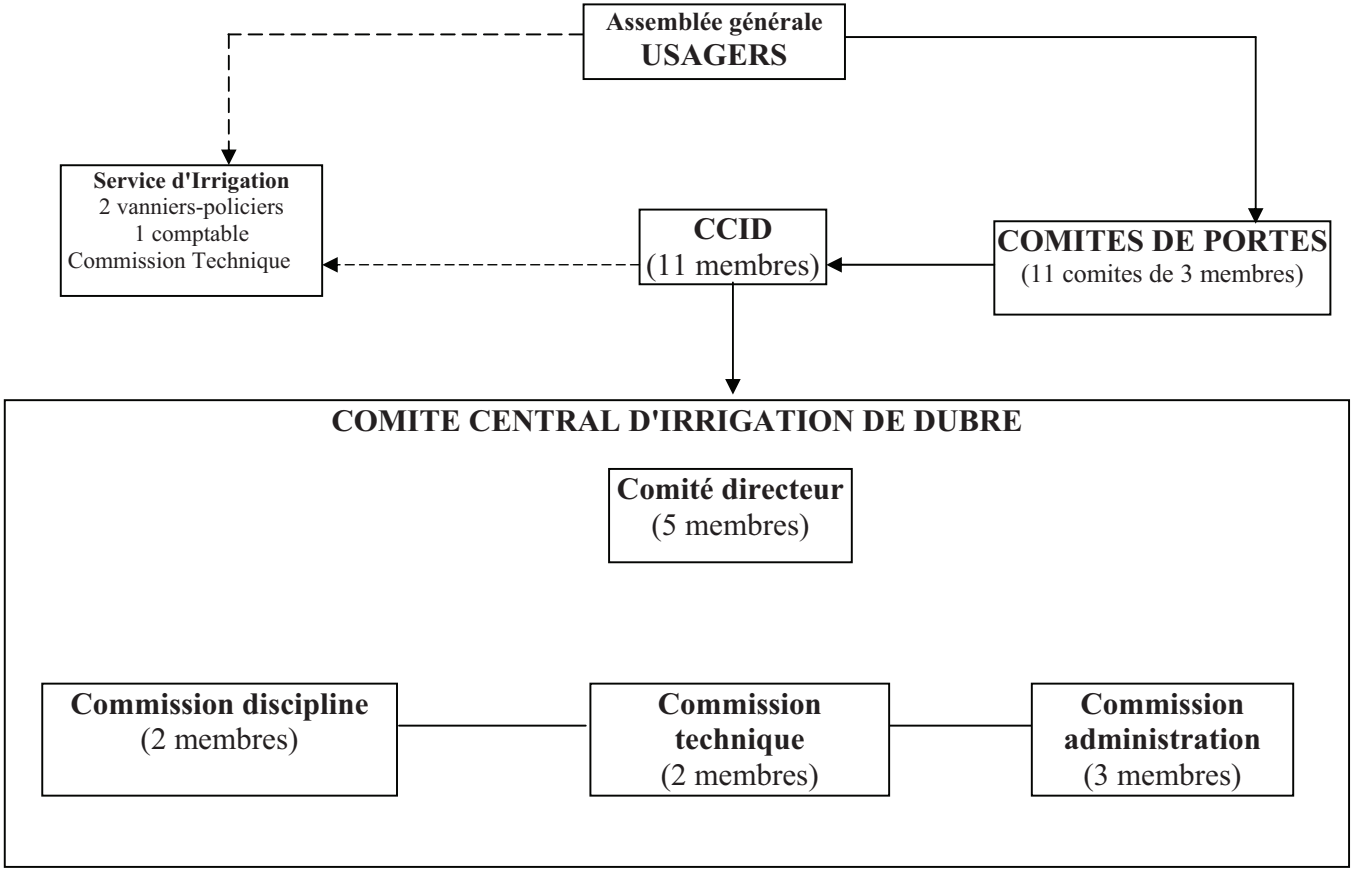
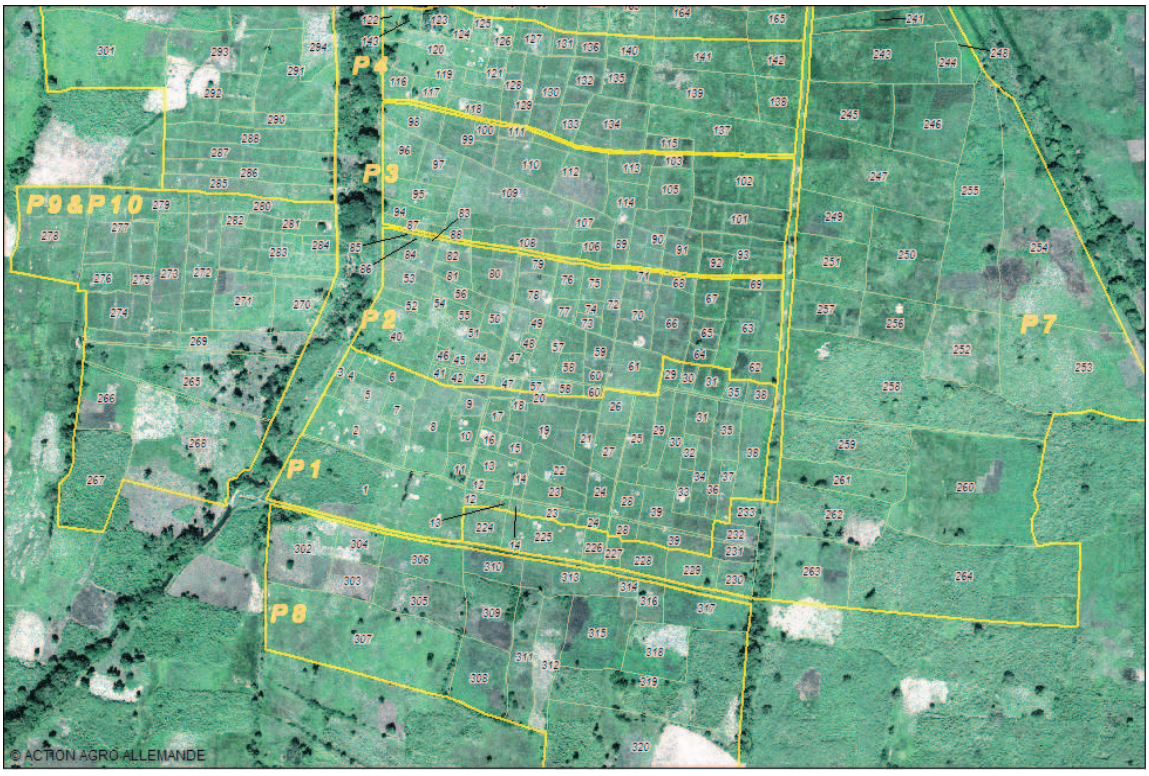


Figure 4: Structure organisationnelle de la gestion du périmètre irrigué de Dubré



ANNEXE V: Plan parcellaire du périmètre irrigué de Dubré



ANNEXE VI: Données relatives aux investigations de terrain

Annexe 6.1 Horaire d'irrigation a Saint-Raphaël

Le tableau 5 suivant présente l'horaire d'irrigation appliquée au niveau du canal principal du périmètre irrigué de Saint-Raphaël

Table 5: Horaire d'irrigation à Saint-Raphaël

Canaux secondaires	Horaire d'irrigation
Cas I : abundance d'eau	
Pas d'horaire, les usagers arrosent leurs parcelles à volonté	
Cas II: suffisance d'eau; ~90 cm de hauteur d'eau à l'entrée du canal principal	
Canaux secondaires 1 à 10 B	dimanche 6H AM jusqu'au jeudi 6H PM
Secondaires 11 à 17	Jeudi 6H PM jusqu'ua dimanche 6H AM
Cas III: rareté d'eau, ~30 cm de hauteur d'eau à l'entrée du canal principal	
Secondaires 1 à 7	Du dimanche 6H AM jusqu'au jeudi 6H PM
Secondaires 8 à 10 B	Du mardi 6H PM jusqu'au jeudi 6H PM
Secondaires 11 à 17	Du jeudi 6H PM jusqu'au dimanche 6H AM

Source: auteur selon les données collectées du CCISR

Annexe 6.2: Etat financier des activités génératrices de revenus détenues par la structure de gestion du périmètre irrigué de Saint-Raphaël

Table 6 états financiers des activités économiques du CCISR

Activities	Date	Chiffre d'affaire en HTG
Boutique d'intrants	Au mois d'avril 2006	439,901.25
Entrepôt	Au mois d'avril 2006	258, 652.72
Moulin à riz	Au mois de septembre 2005	41,849.00
Moulin à maïs	Au mois d'avril 2006	48,975.00

Source: auteur selon les données collectées du CCISR et de la GAA

Annexe 6.3.- Données sur les caractéristiques socio-économiques des usagers

Données sur les caractéristiques socio-économiques des usagers des périmètres

Perimetre irrigue de Dubre

					superficie irriguee en carreaux				
No	**Genre**	**Age**	**NI**	**TF**	**propriete**	**metayage**	**fermage**	**SCS**	
1	M	32	PRI	7	0.375			0.375	
2	M	50	PRI	8		0.438		0.438	
3	M	60	PRI	4		0.125		0.125	
4	M	54	PRI	7		0.25		0.25	
5	M	50	PRI	7	0.5	0.375		0.875	
6	M	45	PRI	5	0.5	0.25		0.75	
7	M	28	PRI	5		0.125		0.125	
8	M	43	PRI	6		0.25		0.25	
9	M	45	PRI	6	0.25	0.25	0.25	0.75	
10	M	30	SEC	4	0.125	0.125		0.5	
11	M	49	PRI	6			0.06	0.06	
12	M	25	ANA	3		0.25		0.25	
13	M	44	PRI	7	0.375			0.375	
14	M	33	SEC	7	0.08			0.08	
15	M	53	PRI	6	0.625			0.25	
16	M	45	PRI	5	0.375	0.125		0.5	
17	M	63	ANA	7		0.35		0.35	
18	M	48	SEC	3		0.125		0.125	
19	M	41	ANA	3		0.25		0.25	
Périmètre irrigue de Grison Garde									
1	M	70	PRI	5	0.625	0.375		0.75	
2	M	60	ANA	6		0.375		0.375	
3	M	32	PRI	6		0.125		0.125	
4	M	36	SEC	5	1			0.75	
5	M	48	PRI	8	0.25	0.25		0.5	
6	M	45	PRI	7		0.1		0.1	
7	M	61	PRI	6		0.25	0.25	0.5	
8	M	60	ANA	2	0.25			0.25	
9	M	51	PRI	10		0.3125	0.313	0.625	
10	M	67	PRI	5	1.625		0.25	0.5	
11	M	54	PRI	10	0.375	0.125		0.5	
12	M	37	PRI	6	0.125	0.0625		0.188	
13	M	69	PRI	2	1.5			0.5	
14	M	25	SEC	3	1.25			0.5	
15	M	65	PRI	6	0.5	0.5		1	
16	M	54	SEC	7	0.5	0.25		0.75	
17	M	42	PRI	5	0.25			0.125	
18	M	35	ANA	3	0.063			0.063	
19	M	45	ANA	11		0.25		0.25	
20	M	48	PRI	3	0.5	1		1	
21	M	57	ANA	3	0.5			0.375	

22	M	48	PRI	11	0.5	0.375		0.375	
23	M	54	ANA	7	1.125	0.625		0.625	
24	M	33	SEC	1	0.25			0.25	
25	F	54	PRI	5			0.2	0.2	

					superficie irriguee en carreaux				
No	**Genre**	**Age**	**NI**	**TF**	**propriete**	**metayage**	**fermage**	**SCS**	**CAP**
26	M	43	PRI	7	0.25	0.75	0.313	0.75	
27	M	52	PRI	7	0.25	0.5	0.25	1	
28	M	51	PRI	9	0.87			0.87	
29	M	51	PRI	10		0.25		0.25	
30	M	60	ANA	4	0.125	0.25	0.375	0.75	
31	M	23	PRI	1	0.125			0.125	
32	M	64	PRI	7	1		0.25	0.75	
33	M	53	PRI	4	0.5			0.5	
34	M	55	ANA	2	1.125			0.375	
35	M	45	SEC	6			0.25	0.25	
36	M	50	PRI	10	0.25		0.05	0.125	
37	M	45	PRI	7	0.25			0.25	
38	M	70	ANA	4		0.625		0.375	
39	M	34	SEC	3	1.125			0.75	
40	M	43	PRI	4	0.25			0.25	
Périmètre irrigue de Saint-Raphaël									
1	M	74	ANA	2	0.225			0.225	MA
2	F	45	ANA	9	0.08			0.08	MS
3	M	49	ANA	8	0.375		0.225	0.6	MA
4	M	37	PRI	7	0.1			0.1	MI
5	M	25	ANA	1		0.04		0.04	MS
6	M	42	SEC	8	0.875		0.5	1.375	MA
7	M	58	ANA	7	0.5			0.5	MA
8	M	43	PRI	4			0.125	0.125	MA
9	M	27	PRI	7	0.125			0.125	MA
10	M	61	SEC	9	0.125			0.125	MA
11	M	33	PRI	6			0.25	0.25	MA
12	M	38	PRI	7			0.125	0.125	MA
13	M	65	PRI	3	0.25			0.25	MA
14	M	35	SEC	4	1.5			1.5	MA
15	M	18	ANA	1	0.25			0.25	MA
16	M	36	PRI	6	0.155			0.155	MA
17	M	47		7	0.625			0.625	MI
18	F	40	SEC	5	0.5		0.25	0.75	MA
19	M	36	PRI	4	0.575		0.125	0.25	MA
20	M	55	ANA	5			0.125	0.125	MA
21	M	23	PRI	1	0.125			0.125	MA
22	M	30	ANA	4	0.25		1	1.25	MA
23	M	35	ANA	5			0.125	0.125	MA
24	M	56	ANA	6	0.75			0.72	MA

25	M	22	SEC	1	0.625			0.625	MA
26	M	20	SEC	1			0.063	0.063	MA
27	M	30	PRI	5	0.5		0.5	1	MA
28	M	47	ANA	6	1.25			1.25	NSP
29	M	50	ANA	6	1			1	MA
30	M	70	ANA	4	0.375			0.375	MA
31	M	30	PRI	5	0.75			0.75	MA

					superficie irriguee en carreaux				
No	**Genre**	**Age**	**NI**	**TF**	**propriete**	**metayage**	**fermage**	**SCS**	**CAP**
32	M	32	SEC	6			0.75	0.75	MA
33	M	45	ANA	3			0.125	0.125	MA
34	F	40	ANA	3	1			1	MI
35	M	44	PRI	7	0.125			0.125	MA
36	M	34	PRI	4	0.75			0.75	MA
37	M	36	ANA	6			0.75	0.75	MA
38	M	58	ANA	5	0.25		0.5	0.75	MA
39	M	32	PRI	5	0.5			0.5	MA
40	M	30	SEC	5	0.375			0.375	MI
41	M	45	ANA	9	0.25			0.25	MA
42	M	57	ANA	3	0.5		0.25	0.75	MA
43	M	36	PRI	6	0.25		0.25	0.5	MA
44	M	63	PRI	4	0.2		0.25	0.45	MA
45	M	33	PRI	6			0.375	0.375	MA
46	M	24	ANA	3	0.063			0.063	NSP
47	M	27	PRI	2			0.2	0.2	MA
48	M	45	PRI	7	0.375			0.375	MA
49	M	48	ANA	5	0.25			0.25	MA
50	M	33	PRI	6	0.125		0.5	0.625	MA
51	M	28	PRI	2	0.25			0.25	MA
52	M	54	PRI	3	0.125		0.25	0.375	MA
53	M	53	ANA	11	0.25		0.25	0.5	MA
54	M	31	ANA	5	0.25			0.25	MA
55	M	55	ANA	6	0.25		1	1.25	MA
56	M	47	PRI	8	0.875			0.875	MA
57	M	40	PRI	6	0.75			0.75	MA
58	M	40	PRI	6	0.125			0.125	MA
59	M	42	SEC	8	0.5		0.625	1.125	MA
60	M	57	ANA	7	0.5			0.25	MA
61	M	29	PRI	3	0.25		0.25	0.5	MA
62	M	29	PRI	5	0.25			0.25	MA
63	M	39	PRI	7	0.12		0.25	0.37	MA
64	M	62	PRI	2	0.25			0.25	MA
65	M	57	ANA	2			0.25	0.25	MA
66	M	24	PRI	3	0.25			0.25	MA
67	M	40	PRI	4	0.08			0.08	MA
68	M	35	PRI	7	2			1	MA
69	M	40	ANA	8	0.375			0.375	MA

70	M	55	ANA	5			0.2	0.2	MA
71	M	26	PRI	4	0.125			0.125	MA
72	M	30	ANA	4			0.063	0.063	MA
73	M	36	SEC	7	0.125		0.25	0.375	MA
74	M	52	PRI	9	0.2		0.152	0.325	MA
75	M	48	PRI	7	0.25			0.25	MI
76	M	32	PRI	2			0.25	0.25	MA
77	M	31	ANA	3			0.375	0.375	MA
78	M	37	SEC	6	0.375		0.375	0.75	MA
79	M	59	ANA	1			0.125	0.125	MA

					superficie irriguee en carreaux				
No	**Genre**	**Age**	**NI**	**TF**	**propriete**	**metayage**	**fermage**	**SCS**	**CAP**
80	M	34	PRI	6	0.063			0.063	MA
81	M	29	PRI	4			0.125	0.125	MA
82	F	60	ANA	18	0.5			0.5	MA
83	M	45	ANA	6	0.25		0.125	0.375	MI
84	M	52	ANA	4					MA
85	M	38	PRI	3	0.25		0.25	0.5	MA
86	M	60	PRI	5	0.125		0.14	0.265	MA
87	M	80	ANA	1	0.75			0.75	MA
88	M	64	ANA	7	0.5			0.5	MA
89	M	38	PRI	6	0.25			0.25	MA
90	M	56	PRI	12	0.25			0.25	MI
91	M	37	PRI	8		0.063		0.063	MA
92	M	38	PRI	3	0.25			0.25	MA
93	M	44	PRI	4	0.125			0.125	MA
94	M	62	ANA	6			0.125	0.125	MA
95	M	40	ANA	6			0.125	0.125	MA
96	M	30	SEC	1	2		0.13	0.33	MA
97	M	34	SEC	4	1			1	MS
98	M	44	SEC	5	0.1			0.1	MA
99	M	49	PRI	6	0.375			0.375	MA
100	M	30	PRI	8	0.75			0.75	MA
101	M	59	ANA	10	2			0.375	MA
102	M	30	SEC	3	0.25			0.25	MA
103	M	38	SEC	6	0.25			0.25	MA
104	M	22	SEC	1	0.625			0.625	MA
105	M	30	PRI	7			0.5	0.5	MA
106	M	31	PRI	1	1		0.25	1.25	MA
107	M	35	PRI	5			0.375	0.375	MA
108	M	32	ANA	4	0.75		0.125	0.625	MA
109	M	39	SEC	7	0.75		0.25	0.5	MA
110	M	68	PRI	5	1			0.5	MA
111	M	39	PRI	7	0.75			0.375	MA
112	M	61	PRI		1.25			1.25	NSP
113	M	55	ANA	6			0.125	0.125	MA
114	M	51	PRI	12	2			2	MA

115	M	36	PRI	7	0.125		0.125	0.25	MA
116	M	49	SEC	5	0.75		0.5	1.25	MA
117	M	65	PRI	4	0.45		0.25	0.7	MA
118	M	39	PRI	7	0.5			0.5	MA
119	M	71	PRI	2	3			3	MA
120	M	37	SEC	5	1.75			1.75	MA
121	M	43	PRI	9	0.42			0.42	MA
122	M	56	PRI	6	0.15		0.125	0.275	MI
123	M	42	SEC	5	0.625		0.5	1.125	MA
124	M	53	ANA	2			0.25	0.25	MA
125	M	35	PRI	5			0.25	0.25	MI
126	M	59	PRI	2	0.19			0.19	MA
127	M	30	ANA	5	0.25		0.18	0.43	MA

					superficie irriguee en carreaux				
No	**Genre**	**Age**	**NI**	**TF**	**propriete**	**metayage**	**fermage**	**SCS**	**CAP**
128	M	30	SEC	4	0.125		0.25	0.375	MI
129	M	40	ANA	8			0.125	0.125	MA
130	M	52	PRI	8	0.75			0.75	MA
131	M	35	PRI	7	0.3		0.275	0.575	MA
132	M	65	ANA	10	0.25			0.25	MA
133	M	31	SEC	3			0.25	0.25	MA
134	M	54	ANA	7	0.5			0.5	MA
135	M	46	ANA	10	0.25		0.25	0.5	MA
136	M	43	SEC	5	0.25			0.25	MA
137	M	40	PRI	4	0.375			0.375	MA
138	M	31	PRI	4	0.125		0.125	0.25	MA
139	M	63	PRI	6	0.5			0.5	MA
140	M	52	PRI	12	0.75			0.75	MA
141	M	36	SEC	6	0.1			0.1	MI
142	M	27	SEC	1	0.25		0.125	0.375	MA
143	M	28	SEC	1	0.225			0.225	MA
144	M	40	ANA	3	0.625			0.625	MA
145	M	62	PRI	7	0.25			0.25	MA
146	M	40	ANA	6	0.25			0.25	MA
147	M	27	ANA	6	0.25		0.25	0.5	MA
148	M	70	ANA	7			1.125	1.125	MA
149	M	26	PRI	1	0.2			0.2	MA
150	M	30	PRI	6			0.25	0.25	MA

NI: niveau 'instruction			PRI: primaire					
M: masculin			F: féminin					
CAP: consentement à payer pour bénéficier de l'eau d'irrigation								
MS: montant supérieur au montant actuel								
	MI: montant inférieur au montant actuel							
MA: montant actuel de la redevance d'eau								
	SCS: superficie cultivée par saison culturale							

Annexe 6.4.- Perception des usagers sur la performance de gestion des périmètres et leur participation aux activités de gestion et d'entretien

Perception des agriculteurs sur la performance de gestion des périmètres et leur participation aux activités de gestion et d'entretien											
périmètre irrigué de Dubre											
No	**EGG**	**Equite**		**resp. horaire**		**AEFBA**		**DSTR**	**Particip. agricult. aux activit.**		
		ATG	**MNT**	**ATG**	**MNT**	**ATG**	**MNT**		**maint.**	**reunions**	**S & M**
1	sft	N/A	8	N/A	8	msuf	suf	msft	svt	svt	svt
2	sft	N/A	9	N/A	6	msuf	msuf	msft	pfs	pfs	svt
3	bien	N/A	9	N/A	6	msuf	suf	msft	svt	svt	svt
4	sft	N/A	8	N/A	7	nsuf	msuf	msft	pfs	svt	svt
5	bien	N/A	8	N/A	7	nsuf	suf	msft	svt	svt	pfs
6	sft	N/A	7	N/A	6	nsuf	nsuf	msft	svt	svt	jms
7	bien	N/A	9	N/A	8	nsuf	suf	msft	svt	svt	svt
8	bien	N/A	9	N/A	8	nsuf	tsuf	sft	svt	svt	svt
9	sft	N/A	8	N/A	7	nsuf	suf	msft	svt	pfs	svt
10	sft	N/A	7	N/A	8	nsuf	suf	msft	pfs	pfs	pfs
11	bien	N/A	9	N/A	8	nsuf	tsuf	msft	svt	svt	svt
12	bien	N/A	9	N/A	8	suf	suf	msft	svt	pfs	svt
13	bien	N/A	9	N/A	8	msuf	tsuf	sft	svt	svt	svt
14	sft	N/A	9	N/A	8	nsuf	tsuf	msft	svt	jms	svt
15	sft	N/A	9	N/A	7	msuf	tsuf	msft	svt	tjs	svt
16	sft	N/A	9	N/A	9	nsuf	suf	msft	svt	tjs	tjs
17	sft	N/A	8	N/A	7	nsuf	suf	msft	svt	svt	svt
18	sft	N/A	7	N/A	8	msuf	suf	nsft	svt	svt	svt
19	sft	N/A	8	N/A	7	nsuf	msuf	msft	svt	svt	svt
Périmètre irrigué de Grison Garde											
1	sft	N/A	4	N/A	2	msuf	suf	msft	pfs	pfs	svt
2	bien	3	8	N/A	4	nsuf	suf	msft	tjs	tjs	tjs
3	bien	7	8	N/A	6	suf	suf	msft	tjs	svt	tjs
4	sft	2	10	N/A	6	nsuf	msuf	sft	tjs	tjs	svt
5	bien	4	7	N/A	6	msuf	suf	sft	tjs	tjs	tjs
6	sft	3	6	N/A	7	msuf	suf	msft	svt	svt	tjs
7	sft	2	7	N/A	7	msuf	suf	msft	jms	pfs	pfs
8	sft	5	7	N/A	7	msuf	msuf	msft	pfs	jms	pfs
9	bien	2	6	N/A	7	nsuf	suf	sft	svt	svt	svt
10	bien	3	9	N/A	5	msuf	msuf	msft	tjs	svt	svt
11	bien	3	9	N/A	9	nsuf	tsuf	sft	tjs	tjs	tjs
12	sft	N/A	9	N/A	7	msuf	suf	msft	svt	svt	svt
13	bien	4	8	N/A	8	msuf	suf	msft	tjs	svt	svt
14	sft	4	8	N/A	8	msuf	suf	msft	svt	svt	svt
15	bien	5	8	N/A	7	msuf	suf	msft	svt	svt	tjs
16	bien	4	7	N/A	6	msuf	msuf	sft	tjs	svt	svt
17	bien	3	8	N/A	8	nsuf	suf	msft	tjs	svt	svt

18	bien	3	9	N/A	9	nsuf	tsuf	tsft	svt	pfs	pfs
19	sft	N/A	8	N/A	7	msuf	msuf	msft	svt	pfs	pfs
20	mal	N/A	3	N/A	3	msuf	nsuf	nsft	svt	svt	svt
21	sft	2	4	N/A	4	nsuf	nsuf	msft	svt	tjs	svt
22	bien	2	8	N/A	7	nsuf	suf	sft	svt	pfs	pfs
23	bien	2	6	N/A	6	nsuf	msuf	sft	tjs	svt	svt

No	**EGG**	**Equite**		**resp. horaire**		**AEFBA**		**DSTR**	**Particip. agricult. aux activit.**		
		ATG	**MNT**	**ATG**	**MNT**	**ATG**	**MNT**		**maint.**	**reunions**	**S & M**
24	sft	N/A	8	N/A	4	nsuf	msuf	msft	jms	jms	jms
25	bien	5	6	N/A	7	nsuf	suf	sft	svt	svt	tjs
26	sft	2	8	N/A	7	nsuf	tsuf	sft	svt	svt	svt
27	bien	2	9	N/A	9	nsuf	tsuf	sft	svt	svt	svt
28	bien	2	7	N/A	8	msuf	suf	sft	tjs	svt	pfs
29	bien	N/A	8	N/A	7	msuf	suf	msft	svt	svt	jms
30	sft	N/A	9	N/A	8	nsuf	msuf	msft	svt	svt	tjs
31	bien	4	9	N/A	7	nsuf	suf	sft	svt	svt	jms
32	sft	6	9	N/A	6	msuf	msuf	msft	tjs	svt	pfs
33	bien	4	7	N/A	7	suf	suf	nsft	svt	pfs	tjs
34	bien	6	8	N/A	7	msuf	suf	msft	svt	svt	svt
35	sft	4	9	N/A	6	msuf	suf	msft	svt	tjs	tjs
36	sft	N/A	7	N/A	7	msuf	msuf	msft	svt	tjs	pfs
37	sft	6	9	N/A	8	msuf	suf	sft	svt	svt	svt
38	sft	N/A	4	N/A	8	msuf	suf	msft	svt	svt	svt
39	sft	5	6	N/A	5	nsuf	msuf	nsft	svt	svt	pfs
40	sft	N/A	7	N/A	6	nsuf	suf	msft	svt	svt	svt
périmètre irrigue de Saint-Raphaël											
1	bien	2	9	2	7	msuf	suf	msft	pfs	pfs	pfs
2	sft	2	7	2	6	msuf	msuf	NSP	pfs	pfs	jms
3	sft	3	9	3	6	msuf	msuf	msft	svt	svt	svt
4	bien	2	9	2	6	msuf	suf	msft	pfs	pfs	jms
5	sft	2	8	2	6	nsuf	suf	NSP	jms	jms	jms
6	mal	2	8	2	7	msuf	msuf	msft	svt	pfs	pfs
7	bien	2	8	2	7	nsuf	suf	sft	svt	pfs	svt
8	sft	2	8	2	6	msuf	msuf	NSP	pfs	pfs	svt
9	sft	N/A	8	N/A	7	N/A	suf	NSP	jms	jms	jms
10	sft	3	9	2	7	nsuf	msuf	msft	svt	svt	svt
11	bien	3	9	5	7	msuf	suf	sft	pfs	pfs	jms
12	bien	3	8	5	6	msuf	msuf	msft	jms	pfs	svt
13	bien	2	9	2	7	msuf	suf	msft	svt	svt	svt
14	bien	2	8	2	7	nsuf	suf	msft	svt	svt	pfs
15	bien	N/A	9	N/A	7	N/A	msuf	msft	jms	jms	jms
16	sft	2	9	2	6	N/A	msuf	msft	pfs	svt	pfs
17	mal	2	9	2	3	msuf	nsuf	nsft	svt	svt	svt
18	bien	2	9	2	7	nsuf	suf	NSP	svt	pfs	jms
19	bien	2	9	2	5	nsuf	suf	msft	pfs	svt	pfs

20	bien	2	9	2	5	nsuf	msuf	msft	svt	svt	jms
21	bien	2	9	2	5	nsuf	suf	msft	svt	jms	svt
22	bien	2	9	2	7	nsuf	suf	msft	svt	svt	jms
23	bien	2	9	2	5	nsuf	suf	msft	svt	svt	svt
24	bien	2	9	2	7	nsuf	suf	msft	svt	pfs	svt
25	bien	2	9	2	6	nsuf	suf	sft	svt	svt	svt
26	bien	2	9	2	7	nsuf	suf	sft	svt	svt	svt
27	sft	2	9	2	5	N/A	msuf	msft	svt	pfs	jms
28	bien	2	NSP	2	5	nsuf	NSP	sft	jms	jms	svt
29	bien	2	9	2	6	nsuf	suf	sft	svt	jms	svt

No	**EGG**	**Equite**		**resp. horaire**		**AEFBA**		**DSTR**	**Particip. agricult. aux activit.**		
		ATG	**MNT**	**ATG**	**MNT**	**ATG**	**MNT**		**maint.**	**reunions**	**S & M**
30	sft	2	9	2	7	nsuf	suf	msft	jms	jms	jms
31	bien	1	9	1	7	nsuf	suf	msft	jms	jms	jms
32	bien	N/A	9	3	7	nsuf	suf	msft	svt	pfs	svt
33	bien	N/A	9	2	7	msuf	suf	msft	svt	svt	svt
34	bien	N/A	9	1	7	nsuf	suf	sft	svt	svt	svt
35	bien	N/A	9	2	7	nsuf	suf	sft	pfs	svt	svt
36	bien	N/A	9	2	7	nsuf	suf	sft	svt	svt	svt
37	sft	N/A	9	2	6	nsuf	suf	msft	svt	tjs	svt
38	bien	N/A	9	2	8	nsuf	suf	sft	svt	jms	svt
39	sft	N/A	9	2	5	nsuf	msuf	msft	tjs	svt	svt
40	bien	N/A	9	2	5	nsuf	msuf	nsft	svt	svt	pfs
41	bien	N/A	9	2	7	nsuf	suf	msft	tjs	svt	svt
42	bien	N/A	9	1	5	nsuf	msuf	msft	svt	svt	svt
43	sft	N/A	9	2	7	nsuf	suf	msft	svt	svt	svt
44	bien	N/A	5	6	6	nsuf	suf	msft	pfs	svt	jms
45	bien	N/A	9	N/A	6	nsuf	msuf	NSP	svt	pfs	svt
46	sft	N/A	9	N/A	5	N/A	msuf	msft	tjs	svt	pfs
47	bien	2	9	3	7	msuf	suf	sft	pfs	jms	svt
48	bien	N/A	9	6	6	msuf	suf	sft	svt	svt	svt
49	bien	N/A	9	6	7	msuf	msuf	msft	svt	svt	svt
50	bien	N/A	9	6	7	nsuf	msuf	sft	svt	pfs	svt
51	sft	N/A	9	1	7	nsuf	msuf	sft	svt	svt	pfs
52	bien	N/A	9	N/A	6	msuf	suf	msft	svt	svt	svt
53	sft	N/A	9	1	7	nsuf	msuf	msft	svt	svt	jms
54	sft	N/A	9	N/A	5	nsuf	msuf	msft	tjs	svt	svt
55	bien	N/A	9	2	6	nsuf	suf	sft	svt	pfs	svt
56	bien	2	9	2	7	msuf	msuf	msft	svt	svt	svt
57	sft	2	9	2	8	msuf	msuf	msft	tjs	tjs	tjs
58	bien	3	9	2	7	msuf	nsuf	nsft	svt	svt	svt
59	bien	N/A	9	N/A	8	nsuf	suf	sft	svt	svt	svt
60	mal	2	7	2	6	msuf	msuf	msft	svt	svt	svt
61	sft	2	9	2	7	N/A	msuf	msft	svt	svt	svt
62	sft	2	9	2	7	msuf	msuf	msft	svt	svt	jms
63	bien	N/A	9	N/A	7	suf	msuf	msft	svt	svt	svt

64	bien	2	9	N/A	7	suf	msuf	msft	svt	svt	svt
65	bien	2	9	2	8	msuf	suf	sft	svt	svt	svt
66	bien	2	9	2	8	msuf	suf	sft	svt	svt	jms
67	bien	4	9	N/A	8	N/A	msuf	msft	pfs	pfs	svt
68	bien	N/A	9	2	8	nsuf	suf	sft	svt	svt	svt
69	bien	N/A	9	2	7	nsuf	msuf	msft	svt	svt	jms
70	bien	N/A	9	2	8	msuf	msuf	msft	svt	svt	jms
71	bien	N/A	9	3	8	msuf	msuf	msft	tjs	svt	jms
72	sft	N/A	9	N/A	7	N/A	NSP	NSP	jms	jms	jms
73	bien	N/A	8	2	7	msuf	msuf	msft	svt	svt	pfs
74	bien	N/A	8	2	7	msuf	msuf	msft	svt	pfs	svt
75	bien	N/A	7	2	6	msuf	msuf	msft	pfs	pfs	jms
76	bien	3	8	2	7	nsuf	msuf	msft	pfs	pfs	pfs
77	bien	N/A	9	N/A	7	N/A	suf	sft	svt	svt	svt

No	**EGG**	**Equite**		**resp. horaire**		**AEFBA**		**DSTR**	**Particip. agricult. aux activit.**		
		ATG	**MNT**	**ATG**	**MNT**	**ATG**	**MNT**		**maint.**	**reunions**	**S & M**
78	bien	N/A	9	1	7	msuf	msuf	msft	svt	svt	tjs
79	bien	N/A	9	2	7	msuf	msuf	msft	svt	pfs	tjs
80	sft	N/A	9	1	7	nsuf	NSP	NSP	jms	pfs	svt
81	sft	N/A	8	N/A	5	N/A	suf	msft	svt	svt	svt
82	bien	N/A	8	2	5	msuf	suf	NSP	pfs	pfs	jms
83	mal	3	6	2	6	msuf	msuf	nsft	pfs	jms	jms
84	sft	N/A	9	2	7	nsuf	suf	msft	pfs	jms	jms
85	sft	N/A	8	N/A	7	msuf	msuf	NSP	tjs	pfs	jms
86	bien	N/A	9	2	8	msuf	suf	msft	svt	svt	svt
87	bien	2	8	2	7	msuf	suf	msft	svt	svt	svt
88	bien	N/A	9	7	7	suf	suf	msft	svt	svt	jms
89	bien	N/A	9	2	5	suf	msuf	msft	svt	svt	svt
90	mal	N/A	6	2	6	msuf	suf	nsft	pfs	jms	svt
91	sft	N/A	9	2	7	msuf	tsuf	sft	pfs	jms	svt
92	sft	N/A	8	6	7	suf	suf	msft	pfs	jms	jms
93	bien	4	9	4	7	msuf	suf	sft	svt	pfs	svt
94	bien	N/A	9	3	8	msuf	suf	msft	svt	svt	svt
95	sft	6	9	2	7	msuf	msuf	msft	svt	svt	svt
96	bien	N/A	8	N/A	8	msuf	suf	sft	svt	svt	svt
97	bien	4	7	5	8	msuf	suf	msft	tjs	svt	tjs
98	bien	5	8	4	8	msuf	suf	msft	svt	svt	svt
99	bien	3	9	4	8	msuf	suf	msft	svt	svt	tjs
100	sft	N/A	2	6	7	msuf	suf	msft	svt	svt	svt
101	bien	4	2	4	7	msuf	suf	msft	tjs	tjs	svt
102	mal	4	8	N/A	8	suf	tsuf	msft	pfs	jms	jms
103	sft	N/A	9	N/A	8	N/A	suf	msft	pfs	pfs	svt
104	bien	7	9	7	7	msuf	msuf	msft	svt	svt	svt
105	sft	2	9	2	8	msuf	suf	msft	svt	svt	svt
106	sft	3	9	3	4	nsuf	msuf	msft	svt	svt	svt
107	sft	8	8	10	5	suf	msuf	msft	svt	svt	pfs

108	mal	8	9	8	5	msuf	msuf	msft	svt	svt	svt
109	mal	9	9	8	2	suf	nsuf	nsft	tjs	svt	tjs
110	sft	4	9	7	5	msuf	msuf	msft	tjs	svt	svt
111	bien	7	8	7	6	msuf	msuf	sft	svt	svt	svt
112	mal	N/A	8	N/A	6	N/A	msuf	msft	pfs	pfs	pfs
113	bien	4	8	4	7	msuf	suf	msft	svt	svt	tjs
114	sft	4	8	3	8	msuf	msuf	msft	svt	svt	svt
115	bien	N/A	9	5	8	msuf	suf	sft	svt	svt	tjs
116	bien	5	7	4	8	msuf	suf	msft	svt	svt	svt
117	sft	5	9	4	8	msuf	suf	msft	svt	svt	svt
118	sft	N/A	7	N/A	5	msuf	suf	msft	svt	svt	svt
119	bien	4	8	4	8	msuf	suf	sft	svt	svt	svt
120	sft	N/A	4	N/A	5	msuf	msuf	msft	tjs	svt	svt
121	bien	4	8	6	8	msuf	suf	msft	svt	svt	svt
122	bien	N/A	9	N/A	7	N/A	suf	msft	svt	svt	tjs
123	sft	4	8	8	6	suf	msuf	msft	svt	svt	svt
124	bien	4	6	4	6	msuf	msuf	msft	svt	svt	pfs
125	sft	4	7	5	6	nsuf	suf	msft	svt	pfs	jms

No	**EGG**	**Equite**		**resp. horaire**		**AEFBA**		**DSTR**	**Particip. agricult. aux activit.**		
		ATG	**MNT**	**ATG**	**MNT**	**ATG**	**MNT**		**maint.**	**reunions**	**S & M**
126	bien	N/A	9	2	7	msuf	msuf	msft	jms	svt	svt
127	bien	N/A	8	5	8	msuf	suf	msft	svt	svt	pfs
128	tbien	N/A	7	3	7	nsuf	msuf	sft	svt	svt	svt
129	sft	N/A	9	2	7	msuf	msuf	nsft	svt	pfs	pfs
130	tbien	4	8	3	7	nsuf	suf	sft	pfs	pfs	pfs
131	sft	4	8	5	6	msuf	suf	msft	svt	svt	svt
132	sft	N/A	9	2	7	msuf	suf	nsft	svt	pfs	svt
133	bien	N/A	9	2	7	msuf	suf	sft	svt	svt	svt
134	sft	N/A	9	2	6	nsuf	msuf	msft	svt	svt	svt
135	sft	N/A	9	5	8	nsuf	suf	msft	svt	svt	tjs
136	sft	N/A	9	4	8	nsuf	suf	msft	svt	svt	svt
137	bien	N/A	9	2	8	nsuf	suf	sft	svt	svt	svt
138	sft	N/A	8	2	7	msuf	suf	msft	svt	svt	svt
139	bien	N/A	8	4	7	nsuf	suf	NSP	svt	svt	svt
140	sft	N/A	9	2	8	nsuf	suf	msft	svt	svt	tjs
141	sft	N/A	7	N/A	6	N/A	suf	NSP	pfs	jms	jms
142	bien	2	9	2	8	nsuf	suf	sft	svt	svt	pfs
143	bien	2	9	2	8	nsuf	suf	sft	svt	svt	tjs
144	bien	N/A	9	2	7	msuf	suf	sft	svt	svt	jms
145	sft	2	9	4	6	msuf	msuf	msft	svt	svt	tjs
146	bien	2	9	2	7	msuf	suf	msft	svt	pfs	svt
147	bien	2	9	2	7	msuf	suf	sft	pfs	svt	svt
148	bien	4	9	4	7	msuf	msuf	sft	svt	svt	svt
149	bien	3	9	3	8	nsuf	suf	msft	svt	pfs	jms
150	bien	3	9	2	8	msuf	suf	msft	pfs	pfs	svt

EGG: Evaluation generale de la gestion du perimetre					
ATG: avant transfer de gestion	MNT: maintenant				
AEFBA: adequation de l'eau fournie aux usagers par rapports ax besoins de leurs cultures					
DSTR: degre de satifaction de l'usager par rapport aux taches accomplies par ses representants					
maint.: maintenance		nsft: non satisfaisant		nsuf: non suffisant	
S & M: surveillance et monitoring de l'application des regles etablies					
sft: satisfaisant		msft: plus ou moins satisfaisant		tsft: tres satisfait	
tbien: tres bien		N/A: non applicable		NSP: ne sais pas	
suf: suffisant	msuf: plus ou moins suffisant			tsuf: tres suffisant	
jms: jamais	pfs: parfois	svt: souvent		tjs: toujours	

ANNEXE VII: Proposition de réorganisation des quartiers d'irrigation a Saint-Raphaël

Table 7: proposition pour la réorganisation des quartiers hydrauliques au niveau du périmètre irrigué de Saint-Raphaël

Porte[1]	Superficies irrigables en hectares	Nombre actuel de quartiers hydrauliques	Nombre de quartier hydraulique proposé
1	36.79	3	1
2	45.22	3	2
3	13.71	3	1
4	11.75	3	1
5	34.18	3	1
6	30.22	3	1
7	41.49	3	2
8	59.51	3	2
9	93.38	3	3
10	184.66	3	6
10A	16.49	3	1
10B	79.52	3	3
11	52.88	3	2
12	66.88	3	2
13	135.21	3	5
14	95.22	3	3
15	163.44	3	6
16	201.95	3	7
17	105.82	3	4
Total	**1468.32**	**57**	**53**

[1] Porte ou canal secondaire