

**COMMUNITY-BASED INNOVATION DYNAMICS IN THE WATER SUPPLY
AND SANITATION (WSS) SECTOR**

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**COMMUNITY-BASED INNOVATION DYNAMICS IN THE WATER SUPPLY
AND SANITATION (WSS) SECTOR**

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To my lovely Teresita and Candela
To my parents

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LIST OF ABBREVIATIONS

ARESEP	Regulatory Authority for Public Services
ASADA	Association of Rural Water and Sanitation System
ASPWQS	Assessment System of Potable Water Quality Service
AYA	Costa Rican Institute of Aqueducts and Sewerage
BFEP	Blue Flag Ecological Program
BFEP-CC	BFEP Community Category
CAAR	Rural Water Systems Administration Committee
CACM	Central American Common Market
CB/CM	Community Based/Community Management
CB-WSS	Water Supply and Sanitation-Community Based
CB-WSS-SI	WSS Community Based Innovation System
CDD	Community Demand Driven
CELCA	Training Center for Aquiares Cleanliness
CINDE	Centro Costarricense de Iniciativas para el Desarrollo
CIVCO	Construction Research Center
CLTS	Community Led Total Sanitation
COOPEJIBAYE	Agricultural Industrial Cooperative of Pejibaye
CR-WSS	Costa Rica's Water Supply and Sanitation
EBAIS	Basic Team of Integrated Health Care
EU	European Union
FDI	Foreign Direct Investment
GHG	Greenhouse Gas
GSi	Global System of Innovation
IAD	Institutional Analysis and Development
IADB	Inter-American Development Bank
ICE	Costa Rican Institute of Electricity
IDA	Agrarian Development Institute
IFAM	Institute of Municipal Promotion and Advise
IMF	International Monetary Fund
INEC	National Institute of Statistics and Census
INTECO	Technical Norms Institute of Costa Rica
IPCC	Intergovernmental Panel on Climate Change
ISI	Import-Substitution-Industrialization
ITCO	Land and Settlement Institute
ITCR	Costa Rica Institute of Technology
JBIC	Japan Bank for International Cooperation
JMP	Joint Monitoring Program
KIO	Knowledge and Information Organizations
MDGs	Millennium Development Goals
MINAET	Ministry of Environment, Energy and Telecommunication

MINHEALTH	Ministry of Health
NGOs	Non-Governmental Organizations
NSI	National System of Innovation
OCGR	Office of the Comptroller General of the Republic (OCGR)
O&M	Operation and Maintenance
PAC	Community Help Program
PAHO	Pan American Health Organization
PAR	Participatory Action Research
PHAST	Participatory Hygiene and Sanitation Transformation
PSO	Problem Solving Organization
PRIGA	Interdisciplinary Program of Water Research and Management
RANAS	National Environmental Network in Water Supply and Sanitation
R&D	Research and Development
RSI	Regional System of Innovation
SSI	Sectoral System of Innovation
SENARA	National Service of Underwater, Irrigation and Drainage
SETENA	Environmental National Technical Secretary
SI	System of Innovation
SNAA	National Service of Aqueducts and Sewerage
SQSP	Sanitarian Quality Seal Program
S&T	Science and Technology
UCR	University of Costa Rica
UNA	National University
UNED	State Open University
USAID	United States Agency of International Development
WIE	Water Innovative Event
WHO	World Health Organization
WNL	Water National Laboratory
WSS	Water Supply and Sanitation
ZF	Zonas Francas

SUMMARY

For most of the one billion people living in extreme poverty worldwide, access to an adequate water supply and basic sanitation (WSS) is limited, resulting in substantial health, economic and social burdens. Although the international community has actively explored solutions to this crisis, primarily focusing on bottom-up approaches in which the beneficiaries participate in the design and implementation of their own WSS solutions, significant problems remain. Innovation presents an important source of feasible solutions in this sector for those in need, but insufficient study exists to allow scholars to determine the dynamics that trigger WSS innovation. In light of the recent emphasis on a bottom-up approach to water issues and the dearth of analysis with regard to the role WSS innovation plays in seeking solutions, the present dissertation sets out to explore innovation dynamics in relation to the establishment of rural Water Supply and Sanitation Community-Based (WSS-CB). The answer comes through an application of a qualitative methodology that focuses on the implementation of two publicly-run and sustainability-oriented programs - the Blue Flag Ecological Program (BFEP) and the Sanitarian Quality Seal Program (SQSP) - in three rural communities in Costa Rica. A theoretical model based on the conceptual frameworks of Systems of Innovation (SI), Community Based/Community Management (CB/CM), and the Institutional Analysis Development (IAD) theory is proposed, including two set of hypotheses addressing the contribution of two independent variables, the participation of the community and the capacity of the community, to local sustainability and local learning. The results show that the dynamics

relating to leadership and a sense of ownership do, in fact, affect both dependent variables and further identify participation and interaction at decision-making and social venues as innovation drivers.

CHAPTER 1 INTRODUCTION

1.1 Introduction

Today, 1.1 billion people lack access to safe drinking water, and 2.6 billion still have no access to basic sanitation, negatively impacting health costs and economic conditions, with women particularly affected. The unavailability of safe drinking water has led to the rapid spread of waterborne diseases,⁷ which has already affected half of the developing world's population. Every year, 1.6 million people, including over 3,900 children per day, die for want of an adequate water supply, sanitation, and hygiene (UN 2005). And those without access to a sufficient water supply and sanitation (WSS) find it more difficult to overcome their impoverished conditions as waterborne illness undermines the ability to work, resulting in manpower shortages and higher health costs for local economies, which, in turn, postpones economic development. For instance, in India, 73 million working days are lost annually to water-borne diseases at a cost of \$600 million in medical treatment and lost production (UN 2005). And local entrepreneurs face an uphill battle when community services cannot provide the water needed to run even small agricultural ventures. Perhaps the greatest burden is borne by women, who are traditionally tasked with the responsibility of fetching water by either waiting in line in urban settlements or walking hours in rural areas. The lack of safe, readily accessible water supply often exposes women to biologically or chemically polluted water sources and keeps them from attending school on a regular basis, decreasing their productivity and income-generating capacity.

The international community has long debated the causes of and possible solutions to this water crisis. The Bill and Melinda Gates Foundation (2006) notes that a disconnect between current end-users, on the one hand, and policy-makers and high-skill professionals, on the other, has often resulted in failed WSS solutions. While the latter, who are primarily from wealthier nations, plan to achieve Millennium Development Goals (MDGs) by developing cutting edge technologies, the former demand “simpler” solutions that will allow them to cope with dignity, access, and income challenges. Because local requirements must be considered, the WSS sector is not good ground for “one size fits all” solutions, making the promotion of bottom-up, community-based approaches to generate locally-oriented innovative solutions an option well worth exploring.

Therefore, this study addresses *the dynamics of innovation in the establishment of rural Water Supply and Sanitation-Community Based (CB-WSS) systems*, and employs a model based on the Systems of Innovation (SI), Community Based/Community Management (CB/CM) and the Institutional Analysis and Development (IAD) conceptual frameworks. The model includes two sets of hypotheses. The first one tests whether the participation and capacity of community members contribute to the sustainability of their local WSS system. The second one considers the same pair of independent variables, but in terms of local training and education. I use case study methodology by applying the model to a sample of three cases in rural communities in Costa Rica with diverging educational levels.

1.2 Research Background

This dissertation will first address WSS by exploring the dynamics that led to the global water crisis. The indisputable fact that a significant share of the world's population lacks access to safe drinking water and basic sanitation has created an international crisis with devastating human effects. Although the international community has set out to bridge the water gap by establishing the MDGs, various issues remain for consideration when analyzing future prospects for the water sector. The intertwining of economic activities such as agriculture, industry and energy, when considered in light of world demographic and economic forecasts, particularly in emerging economies, points only to an aggravation of the problem. This burgeoning crisis should be addressed not only by increasing international funding, but also by overcoming entrenched political and institutional barriers that have stood in the way of fruitful solutions.

Second, this dissertation considers Community Based Water Supply and Sanitation (CB-WSS), which refers to the design, implementation and operation of WSS solutions at the community level. An historical tradition of Community Based/Community Management (CB/CM) studies exists, which started out as a response to top-down decision-making promoted particularly by international organizations. The inability of such organizations to provide sustainable solutions raised the question of whether the participation of end users has been channeled in an appropriate manner. The failure to consider end users' requirements or to empower them to take over their own systems has resulted in neither sustainable nor equitable solutions. A problem-solving process that lacks a plan for building the capacity of end-users leaves beneficiaries

without the skills to take over once international experts leave the field; therefore, a potential solution that starts as a good idea can end up as a useless application.

Third, this paper will apply the conceptual framework of Systems of Innovation (SI) to determine what dynamics lead to innovation, by analyzing innovation at the community level, including a review of the processes of interaction, learning, variety creation and selection. This framework is also applied to analyze the actors involved, collaboration patterns, capacity building and decision-making processes. Although economic factors are important, the analysis does not limit the SI goal to economic growth, but also includes human development as a goal because final solutions in this sector are driven not only by a need for business growth, but also by a desire for human advancement. In addition, this paper draws upon Elinor Ostrom's Institutional Analysis and Development (IAD) Framework to overcome the limitations inherent in a strict application of SI premises to the multi-layered context of community-based decision-making.

1.3 Research Significance

The present study provides significant contributions to the discipline in three respects. First, although innovation studies often encompass varying levels of analysis that consider end users as active participants in learning and selection processes, no analysis exists of innovation at the community level an entity at the bottom of the social pyramid. This dissertation contributes to the discipline by incorporating new dynamics referring to a more cohesive social group, smaller in size, and whose members are organized by common beliefs, norms and the pursuit of a shared goal.

Second, the study deviates from previous SI versions by proposing sustainability as the ultimate goal of the WSS Community Based Innovation System (CB-WSS-SI), which contemplates a WSS system operating with full sustainability, i.e., no community member is downgraded to lower quality services, and equality, i.e., no community member has unmet needs. This rationale responds to problem-solving that seeks to meet basic human needs and improved WSS systems developed with a consideration for the demands of human development. But this definition does not completely ignore the goal of business/economic growth. The sustained operation of WSS systems must be complemented by capacity building processes to develop the skills and knowledge needed for the operation of a system that meets demand at a local level, which necessarily results in varied business opportunities for both external and local agents to provide services and materials.

Third, this dissertation goes beyond the standard SI conceptual framework, which was established with reference to Northern economies and which, therefore, often results in analytical gaps when applied to developing countries, as significant differences exist between these two types of societies. (Lundvall, Johnson et al. 2002). For example, the sound institutional regimes found in more developed nations often are not replicated in developing countries where public policy tools may have endured periods of political instability. Moreover, the focus on Northern nations limited the sample to economies that have historically and steadily promoted public funding for science and technology (S&T), thereby skewing current outcomes to a strategic vision set decades ago. In contrast, developing countries may be unable to allocate public resources to S&T in light of their more immediate humanitarian needs. This dissertation introduces a model that explores

innovation dynamics within the context of developing nations and the goal of human development, therefore providing new insights and perspectives to the current SI discussion.

1.4 Methods

1.4.1 Model and Concepts

The theoretical model used, referred to herein as the “CB-WSS System of Innovation (CB-WSS-SI)” (see Figure 1), seeks to determine the role of innovation dynamics in the establishment of rural CB-WSS systems by drawing upon SI, IAD, and CB/CM frameworks. This study defines CB-WSS innovation as the by-product of a problem-solving process that starts with the interaction between the three Global System of Innovation (GSI) agents -- *Problem Solving Organizations (PSOs)*, *Knowledge and Information Organizations (KIOs)*, and *Governance* -- and an autonomous body, the *Community* (Cozzens and Catalan 2008). This interaction, in turn, results in *Learning*, defined as new competencies or capacities affording the creation, testing, and adoption of new products or new processes (Bortagaray 2007; Cozzens and Catalan 2008). Learning may follow one of various paths -learning by doing, learning by using, or learning by interacting- with learning capacity measured in terms of formal training; enrollment rates at primary, secondary, and tertiary educational institutions; and years of experience (Rosenberg 1982; Dosi 1988; Lundvall 1992). Nevertheless, educational level and years of working experience were not used as learning indicators to identify new competencies or capacities learned by CB-WSS agents, because such indicators do not show what or how new competencies or capacities were acquired. Learning by means of new CB-technologies and CB-approaches increases *Variety Creation* upon which market

and non-market *Selection* mechanisms operate to draw a final solution meeting the CB-WSS-SI final goal: *Sustainability*, i.e. the sustained operation of the CB-WSS system. As Schouten and Moriarty (2003) point out, successful CB/CM provides a fully sustainable and equitable WSS system. A system is sustainable when community members are not subjected to a lower quantity and quality of water, and it is equitable when no one is left with unmet needs.

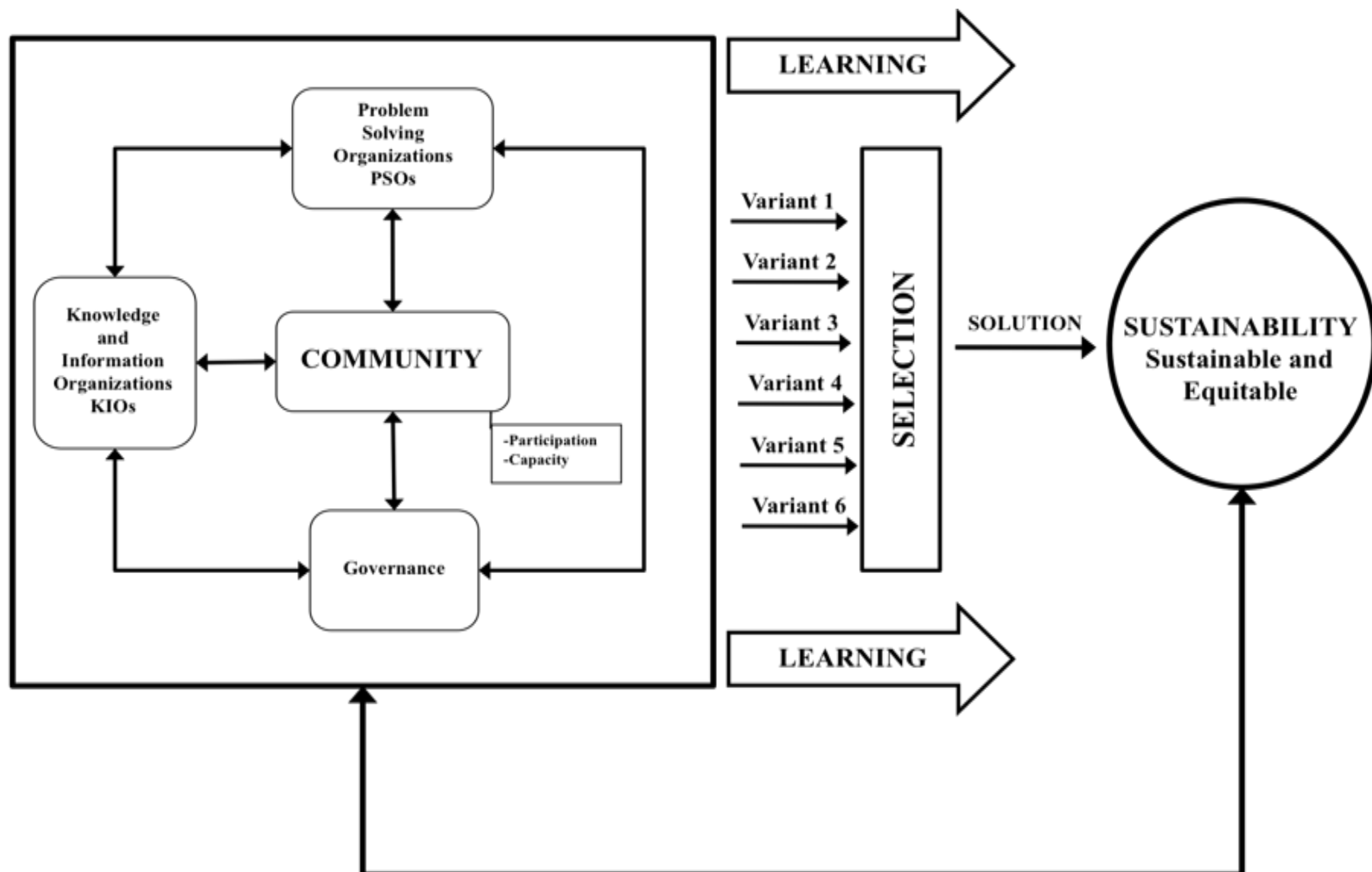


Figure 1 Water Supply and Sanitation Community-Based System of Innovation

As mentioned above, *Community* is added as a new actor to the GSI three-actors scheme. The World Bank defines community as a group of people living in a common area, sharing common development goals, and governed by a set of norms that allegedly provide solidarity; therefore, a community's members should be in a better position to identify their own most pressing requirements (OED 2005). Although community consensus may lead to problem-solving, intra-community diversity must be addressed. Communities are dynamic and constantly undergo transformation processes in their power balance, wealth, size, and water availability (Schouten and Moriarty 2003). Galvis et al. (1997) describe community as:

“a group of people with some common but also some conflicting interests and ideas and different socio-economic and cultural backgrounds. The water supply system may be such one common interest, but at the same time can be a major source of conflict. The identity of the people in the communities is shaped by their history and their socio-economic and environmental conditions. Some of them, often the economically better off, may be better informed, may know more of the world, but may on the other hand, have certain interests in keeping the status quo and therefore may not be willing to solve certain problems”.

Therefore, this study defines community as a group of people living in a common geographical location, sharing a common development goal, ruled by a set of norms where solidarity is the guiding principle, and with a heterogeneous socio-economic structure. Although my research question focuses on community development, certain issues must be considered in order to refine the correct definition of the unit of analysis. My study seeks to determine the role of innovation in the establishment of CB-WSS systems; therefore I concentrate on the specific events that lead to the creation, testing, or adoption of a CB-WSS innovation. In this regard, using community as the unit of analysis may lead to events not related to innovation itself, such as circumstances that surrounded the creation of the community or non-CB-WSS conflicts. This study, therefore, proposes

to focus on a *Water Innovative Event (WIE)*, which this work defines as a systemic and collective choice process in which the actors involved -- Community, PSOs, KIOs, and Governance/Rules of the Games -- interact, learn, and make the final innovative decision, with the goal of increasing the sustainability of their CB-WSS system. Two issues are considered once the WIE case selection occurs: a) a focus on rural communities, and b) a time frame of five years. In this regard, the dynamics of rural communities are devised as a combination of endogenous factors interacting through a problem-solving process whose final goal is the sustainability of the CB-WSS system (see Figure 2).

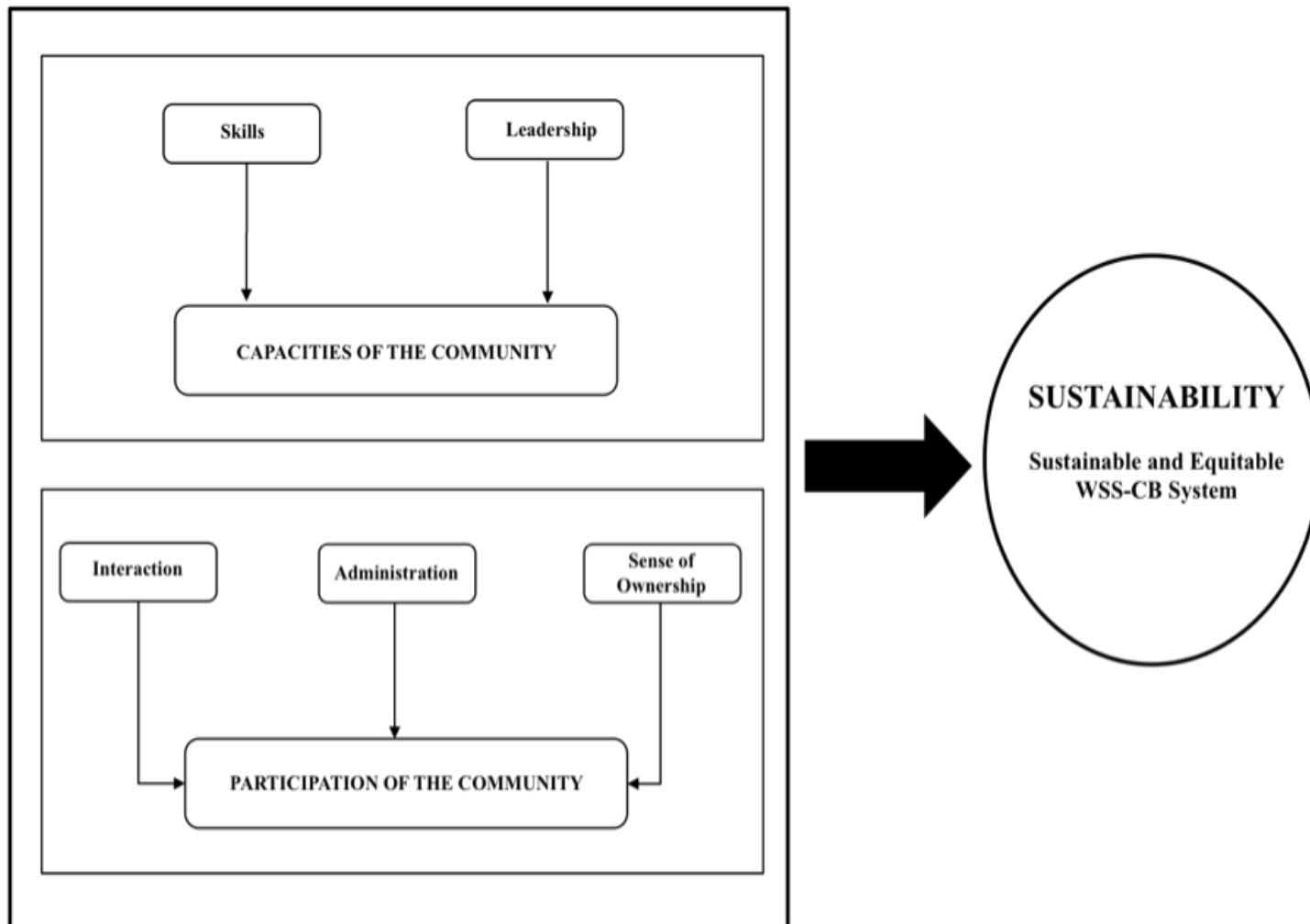


Figure 2 Endogenous Community Dynamics

Concepts describing the endogenous dynamics of the community are grouped under two categories:

- Participation of the Community
- Capacities of the Community

Participation of the Community is conceived as a description of how community members participate in their WSS system through their roles in the system's administration, their interaction patterns, and their sense of ownership. Therefore, this dissertation defines such participation in terms of three variables:

- *Administration*, which describes the participation of community members in the administration of the local WSS governing body, the Association of Rural Water and Sanitation System (ASADA), either as holders of administrative positions or as regular participants in the decision-making process;
- *Interaction*, which refers to the dynamics of the participation of community members at the WIE, that is, the local implementation of the Blue Flag Ecological Program (BFEP) and the Sanitarian Quality Seal Program (SQSP), through activities unrelated to holding administrative positions or the decision-making process, activities that could range from interaction with solution providers to participation in social gatherings leading to WIE; and
- *Sense of Ownership*, which refers to whether community members perceive the WSS system as their own, as exhibited by such factors as the willingness and ability to pay the service fee and the enforcement of collection rules. .

The study defines *Capacities of the Community* as a combination of two variables, *Skills* and *Leadership*.

- *Skills* refers to the capacities of the community members, measured in terms of education and training. To achieve sustainability, the community should be provided the requisite competencies to enable it to fulfill its role as the local decision-maker. For example, a water committee with illiterate members may not operate as successfully as a committee made up of local residents with basic Operation and Maintenance (O&M) knowledge.
- *Leadership* refers to the nature of the leadership exercised within the community, which may have either a positive or negative influence, depending upon whether it efficiently manages local resources or instead fosters lingering conflicts and disputes.

The Case Study Protocol used for the study is presented in Annex 1.

1.4.2 Design

To test the hypotheses, the research employed case study methodology, following the Robert Yin (2003) approach, which calls upon three criteria to determine whether case study is the best research strategy to use. Yin recommends case study as long as “a how or why question is asked about a contemporary set of events, over which the investigator has little or no control.” (p.9). The research question in this study seeks an explanation not dealing with mere frequencies or incidence; the phenomenon to be studied is a contemporary one as CB-WSS innovation is happening now; and the researcher has no control whatsoever over innovative events occurring at the community level.

The research involved a single-embedded case study in Costa Rica, a locale selected for three reasons. First, although Costa Rica performs well in terms of rural coverage, water quality is still an issue hindering the national water performance (AyA-

PAHO 2002; WHO/UNICEF-A 2006; WHO/UNICEF-B 2006; WHO/UNICEF-C 2010; WHO/UNICEF-D 2010). Second, Costa Rica has implemented bottom-up public programs to encourage participation and to strengthen capacity at the community level to improve WSS services. The Associations of Rural Water and Sanitation Systems (ASADAs) are community-based social organizations at the core of Costa Rica's WSS structure, affording community participation in decision-making and planning. Third, although national universities are working on WSS Research and Development (WSS-R&D), Costa Rica's WSS-R&D capacity is still low, providing a platform for studying the role that WSS education in rural areas plays in the design of future policies.

The unit of analysis, or Water Innovative Event, employed in this study is defined as "*Water and Sanitation Sustainable Certification*," referring to the implementation of two publicly-run, bottom-up programs in rural communities: the Blue Flag Ecological Program (BFEP) and the Sanitarian Quality Seal Program (SQSP). The BFEP was created in 1996 by the Water National Laboratory (WNL) to promote self-organization by local residents in coastal areas, communities, educational centers, natural reserves and touristic and environmental zones to achieve their conservation and development in line with natural resources protection, better hygienic-sanitary conditions and the improvement of public health. Once a set of guidelines and milestones are met, BFEP grants end-users an annual certification, represented by a blue flag with the number of stars signifying the quality of the service provided, i.e., the more stars awarded, the better the local hygienic-sanitary and environmental performance. SQSP follows a similar approach. Launched in 2001, the program also encourages self-organization and awards a starred flag certification to communities securing the supply of potable water in

a sustainable and environmentally-friendly manner. The two programs are interrelated: to obtain a two-star blue flag, local residents participating in the BFEP Community Category (BFEP-CC) must first obtain SQSP certification. The programs differ, however, in their focus and scope. While SQSP has a single securing-potable-water category, BFEP considers seven different categories ranging from beaches to natural reserves. This study focuses on the BFEP-CC, and its certification of hygienic sanitary conditions in rural communities, because the variety of factors inherent in that program are better suited to an identification of the dynamics of innovation in the establishment of rural CB-WSS systems. In selecting cases for study, the research focuses first on ASADA-organized communities participating of both BFEP-CC and SQSP. Two criteria were considered: a) the sustainability of the ASADA's WSS system measured according to their total number of BFEP-CC and SQSP stars, and b) the learning capacity of ASADA members measured according to their secondary education level. The first factor provides sample variety with regard to sustainability, whereas the second does so with regard to local learning. Following this rationale and limiting case selection to the 2009 process resulted in a sample of three ASADAS: Puente Salas, Pejibaye, and Santa Rosa de Aquiares. This sample presents varying sustainability and learning capacity, with two ASADAS –Puente Salas and Pejibaye- demonstrating high sustainability but diverging learning capacity-, and two ASADAS –Puente Salas and Santa Rosa de Aquiares- demonstrating high learning capacity, but diverging sustainability.

1.4.3 Hypotheses

1.4.3.1 Hypotheses 1 (H1)

This study posits two hypotheses dealing with sustainability:

H1.1 The greater the participation of the community, the greater the CB-WSS sustainability; and

H1.2 The greater the capacities of the community, the greater the CB-WSS sustainability.

To test H1.1 and H1.2, the research employs case study methodology by applying the qualitative model presented in section 1.4.1 in each of the three cases selected. The model defines the sustainability of the CB-WSS system as being affected by two variables: participation of the community (H1.1) and capacities of the community (H1.2), and measured in terms of BFEP-CC and SQSP stars.

With regard to H1.1, the study tested whether the greater the participation of the community, i.e. the more community members participate in the ASADA administration, the more they participate in BFEP and SQSP initiatives, and the greater their sense of ownership of their local WSS system, the greater the CB-WSS sustainability, i.e. the greater the number of BFEP-CC and SQSP stars the ASADA obtained.

The participation of the community is defined as a combination of the following three variables: first, the participation of community members in the administration of the ASADA with special emphasis on the entire decision-making process stressing a democratic/participatory/bottomup rational; second, the participation of community members at BFEP and SQSP initiatives, excluding administrative or decision-making involvement; and third, the sense of ownership community members have over their own

WSS system, which is evaluated in terms of cost recovery and community members' willingness and ability to pay the service fee. The study drew upon primary sources - interviews with community members, PSOs and KIOs- in analyzing these variables.-

With regard to H1.2, the study tested whether the greater the capacities of the community, i.e. the greater the skills of community members and the better the ASADA leadership, the greater the CB-WSS sustainability, i.e. the greater the number of BFEP-CC and SQSP stars the ASADA obtained..

The capacities of the community are based on a combination of the following two variables: first, the skills of ASADA members that refer to the capacities they may have in terms of education and training; and second, leadership at the community level. In considering the first variable, the study draws upon the National Institute of Statistics and Census of Costa Rica (INEC) dataset regarding educational level data, and on interviews with ASADA members, PSOs and KIOs with regard to training. And to determine how leadership affects the capacities of the community, the study draws upon primary sources regarding ASADA members' evaluation of the ASADA administration leadership and the occurrence of conflicts within the community.

The details of the operationalization of each variable described above are presented in Annex 1.

1.4.3.2 Hypotheses 2 (H2)

H2.1 The greater the participation of the community, the greater the learning at the community level.

H2.2 The greater the capacities of the community, the greater the learning at the community level.

To test both hypotheses, the research relied upon case study methodology by applying the qualitative model displayed in section 1.4.1 in each of the three cases selected. Therefore, the definition of the variables involved in H2.1 –the participation of the community - and H2.2 –the capacities of the community – followed a similar methodology to that employed in H1.1 and H1.2, respectively. But the definition of the dependent variable, learning at community level, defined learning as new competences and new capacities ASADA members have acquired as BFEP-CC and SQSP were applied, drew upon both primary and secondary sources. National and local CB-WSS agents were interviewed with regard to new competencies and capacities acquired during the programs’ implementation, their ability to accomplish new activities due to the operation of the WSS system, and the training received or sought in that regard. Further data on the educational level in each ASADA was drawn from the INEC database.

The details of the operationalization of each variable described above are presented in Annex 11.

1.4.4 Data Gathering

The dissertation draws upon both primary and secondary sources. The primary sources included in-depth interviews with ASADA members, PSOs and KIOs conducted personally in the field. An interview protocol was designed and slightly modified depending on whether the interviewee was an ASADA member or was based at a PSO or a KIO. The questions addressed the dynamics surrounding the variables included in the hypotheses and both the individual’s and the organization’s background.

The interviewees were approached either by email or by phone. At this stage, WNL professionals and researchers from the Universidad Nacional de Costa Rica

Interdisciplinary Water Research and Management Program proved invaluable in recommending potential interviewees. Interviews were recorded, with the consent of the interviewees, and copies of the interview were digitally stored. Notes made in the field and afterwards were later coded using the Nvivo software with coding based on variables included in the hypotheses.

The research included a total of 40 interviews with members from the three ASADAS, managers and professionals at PSOs, and researchers at KIOs, all involved in the dynamics of the BFEP-CC and SQSP. Interviews were conducted in four stages, with the first in March 2008, the second in May 2010, the third in October 2010, and the fourth, by phone in July 2011.

The research also relied upon secondary sources, particularly reports, documents, theses, brochures and newsletters from local and international organizations. The INEC database on education coverage was consulted for national educational information for use in evaluating learning capacity.

1.4.5 Data Analysis

The analysis was based on the coded interview notes taken either during or after each interview. The coding was based on the variables offset out in the theoretical model presented in section 1.4.1. The Nvivo software was used in coding and generating query/matrices by crossing dependent and independent variables regarding each hypothesis. A two-level analysis was set involving: a) intra-ASADA and b) cross-ASADA. The former focused on identifying dynamics with regard to each particular ASADA, and the latter centered on the comparison of the three cases. Both analyses

allowed development of the argumentative interpretation of the research question, based on the patterns and dynamics identified.

1.5 Limitations

1.5.1 Methodological Limitations

Yin (2003) highlights four tests to judge the quality of research design: construct validity, internal validity, external validity and reliability. Construct validity refers to the establishment of constructs or variables in relation to the appropriate study of the research. Tactics proposed to overcome operationalization issues include using multiple sources of evidence, establishing a chain of evidence and obtaining expert review of the case study draft. And Yin defines internal validity as setting the causal relationship between independent and dependent variables omitting any type of spurious relationship. Pattern-matching, explanation-building, phasing out rival explanations and using logic models are employed in this regard. External validity addresses the generalization of the case study's findings. Yin argues that those findings should not be generalized to other contexts but rather to theories, in an attempt to replicate how a scientist generalizes from experiment results to theories. Finally, reliability refers to whether researchers would be able to repeat the operations of the study with the same results; therefore, any scholar using the same research design should come to the same findings. Consequently, a case study protocol was established for this dissertation (see Annex 1) and a case study database was developed using the Nvivo software.

1.5.2 General Limitations

Although local context is the main thrust of this dissertation, it also limits the scope of the study's findings to a certain extent. On the national level, Costa Rica

demonstrates an historical economic development strategy that enthusiastically promotes environmental and natural resource protection. Accordingly, individual preferences and behaviors reflect an environmental awareness that might not be found in other countries, making Costa Rica somewhat unique. Additionally, Costa Rica actively promotes social participation by empowering its citizens through the regular establishment of social organizations in all sectors. While this policy makes Costa Rica a case worth exploring with regard to its national participation dynamics, it may make the study's conclusions harder to generalize to countries that do not necessarily follow the same pattern. At the community level, each of the case studies reflected similar rural profiles and population sizes. Although the sample variation is not as great as might be wished due to limited resources the independent variables of sustainability and learning present enough variance to result in sound findings. For example, had the resources been available, Costa Rica itself presented an opportunity for additional case studies with which to extend the study's findings to other contexts, in light of the country's varied geographical conditions and diverse population, including its indigenous communities.

1.6 Structure of the Dissertation

The dissertation is structured in ten chapters including this introductory one, describing the research question, the methodology, the hypotheses, and the limitations of the study. Chapter 2 discusses the Water Supply and Sanitation (WSS) sector and the drivers and consequences of the so-called Water Crisis. In Chapter 3 contains a review of the conceptual frameworks –Systems of Innovation (SI), Institutional Analysis and Development (IAD), and Community-Based/Community-Management (CB/CM)- upon which the theoretical model guiding the study is built. Chapter 4 describes the current

WSS Costa Rica institutional framework, including a historical review of its rise and evolution. In Chapter 5, descriptions of both the BFEP and SQSP programs are provided, along with the case selection's rationale and result. Chapters 6, 7, and 8 present the three case studies following the application of the theoretical model proposed. Chapter 9 addresses the cross-case study comparative analysis, including descriptions of the dynamics of the independent and dependent variables contained in the model. Chapter 10 summarizes the conclusions and policy implications of the dissertation for the WSS sector and innovation studies community.

CHAPTER 2 Global Water Supply and Sanitation (WSS)

2.1 Introduction

The chapter describes global dynamics in regard to the Water Supply and Sanitation (WSS) sector, with a special emphasis on the so-called Water Crisis. The review encompasses different perspectives. I start off by going through global WSS coverage indicators confirming the scope of the crisis, and by identifying what its actual costs and benefits are. Next, water use patterns are in display, in particular in relation to those economic sectors with the greatest consumption. To enlighten the discussion I review where the barriers to solve the crisis in question are, and what initiatives have been proposed thus far to overcome such hurdles. I close the chapter with the description of those drivers that are affecting the most water resources globally in terms of coverage and availability.

2.2 WSS Indicators

The Joint Monitoring Program (JMP) defines access to drinking water as “the availability of at least 20 liters of drinking water per person per day within 1 km of the dwelling”. When talking about safe drinking water, two further dynamics are added: water quality standards and drinking water improved sources. In terms of basic sanitation, JMP defines access to it as “the proportion of the population with access to an improved sanitation facility for defecation”. By “improved” JMP refers to sources not representing a threat to public health, for drinking water, and to the hygienic separation of excreta from either human contact or the immediate environment, for basic sanitation. JMP

(2010) provides a better description of improved and unimproved drinking water and basic sanitation (see Table 1).

Nowadays 884 million people do not have access to an improved drinking water source that is 13 percent of the world population gets their water from non-healthy sources (JMP-WHO/UNICEF 2010). Numbers are slightly worse in developing countries with 16 percent of their population not having access to improved drinking water sources. Less developed regions are the ones accounting for most of those in need. Sub-Saharan Africa, where only 60 percent of the population consumes water from improved sources, represents more than a third of those with no access to improved drinking water sources (see Figure 3). Albeit what may be a worrying situation in Sub-Saharan Africa, taking an historical perspective adds optimism to the sector: a 10 points increase is noticed worldwide in water coverage during 1990-2008 period, which is mirrored and even exceeded in developing countries (see Figure 4).

TABLE 1 Improved and Unimproved Drinking Water and Sanitation

IMPROVED SANITATION	<ul style="list-style-type: none"> • Flush or pour-flush to: <ul style="list-style-type: none"> ◦ Piped sewer system ◦ Septic tank ◦ Pit latrine ◦ Ventilated improved pit (VIP) latrine • Pit latrine with slab • Composting toilet 	<ul style="list-style-type: none"> • Flush or pour-flush to elsewhere (that is not piped sewer systems, septic tanks or pit latrine) • Bucket • Hanging toilet or hanging latrine • Shared facilities of any type • No facilities, bush or field 	UNIMPROVED SANITATION
IMPROVED DRINKING- WATER	<ul style="list-style-type: none"> • Piped water into dwelling, yard or plot • Public tap or standpipe • Tubewell or borehole • Protected dug well • Protected spring • Rainwater collection 	<ul style="list-style-type: none"> • Unprotected dug well • Unprotected spring • Cart with small tank or drum • Tanker truck • Surface water (river, dam, lake, pond, stream, canal, irrigation channel) • Bottled water¹ 	UNIMPROVED DRINKING WATER

Source: JMP-WHO/UNICEF (2010)

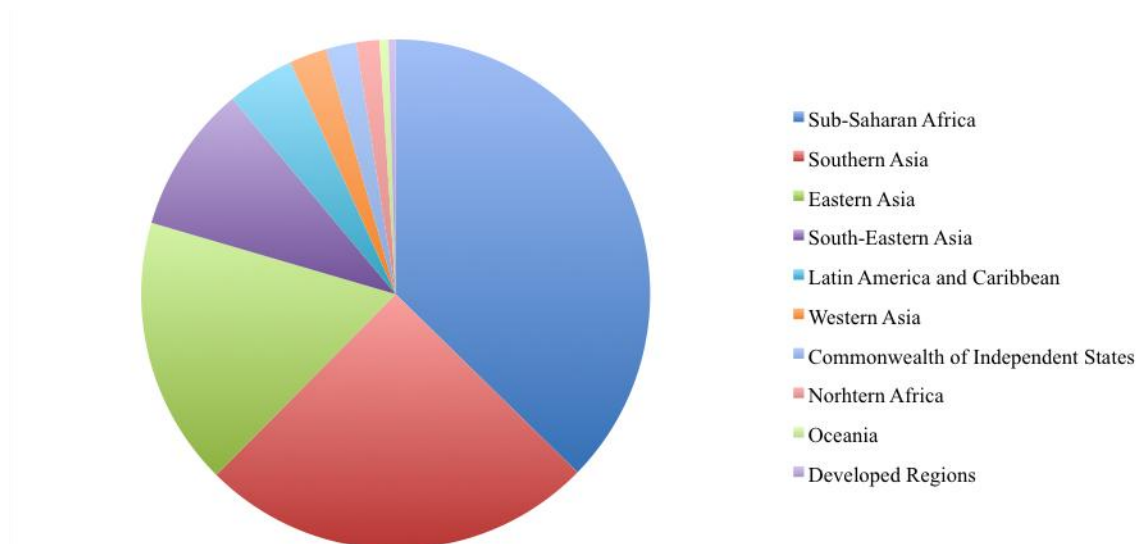


Figure 3 Regional Distribution - Unimproved Access to Drinking Water in 2008

Source: JMP-WHO/UNICEF (2010)

¹ Defined as improved only if household uses drinking water from an improved source for cooking and personal hygiene; when information not available, classification is made on a case-by-case analysis.

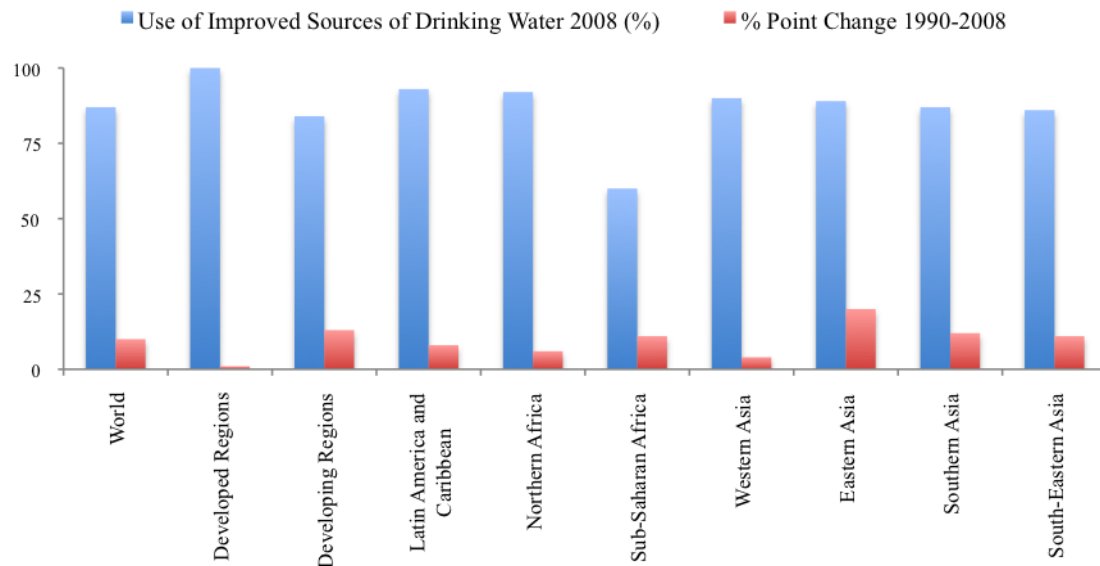


Figure 4 Improved Drinking Water Source by Region (2008) and Change 1990-2008
Source: JMP-WHO/UNICEF (2010)

In regard to basic sanitation, JMP (2010) points out that improved facilities are used by almost two third of the world population, that is 2.6 billion people do not have access to it. Among those in need, 72 and 23 percent live in Asia and Africa respectively, whereas only 15 percent are located in developed countries (see Figure 5). However, as with drinking water, basic sanitation indicators have improved since 1990, as the 7 points worldwide increase in coverage shows. Such trend is driven by significant improvements in less developed nations particularly in South Eastern Asia, Eastern Asia, and Northern Africa (see Figure 6).

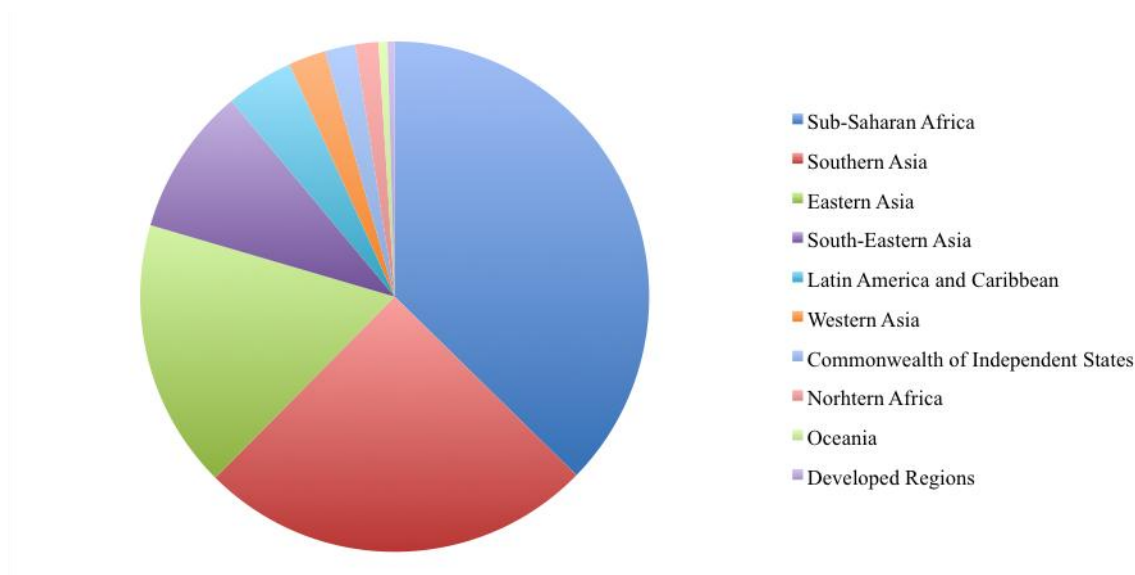


Figure 5 **Regional Distribution - Improved Access to Basic Sanitation in 2008**
Source: JMP-WHO/UNICEF (2010)

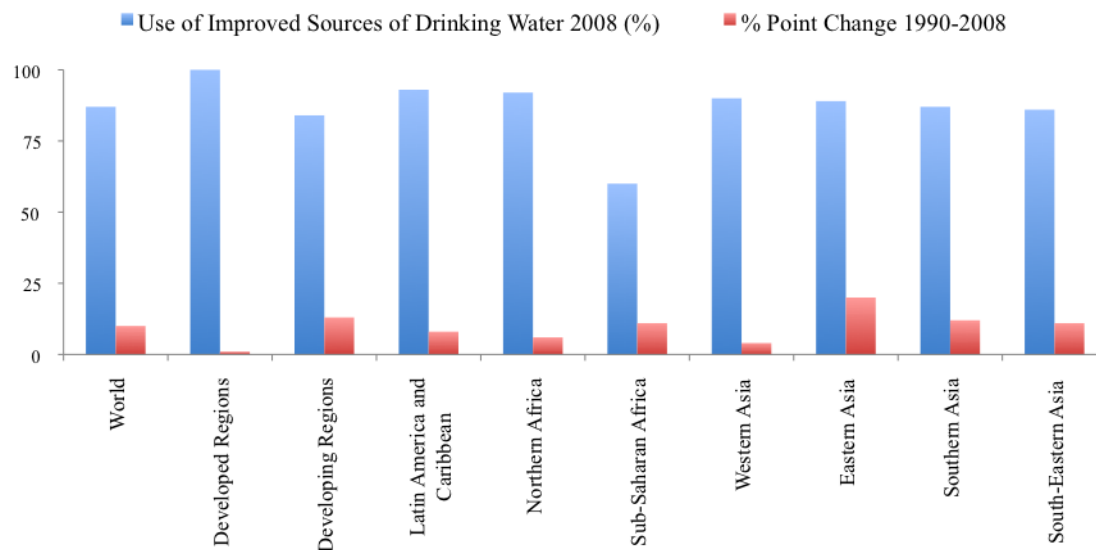


Figure 6 **Improved Sanitation by Region (2008) and Change 1990-2008**
Source: JMP-WHO/UNICEF (2010)

Whether both drinking water and sanitation are on track for the Millennium Development Goal (MDG) target of halving the population with no access to WSS by

2015 shows diverging scenarios. First, JMP (2010) highlights that drinking water is not only on track but will exceed the MDG target by 3 points, that is 9 instead of 12 percent of the world population will be missing access to improved sources in light of the current rate of progress (see Figure 7). In regard to sanitation, the situation is utterly different. There is no expectation to meet the MDG target, as estimates point to a 13 points deficit, that is a billion people who should have benefit from MDG would miss basic sanitation thereby the total number of people without access to improved sanitation will be 2.7 billion (see Figure 8).

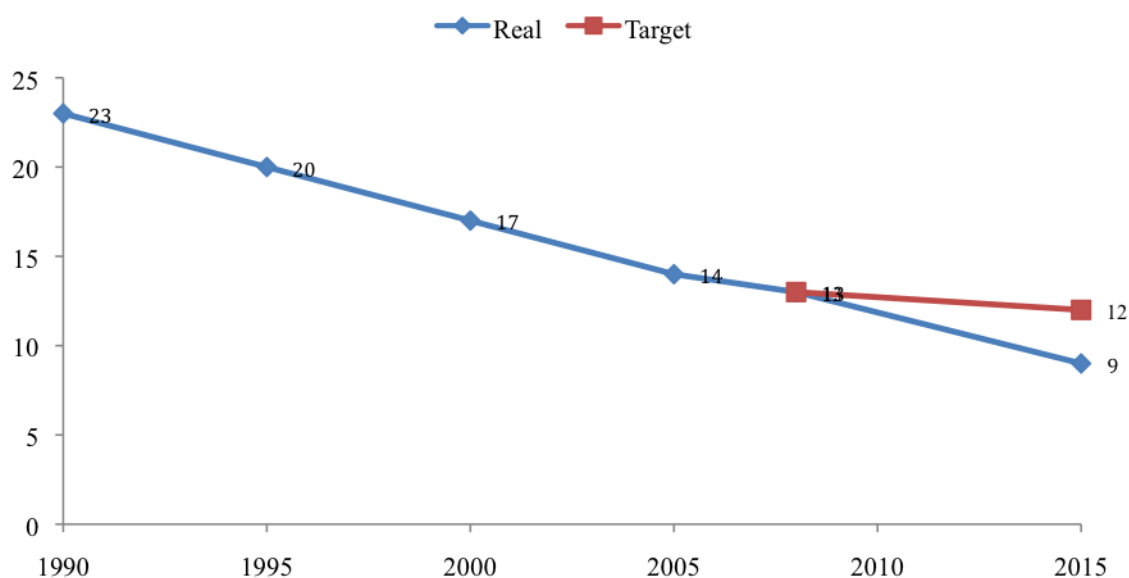


Figure 7 **Drinking Water MDG Projection**
Source: JMP-WHO/UNICEF (2010)

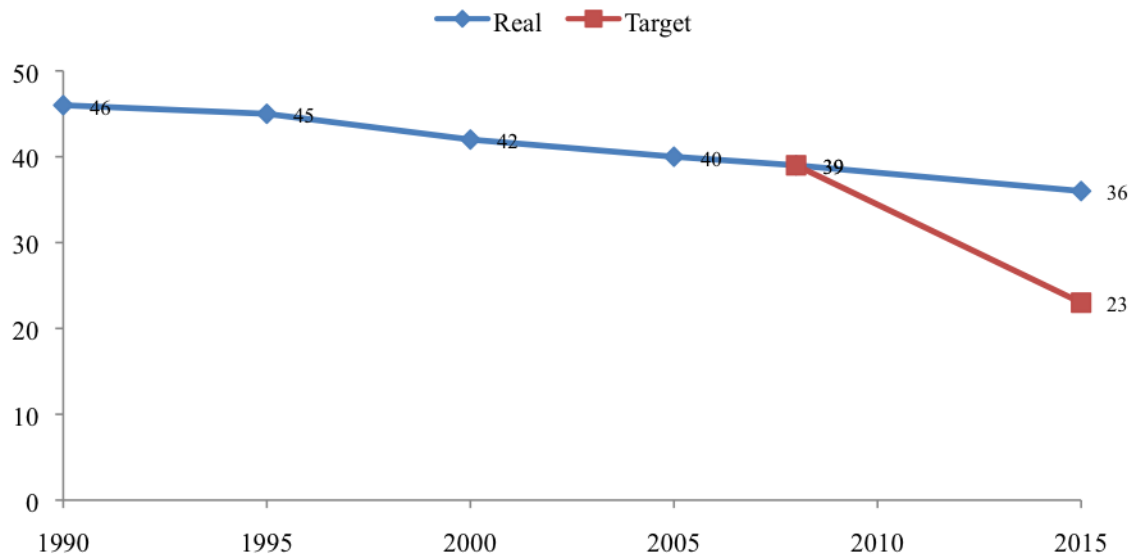


Figure 8 Sanitation MDG Projection
Source: JMP-WHO/UNICEF (2010)

It is worth noting that China and India economic growth have largely influenced WSS upward trends. Both countries amount for 47 percent of the 1.8 billion people that gained access to improved drinking water between 1990 and 2008 (JMP-WHO/UNICEF 2010). In China, 89 percent of the population avail themselves of using improved sources, up from 67 percent in 1990; in India, coverage went from 72 to 88 percent in 18 years. In terms of sanitation, 475 million people gained access to improved sanitation during the 1990-2008 period in both countries, a 37 percent share of the 1.3 billion that gained access globally. However, such significant increase will not be enough to meet the MDG sanitation target.

In terms of urban-rural, disparities may be noticed, though the gap is wider for sanitation than drinking water. With regard to drinking water, in urban areas 96 percent of the population has access to an improved source, whereas in rural areas it is only 76

percent; in absolute terms, rural population with no improved sources is over five times greater than in urban areas (JMP-WHO/UNICEF 2010). It should be noticed how broad the gap is in Sub-Saharan Africa where urban consumers share almost double rural ones' (see Figure 9).

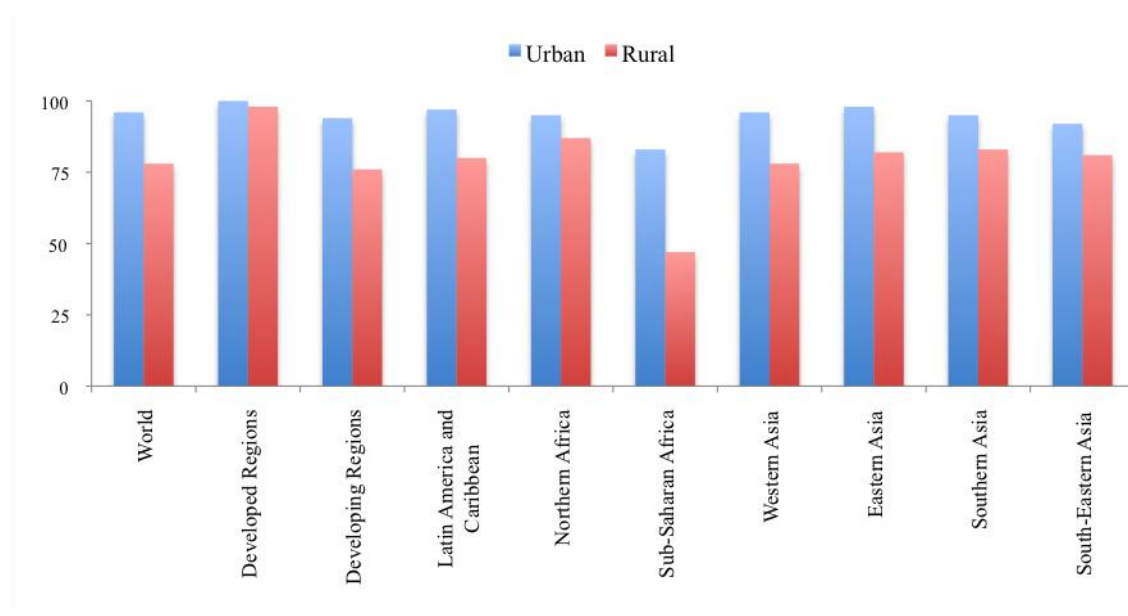


Figure 9 Drinking Water Urban-Rural
Source: JMP-WHO/UNICEF (2010)

In regard to sanitation, JMP (2010) estimates that urban population with access to basic sanitation amounts to 76 percent with the number going down to 45 percent when assessing rural areas. Seven out of 10 people with no access to basic sanitation live in rural areas with major gaps occurring in less developed economies, particularly in Sub-Saharan Africa, Latino America and Caribbean, and Southern Asia (see Figure 10). The urban-rural disparity aggravates when noticing that out of the 1.8 million people who gained access to basic sanitation during the last 18 years 64 percent live in urban areas.

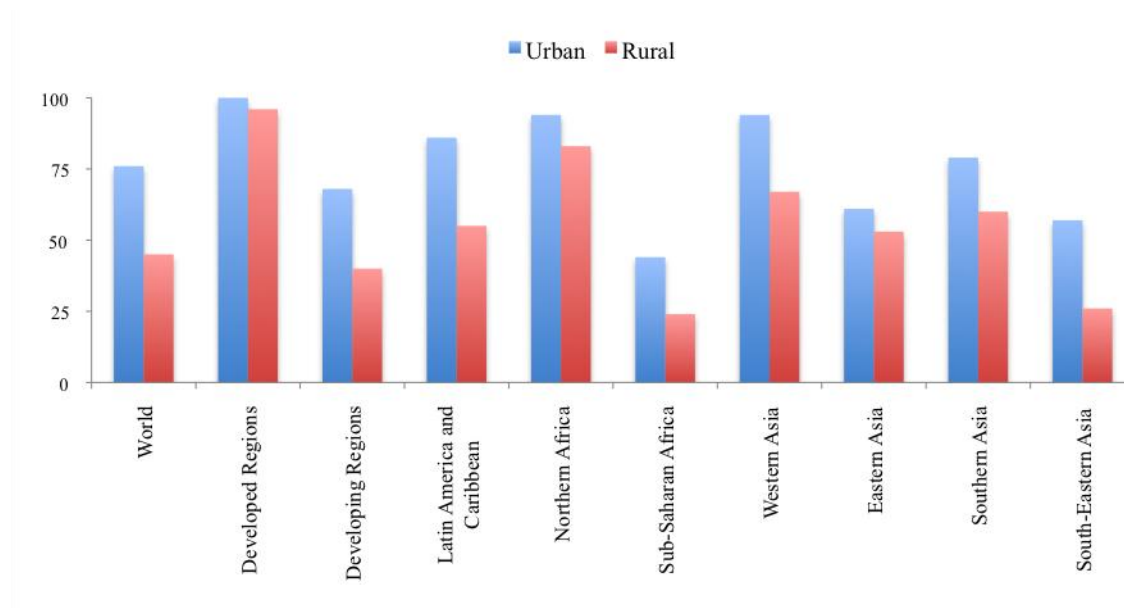


Figure 10 Sanitation Urban-Rural
Source: JMP-WHO/UNICEF (2010)

Distinct features regarding improved sources and healthy practices shall be highlighted. In regard to improved sources, it is worth noting that more than 1.2 million people have gained access to drinking water by means of piped water on premises² with the resulting health and economic benefits of not moving away to fetch water. Trends differ among developing countries. Eastern Asia, Latin America and Caribbean, and Northern Africa focus largely on piped water on premises, whereas Sub-Saharan Africa and South Asia growth in population using other improved sources is 3 times higher than the growth in population using piped water on premises (JMP-WHO/UNICEF 2010).

² Water on premises refers to a water source that is located in the household or in the yard/plot (JMP-WHO/UNICEF 2006)

With regard to sanitation, shared facilities³ have increased at both urban and rural levels though with a steeper trend among urban dwellers (see Figure 11). The highest rates are noticed in Sub-Saharan Africa, where shared facilities make up for 31 percent. In terms of healthy practices, albeit difficulties in halving people with no access to basic sanitation, progress has been made in open defecation. The share of world population practicing open defecation decreased from 25 to 17 percent, decline mirrored in developing countries where the rate went from 32 to 21 percent. However, there is a contrasting urban/rural scenario. As open defecation has declined in rural areas, growth in urban population has prompted a worrying increase of open defecation in cities and vicinities making ground for the spread of diseases that may result in higher morbidity and mortality rates (see Figure 12).

³ Facilities of an improved type that are either public or shared between two or more households (JMP-WJO/UNICEF 2010)

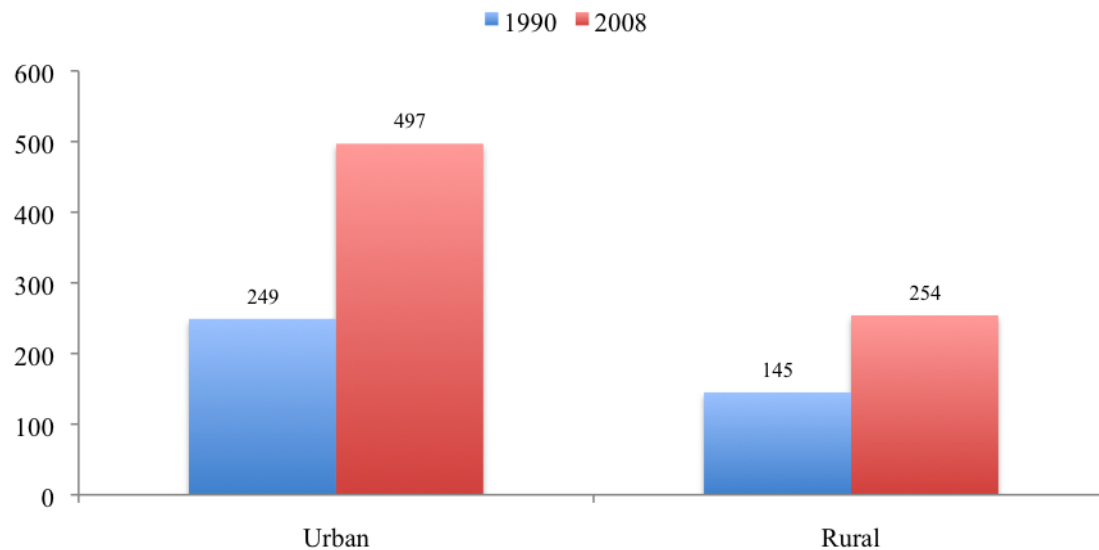


Figure 11 **Number of People using Sanitation Shared Facilities (million)**
Source: JMP-WHO/UNICEF (2010)

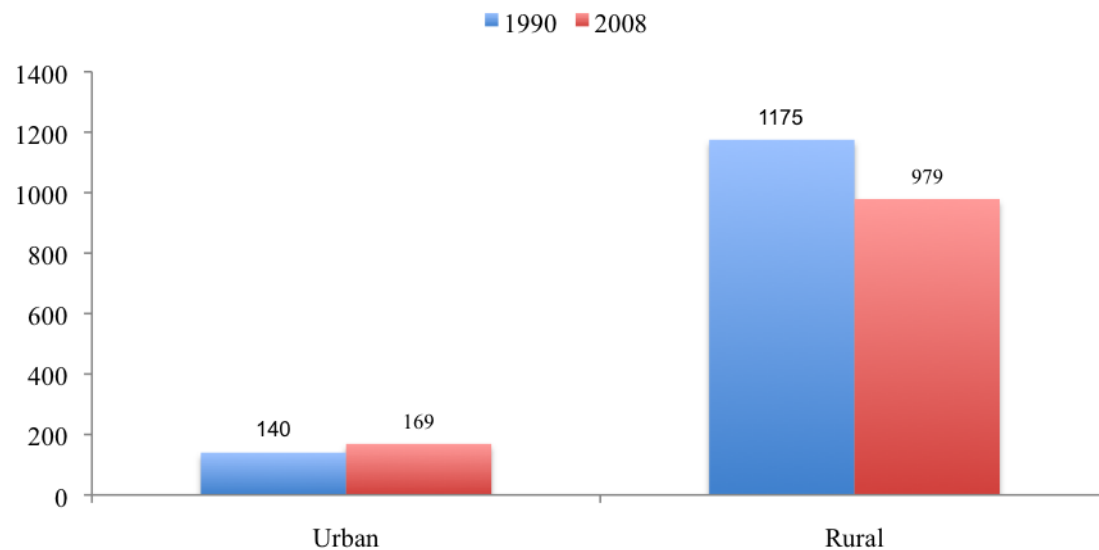


Figure 12 **Number of People practicing Open Defecation (million)**
Source: JMP-WHO/UNICEF (2010)

2.3 Costs and Benefits

WSS may directly affect a whole variety of activities ranging from economic development to health. Though such heterogeneity, there is consensus on one distinctive WSS feature that improvement in WSS contributes to poverty alleviation (WorldBank 2007). The Human Development Report (2006) defines the WSS crisis as “the crisis for the poor” as almost two third of people with no access to drinking water live on less than \$2 a day, and one third on less than \$1 a day. In regard to sanitation, more than 660 million people lacking basic sanitation facilities live on less than \$2 a day, and more than 385 million on less than \$1 a day. Therefore achieving halving population with no access to drinking water and sanitation contributes directly to the decline of poverty particularly in the developing world. To describe WSS costs and benefits I break down the analysis in three sub-sections referring to economic development, health and gender.

2.3.1 Economic Development

The major benefits of improved access to WSS on economic development are reduced health costs and time savings associated with closer location of facilities (UN 2005; WWAP 2009). UN (2005) expands the analysis by describing the following particular scenarios whereby economic development is driven by honed WSS services:

- Water on premises affords agricultural and other productive activities at household level, thereby increasing household income and thus economic development.
- Poor population spends more of their income on water than do the rich, therefore as improved systems are put in place, water cost declines, thus increasing household income.

- Improved access reduces illness and disease rates among adults and children, thus freeing time among the former for more productive activities and keeping the latter from missing school.
- Having water near home saves significant amounts of time particularly to women and girls that may be spent on productive activities and education.
- Healthier children thereby higher rates of child survival lead to lower fertility rates which in turn are a precursor of better quality of life and thus economic development.

In regard to the economic burden of unimproved services, country cases strengthen how considerable it is. In India, each year 73 million working days are lost to waterborne disease at a \$600 million cost related to medical treatment and lost production (UN 2005). In Africa, where 40 billion working hours are lost each year to carrying water, estimates of economic losses attributed to lack of safe water and basic sanitation amount to \$28.4 billion a year or around 5 percent of GDP (Cosgrove and Rijsberman 1998; WHO 2004; WHO 2006). In Cambodia, Indonesia and the Philippines \$9 billion a year are lost to poor sanitation, or 2 percent of their combined GDP (Hutton, Haller et al. 2007). Sanitation, environmental, and tourism losses are part of the calculations with sanitation and hygiene-related diseases amounting for the lion share.

To amount economic benefits of improved WSS, the World Health Organization (WHO) has used as a benchmarking point meeting the MDG on WSS. The return of each dollar invested is estimated between \$3 and \$34, depending on the region, whereas the health costs avoided would amount to \$7.3 billion a year and the value of working days gained to lower illness rates would reach to \$750 million (WHO 2004; Hutton and Bartram 2008). Furthermore, if the target is met, time savings resulting from relocating a

well closer to communities, installing piped water on premises, and having latrines closer to home, amount to \$64 million (WHO 2004).

2.3.2 Health

Various indicators may be used to exemplify the cost of unimproved WSS on health. Diseases resulting from poor water, sanitation and hygiene account for almost 10 percent of the total global burden of illness and 3.5 million deaths per year (Prüss-Üstün, Bos et al. 2008). Diarrhoea is responsible for 1.5 million deaths annually including 5,000 children under 5 years old dying every day, that is one every 17 seconds (Parashar, Bresee et al. 2003; Prüss-Üstün, Bos et al. 2008; UN-Water 2008) Malaria, trachoma, and schistosomiasis are other diseases contributing to the water, sanitation and hygiene-related disease burden, mostly related to the absence of nearby sources of safe drinking water and unsanitary excreta disposal (UN 2005).

Benefits of improved WSS may be substantial. Improved water supply reduces diarrhea morbidity by 21 percent and trachoma morbidity by 27 percent; improved sanitation reduces diarrhea morbidity by 37.5 percent and schistosomiasis morbidity by 77 percent (WHO 2004; UN 2005). Moreover, the use of additional water quality technologies, such as point-of-use disinfection or safe storage, reduces diarrhea morbidity by 45 percent. However, one of the most appealing indicators regards child mortality as moving up to improved sources reduces it by 30 percent (Esrey, Andersson et al. 2001).

2.3.3 Gender

In developing countries, women either in urban or rural settlements turn out to be the greatest pillar of their families with one of their main tasks being ensuring water supply to their households. Most of their day they walk long distances to fetch water of

dubious quality or wait in long lines with serious danger for their physical security (UN 2005). Estimates in rural Africa are that women spend each day six hours walking 10 miles and carrying 20 liters containers on their head, back or hip to collect water⁴. They may even walk twice that distance during the dry season. In their role of water collector, women's income-generating capacity and health are seriously affected as their responsibilities keep them from production and educational activities and they are regularly exposed to biological pathogens and chemical hazards. Furthermore, as women regularly take care of children, the elderly and the ill, waterborne diseases increase their domestic responsibilities constraining their time availability. In this regard, it is worth noting that the higher women's educational background, the smaller and healthier their families, and the higher in their list of priorities their children's education is (UN 2005). However most noticeably of all, each additional year of female education reduces childhood mortality by 5-10 percent⁵. Overall, women face dramatic threats to their well-being and are pushed to go through humiliating situations as going the whole day without relieving themselves, excreting in open areas and being unable to take care of themselves when menstruating.

2.4 Water Use

To identify water consumption dynamics, different factors shall be brought forward. In terms of sector, agriculture is the main water consumer accounting for 70 percent of water withdrawals worldwide; industry and domestic use are next at appreciable distance (Margat and Andreassian 2008). As to geographical distribution, a striking contrast rises: Asia, North America, and Europe amounts to 86 percent of water

⁴ http://www.waterraaid.org/uk/what_we_do/the_need/206.asp visited May 25th, 2010

⁵ http://www.waterraaid.org/uk/what_we_do/the_need/206.asp visited May 25th, 2010

withdrawals though their water resources represent 56 percent of global water resources (see Table 2). At country level, the comparison between the 646 and the 0.3 km³ of water consumed each year per person in India and Cape Verde, respectively, exemplifies how unequal water use may be (WWAP 2009)

TABLE 2 Water Use and Resources, 2000

Region	Renewable Water Resources	Total Water Withdrawals	Water Withdrawals					
			Agriculture		Industry		Domestic Use	
			Amount	Percent	Amount	Percent	Amount	Percent
Africa	3,936	217	186	86	9	4	22	10
Asia	11,594	2,378	1,936	81	270	11	172	7
Latin America	13,477	252	178	71	26	10	47	19
Caribbean	93	13	9	69	1	8	3	23
North America	6,253	525	203	39	252	48	70	13
Oceania	1,703	26	18	73	3	12	5	19
Europe	6,603	418	132	32	223	53	63	15
World	43,659	3,829	2,663	70	784	20	382	10

Source: Comprehensive Assessment of Water Management in Agriculture (2007)

It is worth noting that wealthier nations allocate more water to industry, whereas developing countries do so to agriculture; thus as they grow nations move to more water-intensive structures. The developing/developed asymmetry is confirmed when comparing water footprints –the volume of water used to produce goods and services by a country, including both internal and external scenarios, that is not only water drawn from local natural sources but also water used to produce goods and services abroad that are locally

consumed-: the United States and China consume 2,480 and 700 m³ per capita per year respectively (WWAP 2009)

Therefore, nowadays the WSS discussion needs to be concerned about issues not previously associated to water resources management, making the provision of WSS services a more systemic and comprehensive challenge. The intertwining of those new areas comes about as water has become an essential component of sustainable development, definition that not always has overcome narrow sectoral visions blinding many water decisions (WWAP 2009). Thus climate change, energy, food supplies and prices, and even security have come up as new factors to be considered along with those already on the list when assessing the aggravation of the so-called water crisis. The next sections deal with four areas: energy, agriculture, climate change and industry, each providing new nuances to the current discussion.

2.4.1 Energy

Water and energy are interlinked as water is an input for energy production and energy is needed in water withdraw and delivery. Water use for energy production ranges from cooling in thermal and nuclear plants to irrigation in producing bioenergy. On the other hand, energy costs account for 60-80 percent of water transportation and treatment costs and 14 percent of total water utility costs (GlobalWaterIntelligence 2007).

Two energy sources deal with water consumption. Hydropower accounts for 20 percent of world's electricity production. Although it demands large amounts of water, hydropower is not consumptive as water returns to the river once it goes through turbines thereby making it one of the most appealing clean energy technologies. However, hydropower may face some barriers. It shall be noticed that in developed countries most

of hydropower sites have been already occupied whereas in developing nations high capital investments and social and environmental controversies are deterring national authorities from promoting to increase hydropower capacity.

The increasing production of biofuels, driven by both oil prices and a larger concern about Greenhouse Gas (GHG) emissions, has directly affected water consumption (DeFraiture, Goidano et al. 2007; Muller, Schmidhuber et al. 2008; OECD and FAO 2008). The recent outstanding upward trends in bioethanol and biodiesel global productions reinforce such notion. Whilst the former reached 77 million liters in 2008, thereby more than tripling its production in a 8 years span, the latter rises 11-fold between 2000 and 2007 (OECD and FAO 2008; WWAP 2009). The United States and Brazil are the main bioethanol producers worldwide accounting for more than 77 percent of the global supply, whereas the European Union (EU) provides 67 percent of global biodiesel production. Maize and sugarcane are the raw materials used in the United States and Brazil with 23 and 54 percent of their local production used to produce bioethanol; on the other hand, EU draws upon 47 percent of its vegetable oil production in producing biodiesel (FAO 2008).

To assess how biofuels may affect water resources we have to take into account that forecasts expect bioethanol and biodiesel production to increase to 127 and 24 billion liters in 2017, respectively (OECD and FAO 2008). The impact on water resources depends on whether agricultural production is either irrigated or rainfed with the former having a greater impact on freshwater resources. Current estimates show that to produce 1 liter of liquid biofuel needs 2,500 liters of water, including 820 liters for irrigation (WWAP 2009). Even more, implementing and fulfilling all biofuel plans, policies, and

goals already set needs additional 180 billion liters of irrigation water, far high from the current 44 billion liters (DeFraiture, Goidano et al. 2007). Therefore, further analyses of the water crisis should carefully consider the water-energy link, particularly in regard of their two ways relationship.

2.4.2 Agriculture

Agriculture accounts for 70 percent of freshwater withdrawals, up to more than 90 percent in some developing countries. However, agriculture has a particular characteristic: evapotranspiration makes its effect on water availability much more severe than in other sectors as large parts of water do not return to rivers nor lakes (WWAP 2009). Economic development and population growth in emerging economies have affected the demand for agricultural products by modifying previous regular diets whose new versions include water-intensive products. People coming out of poverty tend to leave behind diets based on wheat to replace them with more meat intensive ones; the former with production water use rates of 400-2,000 liters/kg, whereas the latter with rates of 1,000-20,000 liters/kg.

During the second half of the 20th century, technology played a pivotal role in improving water access, thereby increasing food supply in light of better irrigation systems. Such increase in productivity afforded more than tripling water withdrawals, doubling irrigation areas, and that food production growth outstripped population growth during the last 50 years (WWAP 2009). However, as productivity improved, investment diminished, particularly regarding irrigation, leading towards the worrisome situation of not being able to achieve production levels as needed.

WWAP (2009) expects water use in agriculture to continue to grow though at a slower pace. Food demand will become a major stressor of future water consumption with annual growth similar to population growth rates that is 1.6 percent in 2015, 1.4 percent in 2015-30, and 0.9 percent in 2030-50 (FAO 2006-A). Plus further grains production will be needed to cover the livestock's food demand, as consumption of dairy products and meat will continue to increase. Albeit such pressures, scholars still foresee that productivity will help in bridging the current gap estimating that during the next decades 36 percent more food will be produced with 13 percent more water (FAO 2006-B).

2.4.3 Climate Change

Sea level rise, climate variability and weather extremes such as heat waves, droughts, floods and cyclones have been cited as a direct consequence of climate change whose main effects on humans and the environment come through water (UNFCCC 2007). Flows river may be lowered, energy production affected, and precipitation timing altered. All impacts, including economic losses, health problems and environmental issues will affect and be affected by water (WWAP 2009). Just in Africa, shortages on energy production, reduction on agricultural production and food security, migration, spread of diseases and even increasing conflicts over land and water scarcity are expected (UNFCCC 2006). To face climate change adaptation and mitigation measures are needed which may be expensive to implement: estimates of the cost of adaptation just for developing countries range from \$9 to \$67 billion a year with \$11 billion to water supply infrastructure (WorldBank 2006; Oxfam 2007; UNDP 2007; UNFCCC 2007).

The effects of climate change on water resources are varied, as it is a supply-side driver not a demand-side driver that is it determines how much we have not how much water we need. Climate change is likely to increase human migration in areas where drought, desertification and water scarcity may occur. The Intergovernmental Panel on Climate Change (IPCC) makes particular emphasis on low-coastal areas as storms, floods, and erosion resulting from sea level rise will increase water-related diseases, prompting local native to move out to locations with better and steady access to WSS services (Nicholls, Wong et al. 2007). Economic development is also affected by climate change as shows La Niña in Kenya where damage amounted for \$2,417 million between 1998 and 2000 in terms industrial production, hydropower, agricultural production and livestock (WorldBank 2004). The Stern Review Report concludes that by 2050 world's GDP could be reduced by 1 percent due to climate change effects with an annual cost equivalent to 5 percent of GDP. As to social effects WWAP (2009) points out that climate change damages the most those at the bottom of the social pyramid as climate uncertainty hinders investment and innovation thereby economic development and poverty alleviation. Climate change will also exert pressure through social mobility that is as more people come out of poverty the demand for goods and services with larger ecological and water footprint will increase, effect that will not be lessen by what may be behavior or preference changes in wealthier countries.

2.4.4 Industry

Industry draws upon water in various ways; heating, cooling, transport and solvent are examples of industry's water use. Although it represents less than 10 percent of global water withdrawal, consumption varies among industrial sectors: different

industries demand different water quantity and quality (see Table 3). For instance, to produce 1 ton of paper, estimates of water use range between 80-2,000 cubic meters; numbers are different for oil production, just 0.1-40 cubic meters per ton are needed to produce 1 liter of oil (Margat and Andréassian 2008). In terms of country case comparison, industrial water productivity –defined as the ratio of value of water withdrawn to value of industrial output using water- differs substantially: less than \$10 in the United States and more than \$138 in Denmark (UNIDO 2007). Changes have come about from efficiency gains and the energy transition that have stabilized and even reduced industrial use, leaving behind a rising period between 1960 and 1980 (WWAP 2006). Though sectoral and geographical dynamics have resulted into varying consumption patterns thereby at first sight one might identify them as the leading industrial stressors, WWAP (2009) notes that wastewater and pollution are the ones exerting major pressure.

TABLE 3 Water Use per Ton of Product Produced

Product	Water Use (m³/ton)
Paper	80-2,000
Sugar	3-400
Steel	2-350
Petrol	0.1-40
Soap	1-35
Beer	8-25

Source: Margat and Andréassian (2008)

2.5 Barriers

In light of the gap to bridge to meet the MDGs, it is worth asking what are the causes preventing the international community from reducing the population with no access to drinking water and basic sanitation facilities. One of the first responses is technical issues, specially in regard to the heterogeneity of geographical and natural conditions those in need face in their daily life. The Bill and Melinda Gates Foundation (2006) emphasizes the disconnect between end-users in the South and solution providers, that is policy makers and high skill professionals, in the North; whereas the latter work on cutting-edge technologies not affordable in Southern regions, the former demand simpler, decent and income-producing solutions. However, the list is longer. UN (2005) points out that non-technical issues are as important as technical challenges, particularly political, institutional, and financial constraints crossing national, regional and local contexts.

2.5.1 Political Constraints

UN (2005) cites the lack of political will that is the absence of government commitment to allocate greater resources to the sector as the chief hurdle to expand WSS. Various underlying reasons concur to create such negative scenario. First, the perception that returns to every dollar invested in WSS are lower than those from funds spent in energy and public works. Second, neither politicians nor civil society actors may be able to exemplify the WSS social and economic benefits of expanding improved WSS thereby decision-makers may find no reason for new investments. Third, changes needed to improve WSS may threaten the current position of powerful political groups which may object the service expansion as they may lose historical benefits with it.

There are several tools that may help in overcoming political barriers. First, information to beneficiaries and decision-makers. Being better informed about the social and economic benefits of expanding WSS services enables beneficiaries to make a better case to decision-makers to prioritize the sector who in turn are able to make better-based decisions in regard to expanding the service. Second, policy and institutional reform. Politics may interfere in WSS day-to-day operation affecting investment, price setting, and staff selection and promotion decisions thereby favoring groups not in light of their socio-economical condition but of their political preferences. Overall, to confer transparency to the whole WSS decision-making process may result in substantial improvements in both service expansion, particularly in regard to those in greater need, and the operation of systems already in place.

2.5.2 Institutional Constraints

The impact of institutional constraints transcend whether organizations respond to a formal or less formal profile that is both public utilities and village water committees may be equally affected by institutional dysfunctions. In this regard UN (2005) mentions four types of constraints: capacity building, system of incentives, accountability and regulatory system.

In terms of capacity building, either at urban or rural level, participants need to carry a set of financial, managerial, financial and even social intermediation skills to expand WSS service and to achieve a minimum level of sustainability. Those capacities not only deal with construction and management but also with operation and maintenance that is once external agents leave, local residents shall be able to be responsible of their own system. The highly promoted decentralization process occurring in various national

systems in developing countries is a good example of how capacity building may become a decisive factor to success. The lack of local financial or managerial authority and capacity may lead to failure in expanding service when decentralizing responsibility for WSS even leading the system to stagnation and paralysis (UN 2005). The dynamics of such changing scenario do not only reach national, regional and local public authorities who have been prompted to upgrade their own knowledge and skills as their roles are evolving into new ones with different obligations and responsibilities; users also need to improve their own capacity to both construct their own system and, once in place, to operate and maintain it. To reach that point they shall not only acquire technical and managerial skills but also get informed about what their rights and alternatives of improved WSS services are. On this respect, Non-Governmental Organizations (NGOs) have become a noticeable facilitator accompanying civil actors in planning, organizing and implementing local WSS systems.

Inadequate incentive systems may result in low expansion rates and be detrimental for WSS systems' sustainability. Various examples may be brought forward. First, insecure land tenure makes investors and users reluctant to invest in trunk infrastructure and individual facilities at household level, respectively. Second, WSS agency staff may not be motivated to work on projects benefiting low-income communities in light of the working environment, poor technical challenge, and limited revenue potential. However, UN (2005) emphasizes that the most significant of all is the sectoral "ribbon-cutting" culture that is construction is prioritized over all other activities thereby postponing operation and maintenance and putting the sustainability of WSS systems at risk. Even professional promotions are decided by participation in

infrastructure extension activities rather than by personal involvement in securing the operation of an existing system. Therefore, to set the right incentive system decision-makers should consider not only short-term results but also the whole process of building, operating and maintaining a WSS system over time.

Accountability results in improving service quality provided there are measurable standards of performance and punishment for those not complying with the norms. UN (2005) cites decentralization of planning and budgeting to local institutions as a promising alternative. Users are able to control for the quality of the service they receive and make responsible providers failing on delivering by means of elections, social norms, and public opinion. However, UN (2005) emphasizes that decentralization do not turn well if it is not accompanied by an active role of the central government in oversight, thus accountability could become harder to implement with the underlying consequence of diminishing the likelihood of improvement in service expansion and sustainability.

UN (2005) points out that regulation is a critical activity for public sector systems particularly once decentralization occurs. In regard to WSS, regulation is a path to ensure protection for users and providers interests and to set a friendly and reliable environment for investors willing to fund service expansion. UN cites two types of regulation: quality regulation and economic regulation. The first one refers to monitoring providers to evaluate whether they comply with their contractual obligations thus not delivering a low quality service to users. The second one is required for tariff-settings to prevent users from paying for inadequate service and set a transparent and fair competitive stage. Competition among service providers and benchmarking are the tools regulators mostly

draw upon: whereas competition reduces costs and improves performance, benchmarking delivers information useful for comparative analysis and tariff settings.

2.5.3 Financial Constraints

Inequality is not absent when analyzing the WSS sector, particularly so in regard to financial constraints. Differences are noticed in terms of WSS access and consumption between poor and wealthier households in developing countries, with the former spending a larger share of their income in WSS services than the latter. The contradiction is aggravated when analyzing the income/access-to-improved-WSS correlation noticing that not only wealthier groups pay proportionally less than poor ones, yet their access to improved WSS is greater (see Figures 13 and 14). It is the case that countries with enough resources to cope with universal coverage wind up overdoing in wealthier groups thereby postponing addressing the unserved (UN 2005).

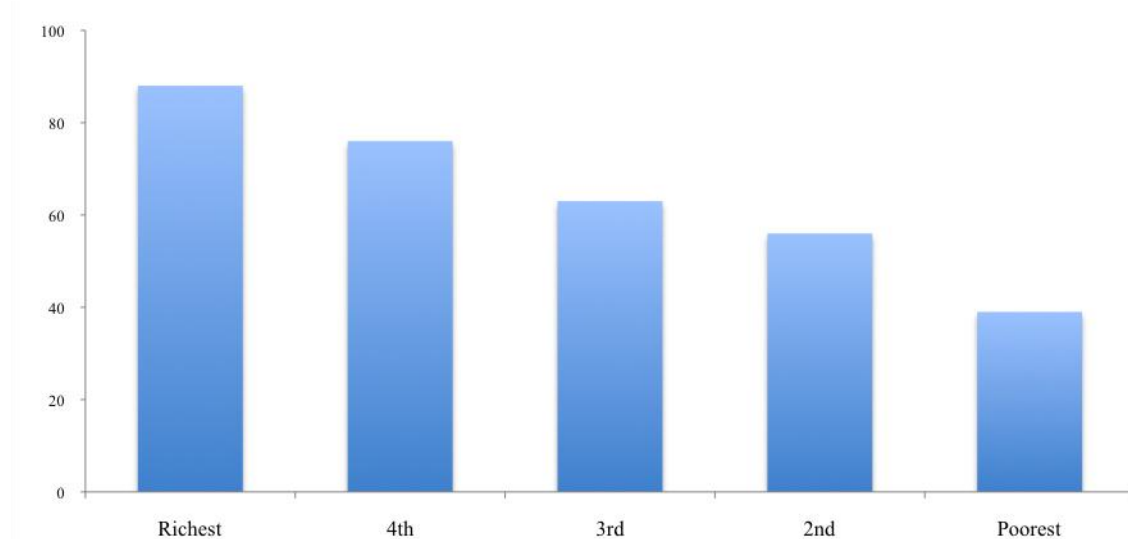
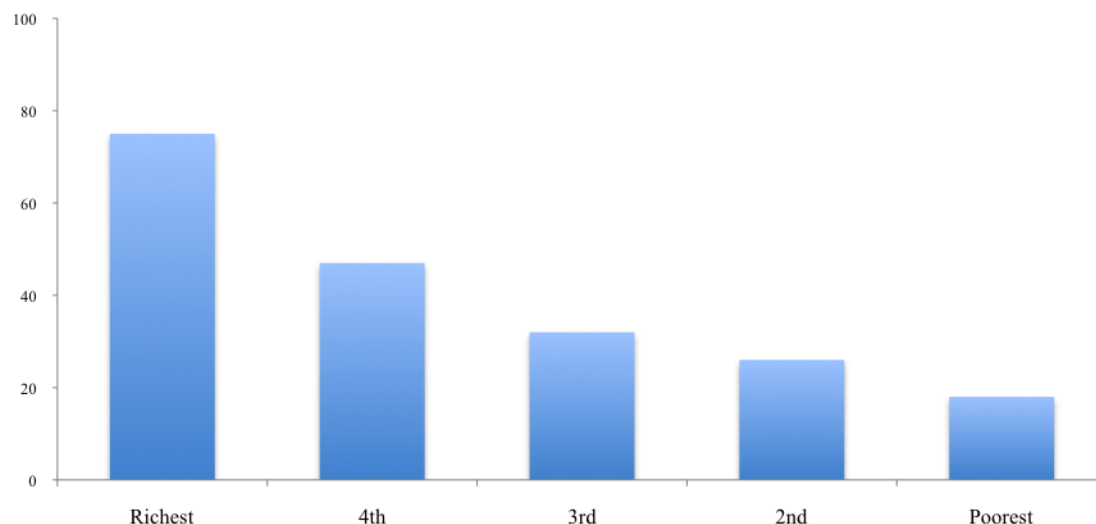


Figure 13 **Population using Improved Drinking Water by Wealth Quintile**
20 Developing Countries
Source: JMP-WHO/UNICEF (2004)



**Figure 14 Population using Improved Sanitation by Wealth Quintile
20 Developing Countries**
Source: JMP-WHO/UNICEF (2004)

Hurdles to increase funding for WSS expansion and sustainability are to be found within WSS utilities, particularly in regard to their managerial and financial capacities. As though those are weak, political pressures preventing from charging service fees contribute in keeping utilities from generating enough cash flows to strengthen their creditworthiness thereby limiting their capacity to attract new investments. Therefore, there is a financial gap to be covered between actual needs and current resources allocation, gap that many thought could have been bridged by the private sector. However, estimates show that private investment is declining since 1997 in light of long payback periods, difficult collection of water fees, and the “lumpiness” of the sector even leading to low private investment in regions with the greatest needs⁶ (UN 2005).

⁶ Only 0.2 percent of all WSS private investment in developing countries went to Sub-Saharan Africa between 1990 and 1997 (Annamraju, Calaguas et al. 2001)

International aid also plays a role as a financial constraint. UN-Water (2008) estimates that from 2002 to 2006 \$18.3 billion were committed to the sector in grants and loans from the bilateral and multilateral agencies, most of it directed to water supply and infrastructure. In addition, by surveying external support agencies, UN-Water presents a list of the Top20 WSS-Aid-priority countries; 16 out of 20 countries report both low WSS coverage and receiving less than \$0.50 per capita in aid; plus, among the 10 countries on the list with more than 50 percent of their population living with less than \$1 dollar a day, 6 receive less than the median WSS aid per capita. On the other hand, the annual spending to meet MDGs have been estimated on \$14.2 billion in sanitation and \$4.2 billion in drinking water; however, that is only considering new capital investment, given that if calculations include maintenance of the existing systems further \$21.6 billion and \$32.2 billion are needed for sanitation and drinking-water, respectively (Hutton and Bartram 2008). Overall countries in greater need may be receiving less help than required, thereby MDGs may be harder than thought to be met.

2.6 Drivers

WSS dynamics described above are brought about by human-induced activities and processes of all types. WWAP (2009) notes that demographic, social and economic drivers may keep exerting pressure on water resources in the mid-long term if not handled well otherwise the water crisis will keep aggravating.

2.6.1 Demographic Drivers

World's population is expected to increase by 80 million people a year, therefore a new demand of further 64 billion cubic meters of freshwater resources will surge

(Hinrichsen, Robey et al. 1997). In addition, by 2050 of the 3 billion people who will be added to world's population, 90 percent will be located in developing countries; by 2100, more than 60 percent of world's population growth will occur in Sub-Saharan Africa and South Asia accounting together for more than half of world's population by 2100 (UN 2007). Those new populations will be based in regions already in water stress with severely limited access to improved WSS thereby likely health and social emergencies are on sight.

The 20th century witnessed a steady growth in global urban population, from 220 million to 2.8 billion people, trend that afforded by 2008 the transition from a rural-dominated to an urban-dominated world (WWAP 2009). The urban population is expected to keep growing during the next decades, particularly in developing countries. By 2030, 1.8 billion will move to urban locations thereby representing 60 percent of world's population, whereas rural inhabitants are expected to decline slightly in 100 million people (UN 2006-B). Developing countries will play a major role on that dynamic: 95 percent of those new urban dwellers will come from Africa and Asia, where urban population is projected to double between 2000 and 2030, making cities and towns in developing word 81 percent of world's urban population (UNFPA 2007). The risk comes about as urban growth is expected to take place in peri-urban areas with limited access to improved WSS, therefore new urban dwellers will be highly exposed to waterborne diseases. In addition to health hazards, serious environmental impacts may arise. Water quality and pollution issues will surge from the transformation of natural landscape as urbanization implies the construction of new streets, parking lots, roofs and

other structures that speed up the flow of water over land surface thereby increasing the likelihood of carrying pollutants into the water system (WWAP 2009).

International migration is driven nowadays by demographic changes, economic disparities, trade liberalization, environmental changes, and new communication technologies (WWAP 2009). Migrants range from people seeking for better living conditions to refugees escaping from political and economic instability with their massive arrival resulting in soil degradation, deforestation, land clearing and scarcity of potable water. Currently, estimates of migrants worldwide are 192 million up from 176 million in 2000. The water-migration relation is a symmetric one that is water stressors prompt migration and migration contributes to water stress. When faced with water scarcity or flooding in their hometowns individuals may make the decision to migrate to new locations. Once they arrive to those new locations, expectations are that their water demand will be met rapidly, thereby new pressures on the local freshwater resources will be exerted.

2.6.2 Social Drivers

Individual attitudes and preferences instead of collective decisions are mostly exerting pressures on water resources through water demands and uses. WWAP (2009) cites four social drivers to be considered when identifying water resources dynamics: poverty, education, culture and values, and lifestyle and consumption patterns.

Before jumping into describing how poverty may affect water resources I should highlight what must be defined as one of the most shocking examples of global inequality: poor people often pay more for water than those living in wealth. In poor informal settlements, people may not be reached by central delivery systems thereby

local urban dealers with their exorbitant prices become their water suppliers. To cope with no access to improved WSS, individuals in need are obliged to actions that result in water pollution and serious environmental consequences affecting directly their own health by means of rapid spreading of waterborne diseases. In addition, water stress may be aggravated as household income may come from economic activities, such as metal working, resulting in large water pollution (WWAP 2009).

In regard to education, the rationale starts out as an educated population has a better knowledge of such concepts as environmental sustainability, water efficiency, and water conservation. A better understanding of those concepts affords new approaches and technologies that may grant access to improved WSS to people living in poverty. Two further effects of education should be mentioned. First, as education increases new demographic trends arise that is fertility rates diminishes with education thereby reducing pressures on water resources. Second, schooling is directly linked to access to improved WSS, as many schools in developing countries build separate WSS facilities for boys and girls increasing girls attendance and performance and keeping a healthier and more comfortable environment for female teachers (WWAP 2009).

Culture and values refer to those social structures and preferences that influence individuals' behavior. In this regard, the water sector presents several examples being one of them the role of women in water decision-making. Regularly women are in charge of providing water for household by walking daily long distances to water sources, while men take over water resources management decisions at local and national levels. Consequences of such labor division are having women exposed to violence and sexual abuse, low school attendance rates for girls, and lower household income. Once women

are empowered in terms of decision-making, not only a better operation of the local WSS system has been noticed but also better social indicators (Mutagamba 2008). Other perceptions and beliefs are in the middle of this discussion. For instance, people may perceived differently the role of lakes and reservoirs thus ranging from energy providers to religious icons (WWAP 2009). Even only in terms of religion, beliefs may have diverging effects on water resources: some religions praise natural resources, including water, as holy objects, while others increase their degradation by following certain type of spiritual ritual.

WWAP (2009) points out that along with population growth, lifestyles and consumption patterns are the most significant drivers affecting water resources. Economic growth, particularly in emerging economies, is lifting people out of poverty, thereby as their income increases, their consumption patterns are evolving towards ones based on products with larger environmental and water footprints. A good example is how their diets are changing as their living standards rise. Social mobility is prompting people to replace less-intensive water diets by new ones more intensive on meat and dairy products. Just in China, a consumer who used to eat 20 kilograms (kg) of meat in 1985, ate more than 50 kg in 2009, thus increasing the demand for grain to feed livestock thereby for water, needing additional 390 km³ of water to produce the new amount of meat required by Chinese (Wiggings 2008).

2.6.3 Economic Drivers

Several economic dynamics are directly affecting water resources at global level. Two examples are social mobility and consumers' new preferences and globalization

(WWAP 2009). As the former has already been described in section 2.5.2, I will concentrate on the latter.

To analyze the effects of globalization upon the water sector, I start out by calling attention to the concept of “virtual water”, that is the volume of water moved through international trade (WWAP 2009). Nowadays, the global volume of virtual water amounts for 1,625 billion m^3 a year, accounting for 40 percent of total water consumption. Virtual water trade may have positive effects as trade between the United States and Mexico confirms. The United States exports to Mexico maize, wheat and sorghum whose productions require 7.1 billion m^3 of water a year; if Mexico would decide to go for self-sufficiency, 15.6 billion m^3 of water a year would be used, therefore 8.5 billion m^3 of water are saved every year (Hoekstra and Chapagain 2008). Though countries with low water productivity export to high water productivity countries, overall virtual water trade savings amount for 350 billion m^3 of water a year that is 6 percent of global agriculture water consumption (WWAP 2009).

By spreading the concepts of water footprint and virtual water, globalization has motivated companies to assume more responsible behaviors in regard to water use. Professional expertise has expanded at global level thereby contributing to new solutions via new technologies and approaches. However, globalization is not only about benefits. By means of different socio-economic dynamics, globalization has also resulted in greater inequality, particularly in the least developed countries thereby leaving the requirements for better living standards of the poorest segments of society unmet. In that sense, as globalization goes on and those in need have still non access to improved WSS

with the resulting threat to their health and livelihood, water resources may go through severe stress in terms of both water quantity and quality.

2.7 Summary

The WSS sector is going through a substantial crisis with a noticeable share of the world's population being left out of a minimum WSS standard. The scope of the crisis reckons with economic, health and gender issues with social and demographic aspects likely worsening the current situation. Nevertheless, though at first one may be prompted to conclude that financial constraints are the reasons behind the crisis, it should not be put aside that political and institutional barriers are as responsible for it, and therefore to deal with them should be at the top of policymakers' to-do list.

CHAPTER 3 THEORETICAL FRAMEWORK

3.1 Introduction

Successful Community-Based Water Supply and Sanitation (CB-WSS) solutions require regular interaction between end-users and problem-solvers, together with local capacity building processes and a thorough understanding of local social dynamics (Dongier, Domelen et al. 2003; Deak 2008; Halcrow and Donnelly 2008). This dissertation's theoretical framework defines CB-WSS innovation as resulting from a continuous process in which CB-WSS agents interact and learn, acquire new competencies and new capacities enabling them to create, test and adopt new products or approaches for obtaining the final goal of greater local WSSustainability. However, certain aspects of this process must not be neglected. The decision-making involved in selecting the best alternative ought to be described with consideration for the collective profile of the process. In addition, for CB-WSS innovations to succeed, their design and implementation should consider local dynamics and requirements, because solutions developed without participation and input from local actors run an increased risk of failure.. In view of these premises, this study proposes a theoretical framework based upon the conceptual framework of Systems of Innovation (SI), to describe CB-interaction and CB-learning dynamics; Elinor Ostrom's Institutional Analysis and Development (IAD), to review the collective choice process resulting in CB-WSS innovation; and the Community Based/Community Management (CB/CM) framework, to incorporate the dynamics of local groups in the analysis. The Chapter addresses each of these approaches

separately, first, the SI conceptual framework, second, then IAD framework and last, the CB/CM is displayed.

3.2 Systems of Innovation

Innovation has been defined in various ways, but perhaps the most appropriate definition is the simplest, that is, defining innovation “as new and better ways of doing things and try them out in practice” (Fagerberg 2005). Understanding the distinction between invention and innovation further hones this definition. Although interrelated and sometimes confused, the concepts are actually distinct. Invention is linked to the first occurrence of an idea for a new product or new process while innovation involves moving such ideas into practice; therefore, a lag exists between the two concepts, with innovation entailing a longer process that may even involve many previous innovations (Fagerberg 2005). Schumpeter (1939) conceives of innovation as a new productive function associated with a new combination of productive factors. He rejects the random perception of innovation by emphasizing the uncertainty faced when innovating, the prevailing first-mover-winner incentive system, and the prevalence of inertia or “resistance to new ways”. Such combination resulted in Schumpeter’s proposition of the so-called “Schumpeter Mark I,” which highlights the role of individual entrepreneurs as novelty and innovation drivers struggling with endogenous social inertia. Later, considering the role of cooperation within larger firms as an innovation driver, Schumpeter proposed the so-called “Schumpeter Mark II,” recognizing big companies as the ones with the resources and capital to invest in Research and Development (R&D).

The three issues cited by Schumpeter have evolved over the historical innovation discussion into new findings related to the challenges posed by path-dependency and

openness at the firm level (Arthur 1994; Ven, Polley et al. 1999; Fagerberg 2005). A firm going into the market early on with a unique and specific innovation offering first-mover advantages may suffer considerable losses once a superior innovation evolves, as the firm may find itself “locked in” on a specific path due to its highly specialized capacities and competencies. For firms to succeed, therefore, they must be open to new knowledge by developing an increasing “absorptive capacity” (Cohen and Levinthal 1990). Overall, firms should recognize themselves as being immersed in a system wherein innovation occurs within their borders but is driven by interaction and learning dynamics. In that sense, a system of innovation arises as innovation follows a systemic process in which firms do not innovate in isolation but rather by interacting with other organizations - firms or non-firms - whose behaviors are shaped by a certain institutional framework (Edquist 2005).

Finding SI's roots requires a return to Friedrich List's proposal of national systems of production and learning, which was based on a set of national institutions ranging from those involved in education and training to those engaged in transport and infrastructure (Lundvall, Johnson et al. 2002). However this early discussion of the issue significantly pre-dates the modern version of SI. . Edquist (1997) recognizes Freeman (1987) as the first scholar to use the National System of Innovation (NSI) concept in published form in his book on Japan's technology policy and economic performance, wherein he defines NSI as “the network of institutions in the public and private sectors whose activities and interactions initiate, import, and diffuse new technologies.” Lundvall (1992) and Nelson and Rosenberg (1993) contributed fundamentally in shaping a new conceptual framework. The latter achieved a comparison analysis by empirically

describing 15 national cases, while the former, in a more theoretically-oriented effort, looked for an alternative to neoclassical economics through a focus on interactive learning and innovation.

The three basic SI actors are firms, research organizations, and institutions/rules of the game. Interaction among these three actors results in learning in the form of creating, testing, and adopting new products and processes. The pivotal actors of the network are firms that gain competitive advantages to strengthen their market position by means of learning and capacity-building processes. The performance of these firms is shaped by research organizations, such as universities or public laboratories, upon whose knowledge base they rely, and by institutions/rules of the game, the establishment of which either facilitates or hinders innovation by the firms (North 1990).

The strengths of SI as defined by Edquist (2005) include the following: SI focus on innovation and learning, SI holistic and interdisciplinary perspective, SI neglect of the notion of optimal by adopting a historical and evolutionary rationale, the emphasis of interdependence and non-linearity, covering product and process innovations as well as subcategories of these types of innovation, and the emphasis on the role of institutions. On the other hand, Edquist notices several SI weaknesses: SI' diffuseness in terms of some concepts, e.g. institutions referred to as organizational actors or institutional rules, and the undefined boundaries of the system, i. e., it is not clear exactly what may be part of the system. In addition, he stresses that SI has not succeeded in becoming a theory but rather remains a conceptual framework or approach. Edquist recognizes, however, that some scholars do not expect SI to become a theory in light of an "overtheorizing" risk as its pragmatic and flexible character grants it great advantage (Lundvall 2002).

Other SI specifications have been proposed in addition to NSI. Cooke et al (1997) modifies the NSI national feature by introducing the Regional System of Innovation (RSI) approach, in which in light of geographic proximity, communications are easier and faster and regional competitiveness, therefore, is strengthened by systemic interactions between firms and the regional knowledge infrastructure (Asheim and Gertler 2005). Malerba (2002) draws on Pavitt's sectoral taxonomy (1984) to deviate from previous geographical approaches by proposing a Sectoral System of Innovation (SSI) in which the three-agent interaction-learning process takes place in relation to a product or a set of products.

The three approaches mentioned above, despite their conceptual differences, share a common feature: all of them promote business growth as SI's main goal. Cozzens and Catalan (2008) diverge from this trend. Their proposal of the Global Systems of Innovation (GSI) framework differs from the economic-oriented definition by focusing on a social-oriented objective: "better living conditions" in line with improved health and a cleaner environment. GSI is also based on the SI three-agents scheme, though names and roles have been redefined to include first, Problem Solving Organizations (PSOs) including public utilities, private firms, health services, and Non-Governmental Organizations (NGOs); second, Knowledge and Information Organizations (KIOs), covering knowledge production and dissemination carried out by local, national, and international organizations such as universities, public laboratories, and R&D centers; and third, Governance referring not only to norms, rules, laws, and how public governmental bodies may be organized, but also to voluntary consensus formation among non-governmental groups.

Although GSI has not been applied yet to the community level, its non-economic goal and new three-agents scheme fit well in the context of community dynamics. The water sector, particularly in developing countries, aims more toward improving living conditions for those in need than toward generating wealth; granting end-users improved health and a cleaner environment is more significant to problem-solvers than maximizing profits. Moreover, by reshaping the three-agent format drawn upon by previous SI frameworks, GSI provides a better description of the WSS sector. PSOs are a good example. Although public utilities might be assumed to behave similarly to for-profit firms, their decision-making is more socially than economically driven. In addition, civil organizations such as NGOs, previously almost ignored, may become major players in light of their various roles as donors, tailor-made-solution providers, and community supporters. Further, to expand the definition of research organizations to include KIOs working on knowledge management and distribution better corresponds to the actual structure of the sector, in which high numbers of such organizations exist and are regularly utilized. (Cozzens and Catalan 2008). And expanding the concept of Governance to include non-governmental bodies corresponds with this sector, because more of such organizations result when community members self-organize to either provide new solutions or manage their own WSS system. Therefore community-driven norms and rules omitted in the previous SI frameworks are now part of the picture.

3.3 Institutional Analysis and Development (IAD)

Nelson and Winters (1982) describe innovation and technological change by means of an evolutionary perspective, in which agents participating in a common system interact, and thereby learn. New competencies and capacities arise as learning occurs,

therefore participants of such a system are able to create, test or adopt new solution variants with selection coming through market and non-market mechanisms. To operationalize such a dynamic is not an easy task. A highly valid outcome requires a sizeable sample, and the review of the institutional setting involved in such a collective decision demands a multi-level framework that covers endogenous and exogenous factors. In this regard, Elinor Ostrom's IAD multi-tier structure proves a good fit for analyzing the role of institutions in community-based collective decision-making (Ostrom 1990).

IAD arose as the result of an interest by a group of scholars in exploring how institutions affect the incentives confronting individuals when making a collective decision and their resultant behavior (Ostrom 1999). The proponents of IAD, therefore, have set out to study the self-organization and self-governance of individuals required to obtain a collective benefit with regard to the so-called common pool resources (Ostrom 1990). To succeed at self-organizing and self-governing, new institutions should be supplied locally, and their establishment and enforcement should respond to credible commitments to follow the rules made by the individuals participating in the system in question and to a mutual monitoring of conformance. For such institutions, built upon trust and a sense of community, social capital comes to afford greater commitments resulting in greater efficiency and sustainability and lower conflict levels. Nevertheless, for those commitments to be fruitful, mutual monitoring must be internal, deviating from the external enforcer option. Thus, the self-organized group should include motivated individuals willing to monitor activities and impose sanctions (Ostrom 1990). If individuals succeed in this effort, cooperation results and "free riding" is avoided.

IAD is proposed as a multi-tier conceptual map with a scope limited to the analysis of a specific activity, the people who take part of such activity, and the patterns of interaction between them (see Figure 15). The *action arena*, an IAD unit of analysis, is defined as “the social space where individuals interact, exchange goods and services, solve problems, dominate one another, or fight” (Ostrom 1999), and includes two entities: an *action situation* and *actors* involved in that situation. The former is characterized by seven clusters of variables: a) participants, b) positions, c) outcomes, d) action-outcome linkages, e) the control that participants exercise, f) information, and g) the costs and benefits assigned to outcomes. The term “Actor” refers to either a single individual or to a group functioning as a corporate actor, and their behavior is affected by four variables: a) the resources that an actor brings to a situation, b) the valuation that actors assign to states of the world and to actions, c) the way actors acquire, process, retain, and use knowledge contingencies and information, and d) the processes actors use for selection of particular courses of action (Ostrom 1999).

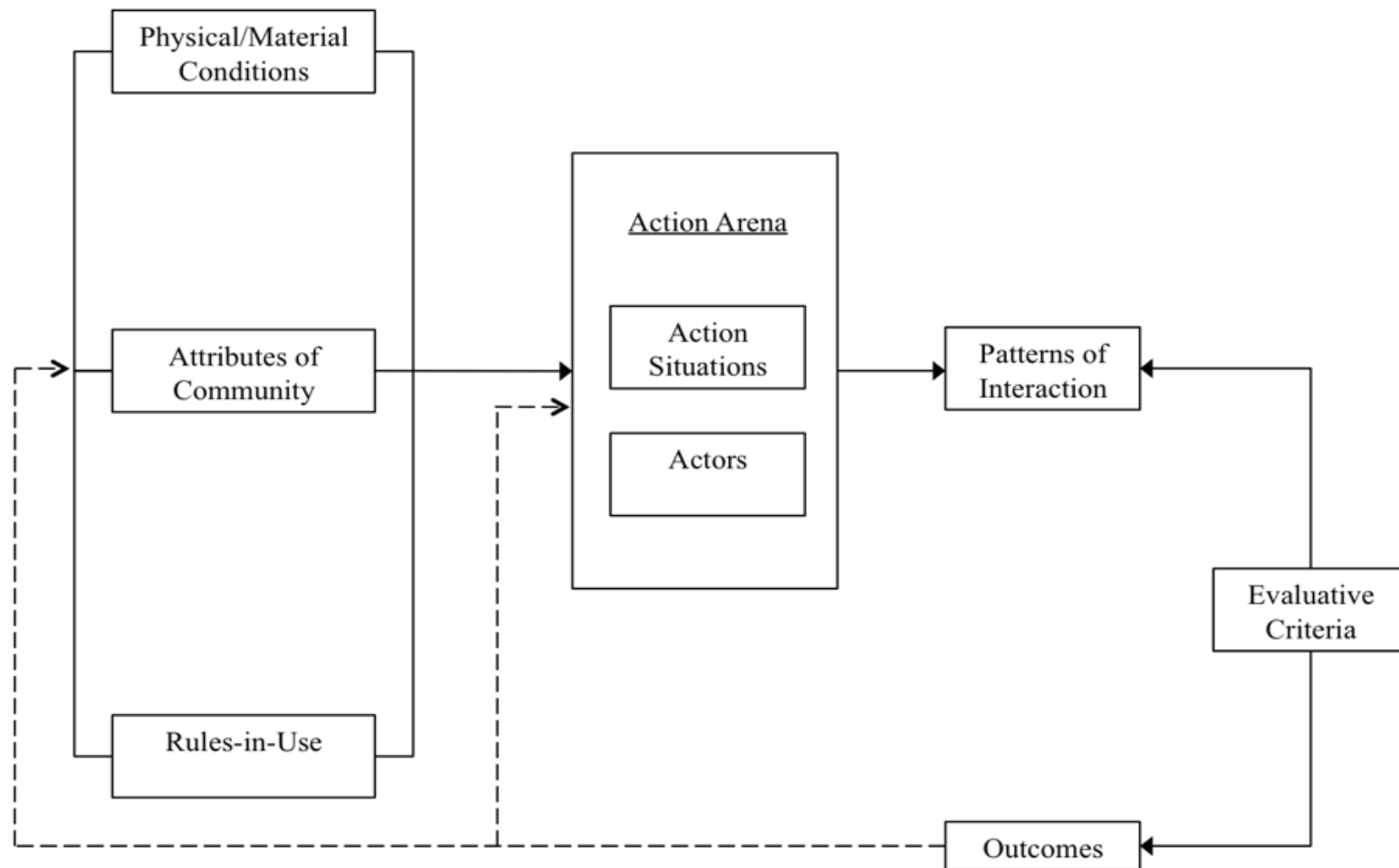


Figure 15 Institutional Analysis and Development Framework (IAD)
Source Ostrom (1997)

The action arena responds to three clusters of variables. The first cluster addresses *rules-in-use*, which are rules used by participants to order their relationship and behavior. Ostrom defines rules as shared understandings among participants that refer to what actions are “required, prohibited, or permitted” (Ostrom 1999). The second cluster concerns *physical/material conditions*, which refers to the attributes of the states of the world that may affect action arenas. The world acted upon by participants may vary the outcomes obtained from the enactment of a set of rules, i.e. same rules may result in different outcomes in different physical/material settings. The third cluster encompasses *attributes of the community*, which considers how specific characteristics of the community in which an action arena occurs may affect individual behavior. Ostrom (1999) cites the norms of behavior, the level of common understanding shared by participants about the structure of particular types of action arenas, homogeneity in preferences of participants, and the distribution of resources, as important factors affecting the structure of an action arena. Further, IAD is multidimensional involving a consideration of three levels of action: a) operational, b) collective choice, and c) constitutional (see Figure 16). The operational level covers day-to-day decisions made by the participants affecting the world directly. The collective choice level sets rules affecting the operational level particularly rules concerning eligibility and specific rules to be used in changing operational rules. At the constitutional level, decision-makers determine how collective-choice participants are selected and the relationship among them. Overall, a hierarchical approach is set wherein the constitutional level affects collective choice outcomes, which in turn affect operational activities.

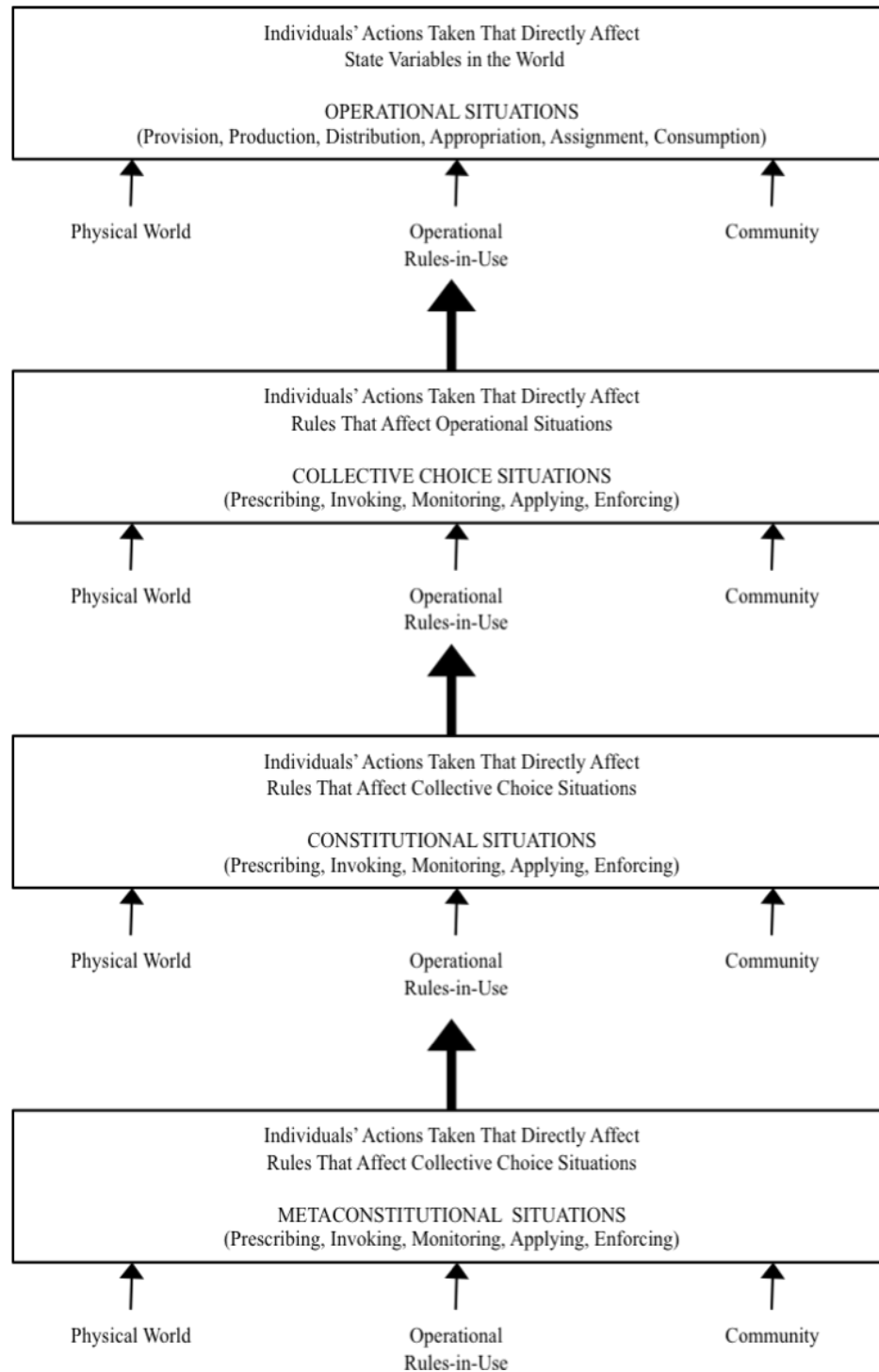


Figure 16 IAD - Levels of Analysis and Outcomes
Source: Ostrom (1997)

As mentioned above, the IAD framework is designed to identify the dynamics relating to the effect of the institutional setting on collective decision-making and the resultant behavior of those participating in the process. Therefore, in each case study in this dissertation, IAD application considers the evolution of institutions and their effect on the collective decision-making in the three communities made to participate in both BFEP and SQSP. A similar timing pattern is followed to address the problems of supply, credible commitment and mutual monitoring.

The *action arena* is defined by the Water Innovative Event (WIE) under study, which is the local implementation of the BFEP and the QSP, which supplies the *action situation*, with the *actors* being all the agents who participate in the implementation of both programs, including local residents, public organizations, firms, research and non-governmental organizations that have played a role in promoting, designing, and implementing both initiatives. All those actors respond to the PSOs and KIOs profiles, and thus their description, actions and patterns of interaction are reviewed with regard to their WSS-CB-SI role. The three clusters of variables are all described in relation to each community in the sample. Therefore, the *physical/material conditions* refer to the location of the community, the natural geography of the area where the community is settled, and the WSS local infrastructure; the *attributes of the community* include the description of the capacity of each community, in particular skills and leadership; and the *rules-in-use* follows the review of those institutions locally governing the WSS system in each of the levels of action proposed by Ostrom: constitutional, collective choice and operational.

The three clusters of variables are directly related to the hypotheses proposed. For *physical/material conditions*, dynamics cross both independent variables – the participation of the community and the capacity of the community -- as the world acted upon by WSS-CB-SI participants is defined by the different contexts in each case study. For *attributes of the community*, the path deviates from the crossing pattern. With the review targeting skills and leadership, the scope of the cluster is constrained to one independent variable: the capacity of the community. For *rules-in-use*, the review is two-fold. The cluster of variables in question is helpful to describe dynamics in relation to *Governance* and *Selection* at the WSS-CB-SI; that is, the review addressed constitutional, collective and operational rules governing the local WSS system and also those affecting local residents when making their decision to implement locally BFEP and SQSP. Therefore *rules-in-use* is exclusively related to the variable of the participation by the community, in particular, in connection with the local WSS administration and the interaction patterns resulting from BFEP and SQSP. In this way, the three IAD clusters relate to the variables embedded in the theoretical model proposed, a model that should require an acceptance of the two sets of hypotheses presented in order to be validated.

3.4 Community-Based/Community Management (CB/CM)

Despite international efforts, WSS still remains as an acute need in the developing world. Although unserved settlements have decreased during the last 30 to 40 years, WSS absolute numbers have only slightly lowered and, in some cases, even increased (TheGatesFoundation 2006). One of the causes of the lingering disparity in WSS access is a lack of funding. The Global Water Partnership's Framework to Action estimates that \$30 billion per year would be required to supply safe drinking water and basic sanitation

to the world's population, a significant increase from its previous appraisal of \$14 million in 2000 (Redhouse and Welle 2004). Nevertheless, the root causes may go beyond funding. The failure to consider the local context may have seriously impaired the odds of success of previously proposed solutions. Given the failure of centralized solutions, focus has shifted to new, bottom-up approaches. (Schouten and Moriarty 2003).

CB/CM refers to a bottom-up form of community participation, in which communities make the final decision on design, planning, and implementation, and are responsible for running Operation and Maintenance (O&M) (Wegelin-Schuringa 1998; Dongier, Domelen et al. 2003). Solutions are defined as involving decentralized decision-making, community ownership, locally-oriented technology, and locally sustainable business and financial models (Narayan, Patel et al. 2000; Oldfield 2006). As long as the rules of the game, access to information, and support channels are properly set, grass roots participation becomes feasible and fruitful; otherwise communities are unable to step in as service providers (Dongier, Domelen et al. 2003). As Schouten and Moriarty (2003) state:

“We believe that the core of community management is ... about communities making strategic decisions: what level of service they want, how they want to pay it, where they want it. The community may also be involved in day-to-day operation and maintenance, in collecting money from users and in buying spare parts - but they do not have to be. They may choose to hire a professional to do this for them. Community management is about power and control. Supporting community management is about empowering and giving control.”

The CB/CM approach has been part of the WSS international discussion for the last 30 years, with several applications already in operation such as Community Demand Driven (CDD), Community Led Total Sanitation (CLTS), Participatory Hygiene and

Sanitation Transformation (PHAST), and Participatory Action Research (PAR) (Dongier, Domelen et al. 2003; Schouten and Moriarty 2003; Deak 2008; Halcrow and Donnelly 2008). CB/CM provides a useful approach in this context as it is a better approach for addressing scattered or even inaccessible populations; poverty, as poor settlements are more willing to manage their own systems, whereas richer ones just buy into an existing one; flexibility, as “one size fits all” solutions are not able to cover the wide variety of water use that rural communities require, and tailor-made solutions are more likely to emerge as a CB/CM outcome; and finally empowerment, granting communities with new skills and decision-making power makes them stronger, more cohesive, and more able to demand their own rights (Schouten and Moriarty 2003).

As with the other development methodologies, CB/CM has its own benefits and limitations. In CB/CM’s favor, scholars cite its higher sustainability resulting from the community’s involvement in funding and O&M; higher efficiency and effectiveness arising out of CB/CM’s higher accountability; higher inclusion by involving those in vulnerable positions in designing their own solutions; greater empowerment of those with no voice, resulting in new community-governance able to manage local resources; more people overcoming poverty as scaling up becomes an easier process, and the formation of new multi-level social partnerships (Sara and Katz 1997; Dongier, Domelen et al. 2003; Wienecke 2005).

Nevertheless, CB/CM has its critics. In his analysis of World Bank-CB projects in Central Asia, Wienecke (2005) noticed that top-down orientation remains as projects are still guided by the Bank at the request of national governments, not of local communities. Moreover, mutually beneficial partnerships do not always result where donors are

reluctant to leave decision-making to the local actors; and further strain on the already limited budgets of those in need arises from newly imposed WSS fees. Schouten and Moriarty (2003) state that communities cannot work on their own as earlier CB/CM champions promoted, because their motivation and capacities must be complemented by external agents coming from government, civil society, and donors; communities require outside support to ensure sustainability and increase coverage.

Scholars have established a set of ruling principles for CB/CM operation. Lockwood (2004) defines success in terms of longer sustainability depending upon four factors: first, participation as the greater the local population involved, the greater the odds of success as people observe their own inputs as actual contributions to the solution provided; second, putting communities in control and thus able to make strategic decisions on a regular base strengthens future sustainability prospects; third, ownership, though sometimes not formally possible, is synonymous with success because as communities perceive their new water system as their own, the chances of getting people involved increase leading to higher sustainability; and fourth, however closely linked to ownership, Lockwood cites cost sharing as a CB/CM success ruling principle as a community's contribution, financial or otherwise, is needed to cover the O&M costs needed to meet sustainability requirements.

The four principles proposed by Lockwood are related to the final outcome of a more efficient and sustainable WSS system. A bottom-up approach built upon empowered local communities with higher participation, tighter control over their own WSS system, and greater sense of ownership should result in more efficient and sustainable long term systems. End-users, who are also “owners”, would receive better

daily service in terms of water quality and quantity and a long-lasting WSS system without regular failures as before.

Schouten and Moriarty (2003) define the main goal of CB/BM as seeking to achieve “widespread, equitable, sustainable community management”, where equitable means that no section of the community is left with minimum needs unmet, and sustainable means that once the service is provided no downgrade in the quantity or quality of service occurs. CB/CM success is defined in terms of a set of intra- and extracommunity factors, with the former including management capacities of the communities, financing, appropriate service level and technology, and water resource availability, and the latter including the efficiency and capacity of intermediate level actors and the existence of appropriate institutions. With regard to the intra-community factors, *management capacities of the communities* results from the community’s sense of ownership, , quality of leadership, and actual skills and capacities; therefore, if the community does not perceive itself as the “owner” of its own WSS system if internal leadership leads to exclusive patterns, or if the actual skill set of the community members does not enable them to take over their own WSS system, the odds of achieving a sustainable and equitable CB-WSS system are low. *Financing* is separated into two categories: capital cost and cost recovery. Capital cost is a donor activity in which international organizations fund the initial hardware and software costs. Cost recovery, primarily an internal activity, is defined as depending upon three factors: willingness and ability to pay, enforcement of rules, and appropriateness to the livelihoods of the community. With regard to the *appropriate service level and technology*, Schouten and Moriarty stress that a successful technology must match the management capacity of the

community, operate over a long-term sustainable financing, and take into account the *water resources availability*. A disconnect between technological development and one of those three factors has been the source of several previous failures. On the other hand, failure to efficiently manage water resource availability is exemplified by an inadequate exploitation of a common water source by different communities, which hinders the sustainability of the resource and thus the sustainability of the community WSS system.

The analysis may be expanded to encompass other factors affecting sustainability. Oldfield (2006) mentions the so-called “appropriate technology” referring to locally-derived technologies that simply and efficiently meet the requirements of the end-users. . Oldfield notes that previous practices, which were primarily based on either high-standard artifacts or large-scale technological infrastructure, postponed local contextualization. Although the “appropriate technology” concept may focus on locally-oriented development, Oldfield’s definition of “community” as a simple technology receptor fails to consider the ability of a community to request technology solutions compatible with its goals and preferences. On the other hand, Oldfield reinforces the need for further culture-specific sanitation and hygiene components complementing the implementation of a new WSS system. He stresses that as good as a new technology may be, its success depends on whether social sanitation and hygiene learning concurs with technology implementation; therefore, training communities in new healthy practices is as significant as having engineers working on new innovations.

3.5 Model and Hypotheses

The three frameworks –SI, IAD, CB/CM- support the dissertation’s theoretical framework and give rise to the theoretical model displayed in section 1.4.1 (see Figure 1).

The model describes CB-innovation dynamics as the outcome of a four-agent interaction process – PSOs, KIOs, Governance and Community -- resulting in learning, i.e., new competencies and new capacity, through which either new products or new processes are created, tested, and adopted. The model proposed in this research deviates from previous SI versions in by rejecting a purely economic definition of WSS goals, and instead adopting a more human-development-oriented objective. However, those SI frameworks that have already addressed the question of human development present a broader definition than is needed. The Cozzens and Catalan (2008) GSI proposal of achieving “better living conditions” is a good match when analyzing the WSS sector globally, but presents some limitations for the CB-WSS case. In both cases - global and community - WSS Innovation pursues better living conditions, particularly in relation to environmental and health conditions. At the community level, however, the emphasis is on the sustained operation of the local WSS system without downgrading users to lower level of water quantity, quality and continuity or leaving any members with unmet needs (Schouten and Moriarty 2003).

With this theoretical model in hand, this study proposes to empirically test two sets of hypotheses referring to the effects of CB-factors on local sustainability and local learning. As to the definition of the CB-factors I include the two already mentioned in section 1.4, that is, the participation of the community and the capacity of the community. Participation refers to how community members take part in the administration of their ASADA, their interaction pattern, and the sense of ownership they have for their own WSS system. Capacity refers to the capacity of the community based on a combination of the community’s skills and internal leadership. The hypotheses are as follows:

-Sustainability

H1.1 The greater the participation of the community, the greater the CB-WSS sustainability.

H1.2 The greater the capacities of the community, the greater the CB-WSS sustainability.

-Learning

H2.1 The greater the participation of the community, the greater the learning at the community level.

H2.2 The greater the capacities of the community, the greater the learning at the community level.

3.6 Summary

The theoretical framework proposed relies upon the conceptual frameworks of SI, CB/CM, and Elinor Ostrom's IAD theory. These approaches combine to explore the dynamics resulting in WSS innovation in rural communities with regard to interaction, learning and variety creation. CB/CM provides a review of the singular context and those factors involved in it; SI addresses collective decision-making regarding the SI selection mechanism; and IAD provides a model that affords the description needed. The theoretical framework resulting from such combination is appropriate for testing the four hypotheses presented in this dissertation.

CHAPTER 4 COSTA RICA WATER AND SANITATION SYSTEM

4.1 Introduction

Located in Central America and bounded by Nicaragua to the North, Panama to the South, the Atlantic Ocean to the East, and the Pacific Ocean to the West, Costa Rica is known as a democratic, free and independent Republic, the so-called “Switzerland of Central America.” A tropical nation with one of the highest diversity of fauna and flora in the world, its privileged geographical location is a crossroads for forestry and animal species of both Northern and Southern cultures. The geography of Costa Rica is complex, with three mountain chains running on a Northwest-Southeast orientation giving rise to the Central Valley, where most Costa Ricans reside, as well as the Atlantic, North, and Northern Pacific plains. Such complexity results in an extensive fluvial network upon which Costa Rica’s Water Supply and Sanitation system (CR-WSS) relies. To explain the context in which the CR-WSS must operate, this paper presents a brief review of the Costa Rica’s historical and socio-economic setting, followed by a thorough description of the country’s ruling institutional framework, including an analysis of its strengths and weaknesses analysis.

4.2 Setting the Country

4.2.1 Historical Review

In the pre-Colombian era, Costa Rica was populated by indigenous groups, which were seriously reduced with the advent of the Spanish colonization (Molina and Palmer 1997). Colonial times in Costa Rica were atypical in comparison with the rest of Latin

America as the country contained no valuable mineral resources for exploitation; gold, silver and native inhabitants were low in numbers. Therefore, in the face of poverty and isolation, local settlers had to become self-sufficient by working their own land and developing a rural egalitarian society identified by scholars as one of the foundations for democratic government (Edouard 1996).

With the defeat of the Spanish army in the Mexican War of Independence, Central American authorities in Guatemala declared the independence of all Central American countries in 1821 (Mitchell and Pentzer 2008). After emancipation, Costa Rica first joined a short-lived Mexican empire, but upon its collapse, opted to join the Federal Republic of Central America as one of its provinces, along with Guatemala, El Salvador, Honduras and Nicaragua. Complete sovereignty and independence did not occur until 1848 when then Chief of State José María Castro Madriz established the Republic of Costa Rica as an independent nation. Costa Rica continued to grow its agriculture-based economy, and its main products at the time, coffee and bananas, became the country's greatest income sources (Mitchell and Pentzer 2008). Although the consolidation of the nation involved major reforms ranging from administrative legislation to the infrastructure and education sectors, Costa Rica was not free of major upheavals. Between 1824 and 1949, only eight of forty-eight Presidents took office after a clean and competitive election (Lehoucq 1998). The 1948 Civil War, however, remains the bloodiest event in Costa Rica's political history. The war set at odds two mixed-ideological coalitions in the midst of accusations of corruption in recent presidential elections, but the end of the conflict resulted in major civil rights and welfare reform in legislation proposed by President José Figueres Ferrer, the leader of the winning

coalition, and also led to the abolition of the army, which became a pivotal decision for Costa Rica's history and development (Cordero and Paus 2008). Article 12 of the Constitution provides that "[t]he Army is proscribed as a permanent institution. For the surveillance and conservation of public order, there will be the necessary policy forces"⁷.

4.2.2 Political and Administrative Organization

Costa Rica is ruled by a constitution adopted in 1949, which defines Costa Rica as a democratic, free and independent republic. The country is divided into seven provinces - San José, Cartago, Alajuela, Heredia, Guanacaste, Limón and Puntarenas - which are each divided into cantons and those, in turn, are divided into districts (see Table 4). The national government maintains a popular, representative, alternative and responsible profile. Like most democratic nations, Costa Rica is ruled by three-branch government, in which the executive, legislative and judicial powers are independent and autonomous in relation to one another. In addition, the Election Supreme Tribunal, an independent body, is responsible for the organization and monitoring of any political election and for maintaining the electoral roll.

⁷ Constitution of the Republic of Costa Rica (1949)

TABLE 4 Costa Rica Political Organization

PROVINCE	NUMBER OF CANTONS	NUMBER OF DISTRICTS
San José	20	118
Alajuela	15	108
Cartago	8	48
Heredia	10	46
Guanacaste	11	59
Puntarenas	11	53
Limón	6	27
TOTAL	81	459

Source: INEC

Two vice-presidents and a cabinet of eighteen members support the president, elected for four years with no reelection. The Costa Rican Congress is unicameral with fifty-seven members elected to four-year terms by means of a popular vote. The Supreme Court, the members of which are elected by Congress for eight-year terms, heads the judicial branch and is also responsible for nominating lower level judges. The Constitutional Court deals with the constitutional aspects of legislation and generally works to prevent the government from impinging upon the rights of its citizens.

4.2.3 Demographics

According to the National Institute of Statistics and Census (INEC)⁸, Costa Rica has an estimated population of 4,563,538 inhabitants. Female and male populations account for 49.29 and 50.71 percent of the total population of the country, respectively. The average annual growth rate during the last decade was 1.6 percent, lower than that of the previous decade during which population grew, on average, at an annual rate of 2.5

⁸ Data drawn from www.inec.go.cr, visited on November 30th, 2010

percent. This downward trend may be attributed, in part, to lower birth rates. The number of births decreased in the decades between 1950 and 2009 t from 42 to 16.6 per 1,000 inhabitants. The reduced birth rates also have affected the age population pyramid. The share of the population under 14 years old decreased from 42.9 percent in 1950 to 24.7 percent in 2009, while the population over 65 years old increased from 2.9 to 6.6 percent during the same period. Immigration has also affected the country's population dynamics. As the country with the highest income per capita in the Central American Region, Costa Rica attracts a significant flow of immigrants, particularly from border countries; most of these immigrants who generally end up engaged in low skill jobs. Nicaraguans represent the largest source of immigration, accounting for 76.4 percent of the immigrant population and 5.9 percent of the national population (Castro 2002). The provinces vary in population size. San Jose has the largest population, accounting for 35.8 percent of the total national population; Alajuela and Cartago follow down the list with 19.2 and 11.2 percent, respectively; and Guanacaste has the lowest population share, representing only 6.15 percent of the national total (see Table 5).

TABLE 5 Population by Province

PROVINCE	POPULATION (Inhabitants)	SHARE (%)
San José	1,633,282	35.8
Alajuela	876,073	19.2
Cartago	510,727	11.2
Limón	444,884	9.8
Heredia	449,257	9.8
Puntarenas	368,827	8.1
Guanacaste	280,488	6.2

Source: INEC

4.2.4 Economic Review

Like most Latin American countries, Costa Rica has not deviated from its historically commodity-dependent economy. Throughout Costa Rica's past, the exploitation of natural resources has driven its infant economic activities, as demonstrated by the country's export of cocoa to South America in the early 1600s and its export of tobacco to Nicaragua, Panama and Mexico in the late 1700s and early 1800s (Greñas 1985; Fonseca 1998). The coffee and banana industries, however, ultimately became the major drivers that propelled Costa Rica into the global market. The coffee industry began to consolidate around 1830, while the banana industry did not emerge until the late 1800s in the Atlantic Region. The banana industry began to thrive with the construction of the railroad connecting the Limón Region with the Central Valley. Minor C. Keith, an American entrepreneur, was responsible for this project and upon its

completion, established and ran his own banana company, the United Fruit Company (Cordero and Paus 2008).

Coffee and bananas continued to serve as the main economic engines during the first half of the 20th century and are still important local economic activities today, but socio-political events also have had a major influence on Costa Rican economic development. The turbulences leading to the Civil War of 1948 not only resulted in a new Constitution, but also led to a new economic development strategy that ushered in the so-called Costa Rican “Golden Age” of growth and modernization from 1950 to 1970 (Seligson and Martínez 2005). National authorities promoted an advanced social welfare state relying on the private sector and strong public intervention in sectors such as banking, infrastructure, utilities, energy and the production of selected goods (Mesa-Lago 2000) with significant results. Between 1950 and 1979, national growth rates were among the highest in Latin America, poverty was reduced, and income distribution was improved; and in the health sector, infant mortality decreased from 87.2 to 28.6 per 1,000 and life expectancy increased from 55.6 to 72.6 years (Seligson and Martínez 2005).

The “Golden Age” resulted from a two-fold strategy. First, coffee and banana exports were heavily promoted, seizing the opportunity to exploit two consolidated industries able to respond to international standards. Second,, an internally oriented strategy was proposed to strengthen local capacity and particularly to foster industrialization. An Import-Substitution-Industrialization (ISI) policy, implemented with guidance by the national government, imposed higher tariffs and public subsidies for new industrial activities. Exports to Central American countries were exempted from this policy after Costa Rica’s incorporation into the Central American Common Market

(CACM) in 1963. The new “entrepreneurial state” profile was complemented by an intensive promotion of social welfare instituted through a set of new institutions and policies. Solís (1992) deems that 25 percent of public investment was allocated to social policy during the period from 1958 to 1962, targeting universal free primary and secondary education; universal access to health care; high coverage of pensions; low-cost subsidized housing; and poverty alleviation programs. In fact, Costa Rica’s poverty initiatives preceded the diffusion of safety nets in other Latin American countries in the 1980s by ten years.

Although the ISI-based strategy brought about welfare reforms, external and internal factors prompted a financial crisis in the early 1980s. The drop in international coffee prices and the unexpected fluctuations in international oil prices in 1973 and 1979 weakened the Costa Rican economy. . Additionally, at the local level, the agricultural sector was unable to create a productive model for diversifying exports beyond coffee and bananas. National authorities were left, therefore, with a smaller public budget that was not able to sustain the “Golden Age” social welfare model. This crisis led to decreasing economic and social indicators; GDP dropped by 16 percent; unemployment expanded to 9.4 percent; inflation reached 81.4 percent; and middle class Costa Ricans slipped back into poverty when public funding failed to maintain the established safety nets on a consistent basis (Solís 1992; Seligson and Martínez 2005).

In response to this crisis, Costa Rica turned to international organizations, such as the World Bank, the International Monetary Fund (IMF), and United States Agency of International Development (USAID). This decision required that national authorities redesign the country’s economic development model, replacing the ISI/welfare-state

model of the “Golden Age” with policies promoting market liberalization across most sectors, Foreign Direct Investment (FDI) attraction, lower state involvement in economic production, and the abdication of proactive policies (Cordero and Paus 2008). The enactment of the new strategy intensified once a structural adjustment program was signed with the World Bank in 1985 leading, to a reduction in tariffs from over 60 percent in 1985 to 11.7 percent in 1995 and to 5.8 percent in 2004 (Paus 2005). The role of international organizations, particularly in the 1980s, was of such significance that USAID alone amounted to 35.7 percent of Costa Rica’s public budget, 20 percent of its export earnings, and about 10 percent of GDP (Seligson and Martínez 2005).

Intel’s arrival in Costa Rica in 1997 was a major boost for the national FDI attraction policy. The \$300 million investment represented by the opening of a new microchip assembly and testing facility outside San José put Costa Rica on the radar for international high-tech corporations. Competition for this investment was intense as Brazil, Mexico, and Chile were also considered feasible options, but Cordero and Paus (2008) identify three reasons explaining Intel’s decision: a) Costa Rica’s location; b) human capital, infrastructure, and a stable local political scene; and c) tax and tariff conditions in the Zonas Francas (ZF) combined with the pro-active role played by Coalición Costarricense de Iniciativas para el Desarrollo (CINDE) in promoting the country.

Costa Rica’s proximity to the United States and Latin America as well as its access to both the Atlantic and the Pacific Oceans gave it a comparative advantage over other contestants, by allowing shorter international delivery times. Additionally, no significant time differences exist among Costa Rica, the United States, and Latin

America. Moreover Costa Rica's past investment in education enabled it to reach higher human capital indicators in comparison to its Latin American neighbors, as the country has a literacy rate close to 100 percent and a nearly universal primary school enrollment. These educational dynamics were complemented by a stable socio-economic and political scenario, as well as an increasing English-speaking population resulting from the introduction of English instruction in primary schools in 1994 and the explosive growth of tourism (Cordero and Paus 2008). Further, Costa Rica's performance in attracting FDI was significantly driven by the creation in 1982 of CINDE, a non-profit organization in charge of marketing the country to foreign investors. CINDE's officials approached foreign investors by inviting them to visit Costa Rica to meet with national authorities. CINDE started off as US-AID funded organization, but that association became a serious constraint for its future operation when Costa Rica no longer qualified as a USA-AID recipient country and funding for the network of international offices implemented by CINDE in Europe, Asia and the United States was drastically reduced. Nevertheless, CINDE's played a pivotal role in attracting Intel to Costa Rica. CINDE officials were able to get President Figueres personally involved in the operation, which resulted in presidential authorization for several ministers to work intensively in facilitating Intel's arrival.

Although the arrival of Intel was met with high expectations, results have been mixed. Benefits include economic growth and high employment, which was a direct result of new university curriculums designed by Intel professionals to meet the company's demand for human resources and a significant transformation of the national telecommunication infrastructure (Bortagaray 2007). Despite these gains, Cordero and

Paus (2008) state that the promotion of knowledge-based assets has not translated to the domestic industry at the expected levels. This underperformance may be attributable to the structure of Intel's supply chain in Costa Rica as the company continues to outsource its production among the company's global affiliates. And despite the educational upgrade, the absorptive capacity still limits its spread at local levels; thus, new and continuing upgrades are still needed to make maximize Intel's presence in Costa Rica.

Costa Rica today is an internationally recognized eco-tourism destination. The country's success in promoting tourism began in the early 1990s with the national effort to promote Costa Rica worldwide as a nation committed to the protection of the environment and biodiversity. The resulting growth in visitors and foreign exchange revenues has generated a good return on this investment. From 1996 to 2007, the number of tourists visiting Costa Rica rose from 781,000 to 1.98 million, and foreign exchange revenues more than doubled, increasing to almost 1.6 billion dollars (ICT 2005; ICT 2007). Nevertheless, such an explosive growth has brought challenges to Costa Rica with regard to the adequate preservation of biodiversity and wild life and the upgrade of local infrastructure (Cordero and Paus 2008)

In summary, although Costa Rica historically has followed the typical Latin American path to pursuing a natural-resource-based economy, while promoting industrialization through ISI policies, its decision to open the local economy has resulted in higher FDI, particularly in high-tech sectors, thereby fostering an incremental modification in the local economic structure. It is worth noting that the country's stable political scenario and maintenance of previously enacted social policies has facilitated the pursuit of this strategy.

4.3 Setting The Water Supply and Sanitation System

This paper addresses the following four aspects of Costa Rica's Water Supply and Sanitation system (CR-WSS): the history of the CR-WSS; the current situation with regard to the coverage, access and quality of the WSS sector; the institutions participating in the CR-WSS; and the strengths and weaknesses of the CR-WSS. .

4.3.1 Historical Review

The first Costa Rican settlers drew water directly from rivers and streams with no conducting system or quality treatment, and thus they chose to settle near available water sources. The situation did not change that much during the Colonial period, though a rising demand for water home distribution systems prompted authorities to construct the first aqueducts in the San José area, including the cities of Alajuela, Cartago and Heredia. These systems were managed by the municipalities with high participation by local users, particularly with regard to maintenance. National authorities continued to manage the funding and organization to construct new facilities in the following years. Although CR-WSS was in its infancy, the increasing level of responsibility led the authorities to establish the *Junta Acuaria* in 1839, a board of professionals exclusively focused on the administration of the San José aqueduct. One of the Junta's first projects was the construction of a water storage tank in the Plaza Principal, which was completed in 1840.

The Junta next promoted piping construction and was responsible for constructing the first piping system in the San José area covering a population of 40,000 people. The work was completed in 1868, but the absence of a filtration system and additional decanting issues resulted in water pollution when it rained. . Piping systems followed in other cities. Heredia, Cartago, Alajuela and Limón built their first systems during the late

1800s and early 1900s. The national government also pushed for the construction of drainage systems around the country starting in San José and Cartago, where work was completed in 1907, with limited coverage. The promulgation of the First Water Law in 1884 complemented this construction activity as it called for environmental protection through reforestation of the affected basins.

Aqueduct construction was strongly promoted throughout the country during the first half of the 20th century, with funding from public budgets financed through foreign loans and new taxes. A sense of public responsibility arose in the wake of all these new facilities. Users became active in the construction and maintenance of their own systems, thus turning into efficiency-promoting actors, e.g., notifying authorities when breakdowns were discovered in the system. Water treatment improved as the use of chlorine was incorporated in the major city systems. The national government generally took the lead in promoting construction, but once the projects and works were completed, municipalities took over the administration of the systems and set the service's tariffs. As the mid-century approached, the Costa Rican Congress passed a new Water Law in 1942 supplementing the previous coverage and supply goals with a stronger consideration of public health regulations.

The second half of the 20th century represented a stagnant phase for the CR-WSS. As investment significantly decreased, fewer new facilities were constructed and maintenance was neglected. The situation worsened. With no new treatment plants and no maintenance of the existing plants, wastewater began to be discharged directly into natural water sources, and septic tanks became the principal method for managing personal sanitation. Overall, the low investment rate, increasing migration to urban areas,

the poor maintenance performance by municipalities, and low tariffs, added up to a deficient WSS, which failed to match the users' demands. (AyA-PAHO 2002).

Facing such an unfavorable scenario, the national government decided to pursue major reform, resulting in the passage of Law N°2726 on April 14th, 1961, which created the National Service of Aqueducts and Sewerage (SNAA). The SNAA began as an agency with a broad mission, aiming to take over CR-WSS planning, funding, development, and normative tasks in regard to water supply and wastewater treatment as well as normative aspects of rainwater systems. From the beginning the SNAA dealt faced inadequate funding due to its dependency on public budgets and the of the relatively low tariffs imposed, which failed to subsidize the necessary operations and investments. Eventually, presidential intervention provides enough political support to increase tariffs and to allow the SNAA to borrow money from foreign lenders. This intervention took the country into a new era of high dynamism leading to significant improvements in public health and water supply coverage indicators by the end of the decade (AyA-PAHO 2002).

As part of its initial agenda, the SNAA concentrated its efforts on solving the serious problems faced by metropolitan areas at the time. Additionally, the national government with the support of the Pan American Health Organization (PAHO) and the funding of the Inter-American Development Bank (IADB) undertook a nation-wide rural aqueduct program that afforded new water supply systems for rural settlements, which compelled community members to actively participate in the construction and operation phases. Recognizing the unique sanitation presented at the rural level, and the problems

presented in constructing rural sewerage systems, the Ministry of Health (MINHEALT) promoted a latrine program at the time.

In 1976, following the passage of Law N°5915, SNAA was renamed as the Costa Rican Institute of Aqueducts and Sewer (AyA). AyA continued to work to improve WSS service in urban and rural regions. An IADB-co-funded program was executed between 1971 and 1976 to build new WSS facilities and upgrade facilities already in operation in urban areas. The Metropolitan Area of San José and the cities of Limón, Puntarenas, Liberia and San Isidro de El General were beneficiaries of this program, which included completion of the First Stage of the Metropolitan Sewer System. Later, during the period from 1977 to 1981, another IADB-co-funded program allowed for completion of the Second Stage of the Metropolitan Sewer System. In contrast, demand in rural areas was addressed by implementing various publicly funded programs, such as the Community Help Program (PAC). In addition, two new agreements helped to improve rural WSS. First, MINHEALTH and AyA agreed to work on supplying water to scattered and small communities around the country with funding from MINHEALTH, UNICEF and the communities themselves, with a process technically supported by AyA. Second, AyA and the Institute of Municipal Promotion and Counsel (IFAM) designed and implemented a public program that allowed municipalities to obtain loans from IFAM and to receive technical support from SNAA.

In the early 1980s, AyA faced a serious financial and institutional crisis, which resulted in national government intervention through the convening of a Junta Interventora, which oversaw AyA for a two-year period. Through this intervention, AyA was reorganized, its finances were re-ordered, and its planning was re-assessed in an

effort to avoid stagnancy. However, several natural disasters have tested AyA's capacity to improve the WSS performance and to match users' demand. Earthquakes in the cities of Limón and Alajuela, floods in the Southern and Atlantic regions, and a cholera epidemic affecting not only Costa Rica but Central America as a whole, obliged AyA to apply itself to building new infrastructure and reemphasizing water quality foresight. International organizations still play a significant role in funding new WSS facilities, such as the loans provided by the IADB and The World Bank to continue the improvement of aqueduct and sewer systems in both urban and rural regions. As the turn of the last century approached, significant innovation occurred. In 1995, AyA created a publicly funded program designed to supply water to 320 rural communities, benefiting 173.000 people. The decision to concentrate efforts in rural projects led national authorities to transfer more decision-making authority to local communities. Thus, in 2000, Executive Decree 29100-S created the Associations of Rural Water and Sanitation Systems (ASADAs) to replace the Rural Water Systems Administration Committees (CAARs) with their own legal status and to place them under AyA's supervision.

Although national authorities have worked to upgrade Costa Rica's WSS system by improving infrastructure and promoting decentralization, 1 issues remain regarding water quality and wastewater treatment. In 2000, the Office of the Comptroller General of the Republic issued an official report outlining the consequences of inadequate sanitation coverage and concluding that AyA's efforts during the last two decades to build new treatment plants and new drainage systems were insufficient. Accordingly, further initiatives should address not only the extension of coverage but also health and environmental issues regarding domestic and industrial waste.

4.3.2 Coverage, Sources and Quality

a) Coverage

Upon initial review, the indicators with regard to WSS coverage in Costa Rica appear high. The numbers reflected in the WHO/UNICEF Joint Monitoring Program (WHO/UNICEF JMP) show that in 2008 improved water coverage reached 95 percent of the national population, including urban and rural areas, with improved sanitation at 99 percent. Even analyzing urban and rural zones separately the indicators remain high (see Table 6).

TABLE 6 Improved Water Supply and Sanitation Coverage

	URBAN (%)	RURAL (%)	TOTAL (%)
Improved Drinking Water Source	100	92	95
Improved Sanitation	99	99	99

**Source: WHO/UNICEF-C (2010)
WHO/UNICEF-D (2010)**

An in-depth review, however, reveals a different view, particularly with regard to sanitation. When the coverage definition for water supply is narrowed to concentrate on house connections and to focus sewerage connection for sanitation, the numbers decrease. In fact, a dramatic change, from a high 87 percent to an almost negligible 4 percent, occurs for sanitation coverage in rural areas (see Table 7). The explanation for such a dramatic shift can be explained by the widespread use of septic tanks, involving

58.7 of the urban population and 88.5 percent of the rural populations. Therefore, the initial high sanitation coverage performance is directly attributable to the definition used by WHO/UNICEF when referring to an “improved” sanitation facility, which is defined as “as one that hygienically separates human excreta from human contact”⁹.

TABLE 7 Water Supply and Sanitation Coverage

	URBAN (%)	RURAL (%)	TOTAL (%)
Water Supply/House Connection	99	87	94
Sanitation/Sewerage Connection	40	4	26

**Source: WHO/UNICEF-C (2010)
WHO/UNICEF-D (2010)**

Nevertheless, these semantic differences should not diminish the results of Costa Rica’s steady efforts to increase its national water supply coverage during the last decades. Since 1990, house connection coverage has gone from 92 to 99 percent in urban areas, and in rural zones coverage showed a significant increase, from 71 to 87 percent. The increasing trend is more remarkable when extending the range of analysis to the period between 1967 and 2000, when coverage in Costa Rica went from 65 to 97 percent, with the rest of Latin America reaching an average of 85 percent in 2000 (Sánchez 2009). Those trends are a direct consequence of the country’s policy agenda to increase rural

⁹ <http://www.wssinfo.org/definitions-methods/introduction/> visited on February 22nd, 2011

coverage resulting in the implementation of new communitarian programs fostering local self-organization and participation.

Costa Rica also presents a set of public and publicly-supervised private organizations responsible for water supply. AyA is the main supervisory body, along with municipalities, the Heredia Public Service Enterprise (ESPH), the ASADAs, the CAARs and some small private operators. The fact that the ASADAs and CAARs reflect a higher citizen participation rate and ESPH coverage share than municipalities, -amounting to 26.3 percent of the whole population, confirms that benefits of pursuing a community-driven agenda to provide increasing WSS coverage (see Table 8).

TABLE 8 Water Supply and Sanitation Coverage by Organization

Organization	Number of Aqueducts	Population Covered	
		Amount	(%)
AyA	180	2,074,941	46.4
Municipalities	240	766,142	17.1
ESPH S.A.	12	205,486	4.6
ASADAs/CAARs	1,827	1,175,092	26.3
Private Operators	n/i	178,851	4.0

Source: Sancho (2008)

b) Sources

Costa Rica obtains water through superficial and underground sources. Espinoza et al (2004) estimate 170 km³ as the amount of annual national rainwater, with 75 km³ going to rivers, 37 km³ to aquifers, and the rest going to the atmosphere through evaporation and transpiration. Thirty-four watersheds are identified in relation to the region they cover: Pacific, North and Caribbean; and fifty-eight aquifers are identified, thirty-four of which are defined as coastal, fifteen as continental, and nine as sedimentary-continental (Quesada 2002; IMTA 2008; MINAET 2008). Considering the amount of water captured and stored in light of the actual average water population demand, Costa Rica has not felt major pressure over the centuries to hone its water resource national planning because no sign exists that the supply can be exhausted, which may have led to a lax approach in implementing resource protection (Espinoza, Morera et al. 2004).

c) Water Quality

Costa Rica generally has demonstrated significant advances in water supply management, achieving high urban and rural coverage indicators that put it at the top of list among Latin American countries. But barriers to complete coverage remain. Viewing the population as a whole, 82 percent have access to potable water, leaving considerable 16.2 percent without safe drinking water (see Table 9). Espinoza et al (2004) conclude that 20.1 percent of all aqueducts providing water employ disinfection as the only treatment process, while a mere 1.6 percent apply the conventional treatment involving flocculation and chemical coagulation, decantation and filtration. The aqueducts relying only upon disinfection generally draw water from high quality underground sources;

while those aqueducts applying conventional methodologies generally draw on superficial sources.

TABLE 9 Potable Water Coverage by Organization

Organization	Population with Potable Water		Population with No Potable Water	
	Amount	(%)	Amount	(%)
AyA	2,030,161	97.8	44,8780	2.2
Municipalities	584,745	76.3	181,397	23.7
ESPH S.A.	205,486	100	0	0
ASADAS/CAARS	702,970	59.8	472,122	40.2
Private Operators	149,340	83.5	29,510	16.5
TOTAL	3,672,702	82	727,809	16.2

Source: Sancho (2008)

In contrast, Segura et al (2004) conclude that Costa Rica lacks an efficient sanitation system. Efforts made in the past collapsed with an increasing population and no proper maintenance practice, so that only 26 percent of the population have access to sewerage sanitation, and only one in fifteen Costa Ricans, or 6.6 percent of the national population, have access to both sanitation and wastewater treatment services. The greatest coverage occurs in the cities of San José (51 percent), Heredia and Cartago (15 percent each), while the rest of the country has under 10 percent coverage (Morales

2010). Segura et al (2004) cite various reasons to explain the poor treatment performance: a) technical faults in treatment systems; b) the excessive use of septic tanks; c) no resources to carry integral actions; d) the education and customs of the local population; and e) the overlapping and vagueness on the definition of institutional roles. A substantial threat arises with the regular practice of discharging waste directly to either rivers or through the drainage system when septic tanks fail, thereby increasing pollution and the likelihood of waterborne diseases. Reynolds (2001) adds that the use of septic tanks often fails to consider carrying soil studies prior to construction, resulting in a greater likelihood aquifers may become polluted with fecal material. Limited water treatment either in relation to water supply or to sanitation and the lack of an adequate WSS infrastructure in certain areas of the country have caused outbreaks of waterborne diseases with diarrhea at the top of their list (see Table 10) and second among reportable diseases at the national level.¹⁰ Costa Rica continues to seek solutions to these problems, including the planned construction of a new treatment plant for the Great Metropolitan Area funded by the Japan Bank for International Cooperation (JBIC) in conjunction with the national government.

¹⁰ A reportable disease is defined as a disease that must be reported to federal, state, or local health officials when diagnosed. Reportable diseases include active tuberculosis, viral hepatitis, syphilis, gonorrhea, and HIV. <http://www.medterms.com/script/main/art.asp?articlekey=26699> visited on February 23rd, 2011.

TABLE 10 Waterborne Reportable Diseases

DISEASE	NUMBER OF CASES
Diarrhea	138,410
Dengue	12,236
Leptospirosis	298
Hepatitis	230
Shigelosis	222
Salmonella	90

Source: Segura et al (2004)

4.3.3 Institutions

The participating institutions, their norms, roles and competencies, will first be considered with regard to the legal framework upon which WSS organizations are obliged to act, followed by a description of the participating WSS organizations, marking the difference between those involved in the macro scenario of water resources management and those participating as operators of the national WSS system (see Figure 17).

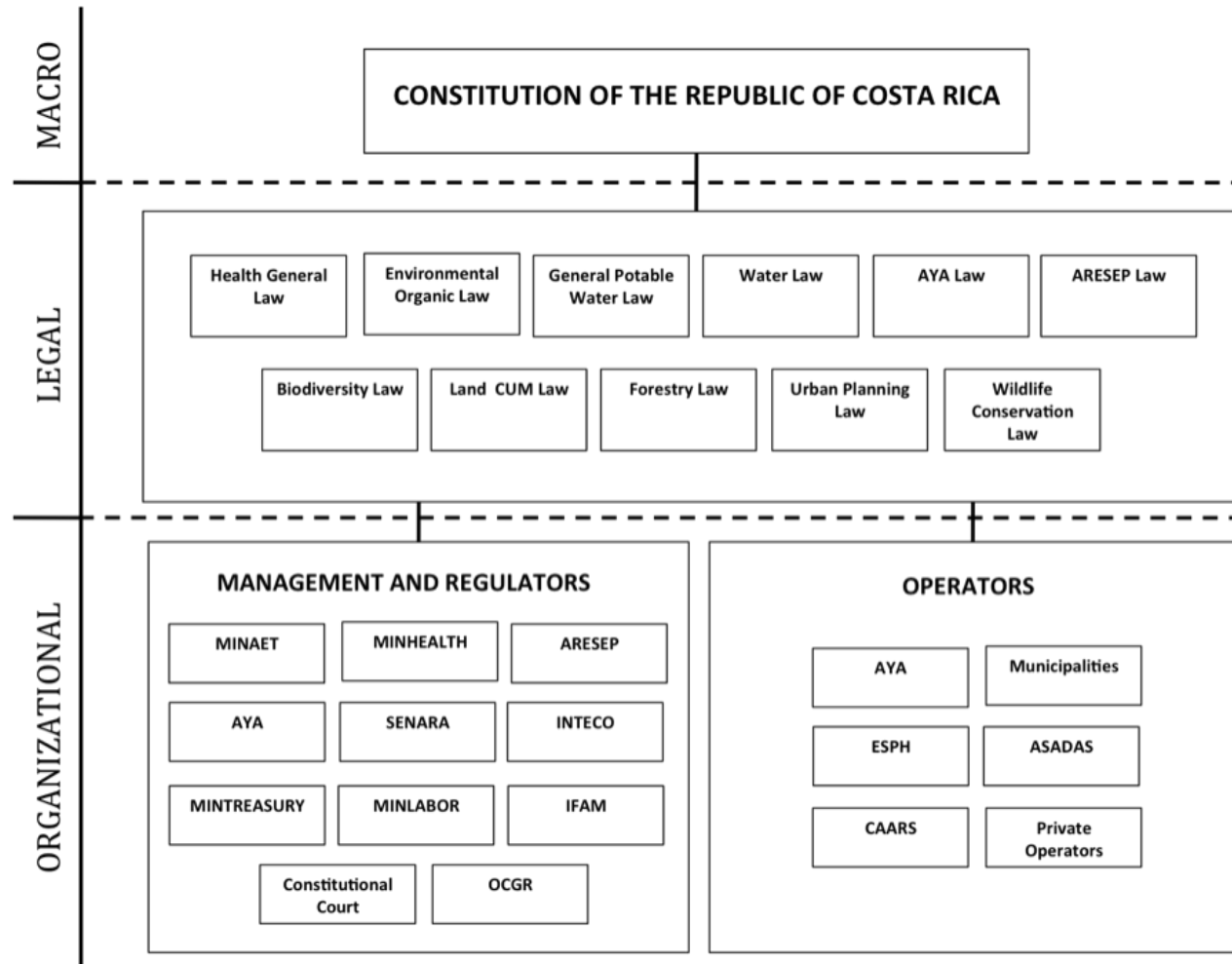


Figure 17 Institutional and Legal Framework Costa Rica's WSS System
 Source: Own Author

4.3.3.1 Legal Framework

The primary piece of legislation affecting the CR-WSS framework is the *Political Constitution of the Republic of Costa Rica*. The Constitution addresses the Water Sector in the definition of citizens' individual rights and guarantees set out in Article 46, which provides that “[c]onsumers and users have the right to health, environment, security and economic protection, to receive adequate and truthful information, to freedom of choice and to a fair treatment”. In Article 50 when defining social rights and guarantees, the Constitution reinforces the significance of living in a healthy environment by ensuring that:

“[t]he State will procure the highest welfare for all national citizens by stimulating production and an adequate distribution of wealth. Every person has the right to a healthy and ecologically balanced environment. That is how he/she is entitled to report actions that infringe such right and to demand reparation for the damage. The State will guarantee, defend and persevere that right. The law will determine the corresponding responsibilities and sanctions”.

In addition to these provisions, Article 121 defines those goods that are strictly prohibited from state ownership to include “forces that can be obtained from waters of public domain in national land.”

Two constitutional modifications that would further protect access to water resources are currently being considered.¹¹ The first proposes modifying Article 50 to reinforce the premise that access to water supply and sanitation is a constitutional right.

The proposed addition provides:

”Water is a fundamental and inalienable human right. Every person has the right to potable water and sanitation in accordance to the law.
Both the State and each person are mandated to watch over the defense, protection and restoration of water resources. Water supply to population is a priority.

¹¹ <http://www.elpregon.org/costarica/politica/3000-reforma-constitucional-del-agua-sera-estudiada-por-comision-legislativa-especial->, visited on February 9th, 2011.

Water-related norms and national policies must guarantee the sustainable management of water and the solidarity with future generations.”

A second proposed modification would alter the wording of Article 121 to state, “Waters are of public domain, belong to the Nation and are definitively forbidden to leave Nation’s domain; their use and exploitation will be ruled in accordance to the law.”

The public discussion is still ongoing in political circles, but overall, the Constitution grants the environment a high level of protection. Thus, this dissertation defines water resources protection as a constitutional obligation.

This constitutional protection has provided a platform for the passage of specific legislation aimed at enforcing this constitutional guarantee and other legislation is under consideration in connection with the administration of the national WSS system.

A. Health General Law N°5395

The Health General Law, passed in 1973, obligates every person to contribute to the promotion and maintenance of the conditions of natural and artificial environments that cover the vital and health needs of the local population, and prohibits any action, practice and operation susceptible of harming the environmental elements of air, water and land. The law also defines norms regarding water supply operation that require any water supply system to supply potable water continually and in enough quantity to meet demand. Responsibility for water quality control is vested in MINHEALTH, entitling the Ministry to intervene if operators do not meet these requirements.

The law defines water as “...as of public domain whose consumption has priority over any other use...”¹². Thus, legal and natural persons are prohibited from polluting shallow water, groundwater and seawater, either directly or indirectly by discharging or

¹² Health General Law, Article 264

storing liquid or solid pollutants that can harm people's health. MINHEALTH is the only entity entitled to authorize the discharge of liquid or solid waste where dischargers comply with controlling norms and previously established procedures.

B. Environmental Organic Law N°7554

Issued in 1976, this legislation defines water as of public domain, the conservation and sustainable use of which are of social interest. The law identifies the State and municipalities as promoters of an active and organized social participation in decision-making and subsequent actions designed to protect and improve the environment, to foster environmental education and to create a sustainable environmental culture. To prevent environmental pollution, all public organizations must prioritize the establishment and operation of adequate services in vital health areas including water supply for human consumption; sanitarian disposal of wastewater, sewage and pluvial water; and waste collection and management. Thus, the law requires that all wastewater and sewage must be treated before being discharged into rivers, lagoons, seas or other bodies of water, complying also with quality norms relating to the receptor body in accordance with its use and potential.

C. General Potable Water Law N°1634

This law defines the planning, design and implementation of potable water supply facilities as a public utility. Because the law was issued in 1953, before AyA's creation, it places responsibility in the Ministries of Health and Public Works for the design and construction of new potable water supply systems and the selection and localization of the water sources the new facilities will utilize. In addition, municipalities are given responsibility for the operation and maintenance of the new systems, and for setting tariffs

in conjunction with the two ministries. Clearly, the CR-WSS has evolved significantly since this law was enacted, and thus new institutions have taken the place of the old ministries. Regardless of this evolving dynamic, however, some provisions of the law still govern, including the prohibition against construction, installations, and works next to water sources drawn upon by local WSS systems if such projects may damage either operation and distribution activities or the physical, chemical or bacteriological conditions of water.

D. Water Law N°276

Issued in 1942, the Water Law regulates all aspects of water resources. The law defines water as of public domain and establishes specific guidelines regarding the exploitation and protection of the resource particularly with regard to the concession process. To protect water resources, the Water Law promotes the conservation of forests and woods, particularly those located by rivers and springs by setting a five-meter-wide area ban around the source to prevent woodland destruction. Although other legislation provides similar protection, the Water Law is considered to be outdated in relation to the demographic, cultural, environmental, and water resources conceptualization that have occurred since its passage (Centeno, Corrales et al. 2010). Reynolds (1996) notes that the Water Law does not include updated concepts needed for planning and use and recovery of water resources and that it provides no effective and agile solution mechanisms to apply when a new conflict arises. A proposed revision would replace the Water Law with a new version that preserves the definition of water as of public domain by requiring the State, private organizations and individuals to participate in the preservation and adequate management of water resources. The new law would introduce the concept of an

ecosystem to the sector and would require that the exploitation and distribution of water resources harmonize human resources and sustainable co-development to the benefit of present and future generations. The new law also proposes a new management structure established along basin-level integral planning in order to achieve the conservation, protection and exploitation of water resources. The discussion on the new Water Law, dubbed the “Water Resources Law” includes the Constitutional modification discussed above and has reached the Legislative Assembly for a final decision.

E. Costa Rican Institute of Aqueducts and Sewers (AyA) Law N°2726

This law came into effect in 1961 to establish AyA as an autonomous public body responsible for directing, policy setting, establishing and applying norms, planning, financing and development, as well as solving issues, related to water supply, wastewater, and sewage. The agency was authorized to set normative aspects of pluvial drainage systems in national urban areas. At inception, AyA was given operational, regulatory, supervisory, and protective functions, although a particular emphasis was placed on the feasibility of AyA operating municipality-run systems in cooperation with local governments, except any system covering the Metropolitan Area, which is legally defined as an exclusively AyA-run operation. It is worth noting that although CAARs and ASADAs had not yet been established, the ability of AyA to delegate operations to rural associations was already part of the law.

The law also empowered AyA to set tariffs. With no regulatory authority in place, the legislature put the agency in charge of establishing tariffs as long as the fee considers the community contribution during construction, operation and maintenance of WSS facilities, as well as criteria of social justice and distribution that take into account users’

social origin; thus, a progressive dynamic operates in which the richest subsidize the poorest. In addition, the law allows the State to subsidize, in whole or in part, areas or groups of users, who in light of their economic situation are unable to pay the established tariffs. AyA also serves as the reviewing agency because all WSS construction, extension or modification projects, whether privately or publicly funded, are obliged to go through AyA's examination and approval. The law further requires AyA to cover the expenses for conserving, extending and securing forests that protect natural water sources in all systems it operates.

F. Regulatory Authority for Public Services (ARESEP) Law N°7593

This Law, enacted in 1996, transformed the National Service of Electricity into an autonomous organization, named the Regulatory Authority for Public Services (ARESEP). ARESEP is tasked with regulating various public services, including electricity, transportation, telecommunication, fuels, and water supply and sanitation, thereby setting tariffs and prices with regard to the service provided and ensuring that public service providers comply with the requirements for quality, quantity, timing, and reliability in their operation; collaborating with other public bodies to protect the environment with regard to those public services regulated by the agency. In simpler terms, ARESEP is charged with harmonizing the users' demand with the interests of the service providers.

The agency is further authorized to regulate and audit service providers both financially and technically service providers to determine whether they properly consider the factors affecting the service cost in terms of investment, debt, income, cost and spending and economic return; to technically supervise field plants, equipment and

facilities to verify the quality, reliability, continuity, costs, prices and tariffs of the public service; and to watch over the fulfillment by regulated firms of tax, social and labor obligations.

G. Biodiversity Law N°778

The Law was issued in 1998 after a participatory process in which stakeholders were free to give their opinions and agreed upon a final version¹³. It is aimed at conserving biodiversity and the sustainable use of resources, as well as fairly distributing the subsequent benefits and costs. The biodiversity conservation crosses the design and implementation of sociocultural, economic and environmental policies. The participation pattern in the pre-enactment stage is reinforced in terms of the dynamics of social engagement, promoting education and public awareness on conservation and use of biodiversity. In addition, the Law establishes an equalitarian access to environmental and economic benefits derived from biodiversity for all social segments with a particular emphasis on local communities and indigenous population. The law shares with the Health General and Environmental Organic Laws a common pattern of promoting social participation and reinforcing the citizenry's right to a healthy environment in which ecologically protective and economically productive activities harmoniously co-exist.

H. Forestry Law N°7575

This Law came into effect in 1996 and names the State as the primary entity responsible for the conservation, protection and administration of the natural forests in accordance with sustainable and adequate use principles. The law protects areas

¹³ In 2010, Costa Rica was awarded the Future Policy Award by the World Future Council (WFC) – www.worldfuturecouncil.org-. WFC is a non-profit organization based in Hamburg, Germany, that recognize laws that benefit the quality of life of present and future generations. <http://www.nacion.com/2010-10-26/AldeaGlobal/NotasSecundarias/AldeaGlobal2567557.aspx> visited on February 9th, 2011.

bordering springs, rivers, lakes, streams, natural and artificial reservoirs and aquifers which coincides with the Water Law's goal of preserving water by protecting forest resources.

I. Wildlife Conservation Law N°7317

Enacted in 1992, the Wildlife Conservation Law prohibits the discharge of sewage, waste or any polluting substance into any type of water source, including rivers, lakes, springs, brooks, swamps or reservoirs, and requires treatment plants at waste-dumping operations under the supervision of the Ministry of Health.

J. Land Conservation, Use and Management Law N°7779

The Law was adopted in 1998 and promotes land conservation, protection and improvement through the comprehensive and sustainable management and adequate environmental planning that considers co-existence with other natural resources. Thus, when undertaking any new type of land use project, planning must be done at the basin level, thus including an assessment of the effect that the social and economic factors may have upon water resources.

K. Urban Planning Law N°4240

Passed in 1968, the Urban Planning Law defines urban planning at the national and regional levels to include the promotion of efficient development of urban areas, which contributes to the better use of natural and human resources. The Law also provides for the co-development of territorial planning and natural resources, particularly water resources, fostering a harmonic evolution between both.

4.3.3.2 Organizations

This paper divides its analysis of the participating CR-WSS organizations into two segments. The first provides a description of those organizations responsible for the administration of water resources and the second reviews those organizations that work directly to provide service.

4.3.3.2.1 Water Resources Management

Various organizations participate in the management of water resources in Costa Rica, particularly with regard to regulation and supervision. Under the legal framework currently in force, these ministries and agencies are designed to monitor the fulfillment of the WSS norms and guidelines.

A. Ministry of Environment, Energy and Telecommunication (MINAET)

MINAET was created in 1995 as an updated version of the previous Ministry of Natural Resources, Environment and Mining. MINAET is the guiding institution with regard to water resources in Costa Rica with the stated mission of promoting the conservation and exploitation of water resources to improve national health and sustainable human development through a system of comprehensive management. Accordingly, MINAET is the public agency responsible for approving water resources exploitation concessions through a process headed by the MINAET Department of Water, in consultation with various public organizations with WSS technical competence, such as AyA and the National Service of Underwater, Irrigation and Drainage (SENARA). AyA and the ASADAs are exempt from this approval process, as both have legally-granted authority oversee the exploitation, use, governance and foresight of public waters provided they exploit water resources for the operation of WSS systems. Both

organizations need only inform the MINAET Department of Water about new exploitation activities they plan to pursue.

MINAET participation within the CR-WSS goes beyond concession approval. The ministry is also responsible for the institutional coordination of basin management at both the macro and micro levels; for application of the wastewater treatment regulatory framework, particularly supervision and control; and for the promotion of water use efficiency programs. MINAET does not work in isolation, and its collaboration with MINHEALTH, AyA and NGOs has resulted in the issuance of the *Wastewater Reuse Rules Proceeding* currently regulating water quality and treatment. In addition, MINAET oversees, through the Environmental National Technical Secretary (SETENA), the analysis and approval of the environmental impact studies of each proposed water supply, sanitation and wastewater treatment system.

B. Ministry of Health (MINHEALTH)

MINHEALTH is legally responsible for the regulation and control of water quality and for the supervision of solid and liquid waste disposal in national waters, with the goal of improving the health conditions of the local population. To fulfill this goal, MINHEALTH is authorized to set water quality norms, to review and approve new WSS facilities, and to require liquid waste treatment and waste management plans for WSS operators; MINHEALTH is even legally authorized to intervene when WSS operators put their consumers' health in jeopardy. The ministry's supervising role also encompasses the proposal of new WSS infrastructure, requiring that operators undergo its examination and approval when starting new operations. The ministry's collaboration with the National Water Laboratory (WNL) and various NGO's on water quality standards led to the

issuance of the *Potable Water Quality Rules Proceeding*, which has been upgraded periodically since it came out in 1997.

C. Regulatory Authority for Public Services (ARESEP)

ARESEP is the national public service regulatory agency that exercises financial supervision over different economic sectors and both public and private operators. ARESEP is responsible for setting tariffs and for regulating the quality, quantity, reliability, timing and provision of the service; therefore the agency's regulatory work is both economic and technical. ARESEP functions are defined in accordance with ARESEP Law N°7593 issued in 1996 and the enactment of those premises follows the standards set out in the *ARESEP Law Rules Proceeding*.

With regard to economic regulation, the ARESEP Law obligates the agency to consider criteria of social equity, environmental sustainability, energy conservation, and economic efficiency when setting tariffs and to prevent tariffs that may harm the financial equilibrium of the operators. The agency's technical regulatory function is complementary to the economic one because it establishes the norms and conditions applicable to service providers. Thus, ARESEP participates in the WSS national system by defining prices in line with the consumers' and the providers' actual context and by standardizing basic norms to ensure an efficient and effective service. In addition to its economic and technical functions, the law requires ARESEP to supervise the fulfillment of the norms previously set by the agency and thus grants ARESEP authority to exercise control over facilities and equipment to verify the compliance with their original mission. The agency is further obligated to receive, investigate and resolve users' complaints not satisfactorily resolved by the service provider, making ARESEP's resolution procedures

mandatory for operators. The agency further supervises the process to ensure that problems are rectified as quickly as possible.

D. Costa Rican Institute of Aqueducts and Sewers (AyA)

AyA has a two-fold function within the national water sector as it is both the largest system operator and the designated regulator and supervisor for all such systems. . AyA is an autonomous public organization created in 1961 under Law N°2726, as modified in 1976 by Law N°5951. In accordance with its dual roles, the Law grants the agency varying responsibilities ranging from directing, policy setting, planning, applying norms, financing, development and sorting out all aspects related to water supply, sanitation, pluvial drainage, and the evacuation of domestic and industrial wastewater. The Law also entitles the agency to exercise a regulatory role in connection with its own and the ASADAs' operations.

Regulation at AyA encompasses various activities. First, although it recognizes ARESEP's authority as the public body responsible for tariff setting, the agency conducts tariff calculations with regard to its own and the ASADAs' operations although to formalize those calculations, AyA has to undergo ARESEP review and approval. This duality is explained by the fact that AyA's creation occurred prior to the creation of either ARESEP or MINAET and before the enactment of the General Health Law. AyA, therefore, was conceived to be a multitasking WSS public organization with operating, planning, regulating and oversight roles. Currently, AyA also plays a role in setting technical norms through the development of technical proceedings that regulate the construction, operation and maintenance of WSS systems. The agency does not write technical norms, a Technical Norms Institute of Costa Rica (INTECO) responsibility, but

it participates in INTECO-headed committees when the norms at issue relate to AyA's mission. Nevertheless, AyA has issued "Design and Construction Norms for Urbanization and Development" to formalize the review, approval and construction of WSS projects, although that would seem to be an INTECO responsibility. AyA also plays a key role with regard to water quality and environmental protection in conjunction with the WNL, the entity in charge of water quality control in AyA-operated facilities; ASADAS; and third parties.

E. National Service of Underwater, Irrigation and Drainage (SENARA)

SENARA was created in 1983 under Law N°6877. A unit of the Ministry of Agriculture and Livestock, the agency governs the setting and supervision of groundwater norms. Although the extent of its regulatory capacity has been questioned, SENARA is periodically consulted by the MINAET Department of Water when reviewing groundwater concessions and by AyA when facing aquifer-related decisions.

F. Technical Norms Institute of Costa Rica (INTECO)

INTECO is a non-profit, private organization created in 1985 that was recognized in 1995 by Executive Decree as the national body of normalization. In 2002, INTECO's entitlement was extended for a fiveyear period under the Quality National System Law N°8279. Further extensions depend upon INTECO's performance. Therefore, INTECO is officially recognized as having responsibility for setting and diffusing technical norms. Upon request it also may get involved in supervising and monitoring those norms. INTECO works by forming committees comprised of suppliers, users, public organizations and research centers. These committees discuss and agree upon a draft of norms to be approved by the INTECO Board of Directors, a 15-member group

representing public and private institutions with an interest in the norms being designed. The norms are not mandatory unless fulfillment is required as part of technical proceedings issued by the Ministry of Industry and Trade. In the WSS sector, for example, INTECO established water supply and pluvial drainage piping norms already in operation.

G. Ministry of Labor

The Ministry of Labor manages a publicly funded Family Benefit Program utilized in the promotion of rural aqueducts, thereby contributing to CR-WSS financing by improving the economic conditions of the beneficiaries and the application of regulatory norms.

H. Ministry of Treasury

The Ministry of Treasury is responsible for administrating the national public budget and for executing economic policy in conjunction with the Central Bank and the Ministry of Planning and Economic Policy. The ministry authorizes internal and external indebtedness and sets the spending limits for public organizations. In this capacity, it directly affects AyA's agenda because it defines the limits of AyA's future investments and operations. ESPH S.A. and municipalities are not subject to oversight by the Ministry of Treasury, creating a comparative disadvantage for AyA in relation to other operators.

I. Institute of Municipal Promotion and Advise (IFAM)

IFAM was created in 1970 under Law N°4574 with the goal of strengthening municipalities by fostering efficiency and efficacy among local governments. A distinctive feature of IFAM is its ability to make short-, medium- and long-term loans to municipalities to fund local works and services, and to guarantee loans obtained by

municipalities from banking operations. In addition, IFAM provides advice on organizational efficiency for municipalities that undertake new projects.

J. Constitutional Court

The Constitutional Court, part of the country's judicial branch, resolves constitutional and legal issues impacting the rights of the citizenry. The court's decisions are final and thus not subject to appeal. On occasion the court has addressed issues defining the relative authority among the institutions participating in the WSS sector.

K. Office of the Comptroller General of the Republic (OCGR)

The OCGR is responsible for monitoring and supervising the public treasury, and thus has the authority to examine the finances of publicly funded CR-WSS organizations. Moreover, although ARESEP generally sets the tariffs for the CR-WSS, the Constitutional Court has determined that the OCGR should be in charge of setting tariffs for municipalities.

4.3.3.2.2 Service Providers

In addition to the organizations charged with water resources management, the administrative structure of the WSS sector includes various public and private entities with differing profiles defined by the public they serve and the context in which they operate..

A. Costa Rican Institute of Aqueducts and Sewers (AyA)

As previously discussed, AyA was created in 1961 although it was originally named the National Service of Water and Sewerage (SNAA). The Law defines AyA as the public agency responsible for directing and designing policies; establishing and applying norms; promoting planning, funding, and development; solving any issue

relating to water supply, collection and dumping of black waters and industrial waste; and the normative aspects of sanitation and pluvial drainage systems at the national level. As the national WSS guiding public organization, AyA is obliged to support all public bodies in relation to WSS matters and to coordinate public and private organizations engaged in establishing new WSS facilities and to water pollution. Compliance with AyA oversight is mandatory.

AyA also is a decentralized service provider with an obligation to directly manage and operate all WSS systems in the country. The institution is responsible for ensuring continuity of service, and if an operator is unable to maintain the operation of a local WSS system, AyA is obliged to take over. AyA has additional responsibilities in the following areas:

- Water Supply and Sanitation Systems and Projects: AyA is responsible for directing and supervising any WSS-related facility; thus it has the authority to evaluate the need for a new facility or new project and to determine whether the new construction will be publicly or privately funded.
- Water Resources Governance, Exploitation, and Use: Although MINAET is the public agency in charge of water resources governance, AyA maintains governance, exploitation and use rights when the WSS projects in which the agency participates require it.
- Water Resources Conservation: AyA shares competencies with MINAET with regard to water resources conservation, specifically the promotion of basins conservation and ecological protection, as well as the prevention of water

pollution requiring both agencies to coordinate their efforts to avoid duplication of effort.

- Health Protection: AyA controls water quality by means of WNL activity. Supervision is limited to systems either operated or supervised by AyA. The controlling task of AyA overlaps with MINHEALTH's role as the national institution responsible for preventing water pollution.
- Regulation of WSS Service: AyA is able to supervise the efficiency of the systems it controls by following the applicable ARESEP guidelines.

B. Heredia Public Service Enterprise (ESPH)

ESPH was formed in 1949 as the public utility responsible for the distribution of electricity in Heredia, and it was not until 1976 that WSS was added to the company's responsibilities. ESPH was originally formed as the City of Heredia Electrical Service Administration Council, and became a publicly-run private water utility, ESPH S.A., upon the enactment of Law N°7787 in 1998. Currently,, ESPH S.A. coordinates the local governments of the Heredia Province in an effort to unify the operation of the local WSS and electric energy systems, as well as the conservation, management and exploitation of the province's water resources. This structure was implemented to alleviate ESPH's commercialization and operational responsibilities in an effort to maintain the organization's public profile and to improve its prior performance. ESPH delivers safe drinking water to more than 42,000 households, which accounts for six percent of the national population. ESPH and AyA serve similar functions in ensuring the quality, reliability and timing of the WSS service, but ESPH has no responsibility for the environmental protection of water resources or the prevention of water pollution.

C. Municipalities

According to Article 169 of Costa Rica's Constitution, municipalities are charged with managing and operating local services at the county level. Before the creation of AyA, therefore, municipalities were the primary operators of local WSS systems. In 1961, however, the AyA Law granted municipalities the right to hand over the operation of those systems to AyA if they were experiencing significant disparities and poor performances at the local level. Although several municipalities followed the AyA path, those with good performance were allowed to keep their operational role provided they continued to meet as the requisite efficiency and quality indicators. Otherwise, AyA was entitled to take over operations. The only region that exempted from maintaining local control was the Metropolitan Area, which the law placed under AyA's control. Accordingly, the current relationship between the municipalities relationship and AyA is twofold: in those municipalities without capacity to run a WSS system, AyA operates it, but in those municipalities capable of operating their own system are subject to a constant and thorough supervision by AyA over the system's construction, operation, and maintenance. Additionally, municipalities are empowered by the General Potable Water Law to operate their own treatment systems and to establish regulations and mechanisms of control with regard to hydraulics under their own jurisdiction, provided they comply with AyA guidelines and norms.

D. Associations of Communal Water and Sanitation Systems (ASADAS)

The Ministry of Health's Decree Law N°29100-S, enacted November 9th, 2000, redefined the Rural Aqueducts Administration Committees (CAARs)¹⁴ into a new type of communal association subject to stricter AyA control and supervision: the Associations of Communal Water and Sanitation Systems (ASADAs). The new legal framework drew upon AyA's ability to delegate the administration, operation and maintenance of local WSS systems, either individually or jointly, to associations constituted and registered in accordance with the Law of Association N°218 with the unique goal of providing local WSS service. The interaction between AyA and ASADAs, therefore, is one of subordination with AyA entitled to order the physical and administrative integration of various local systems or to even terminate in advance the delegation agreement between the institutions if the ASADAs do not comply with AyA's quality, quantity, coverage and reliability standards. When a delegation contract is terminated, all of the ASADAS' assets revert to AyA. AyA's authority also allows it to summon the ASADA's general assembly to discuss removing one or more members of the ASADA's board of directors if AyA demonstrated that the board was not working efficiently to meet either the AyA-issued technical norms or guidelines.

A board of directors heads each ASADA, the members of which are elected in open elections held at the general assembly, with all local residents with no debt and registered as an ASADA associate entitled to vote. The ASADA hires its own staff as needed, but is required to hire at least one administrator and a plumber. The administrator reports directly to the board of directors and is responsible for the ASADA's daily

¹⁴ The Rural Aqueducts Administration Committees (CAARS) are long-standing local organization pursuing to operate local WSS systems. Although they work under AyA's supervision and control they do not have legal status in order to formally operate.

operation, while the plumber, who reports to the administrator, is responsible for the maintenance of the WSS system. Article 21 of the ASADA Rules Proceeding defines the association's function as follows:¹⁵

- **System Administration:** ASADAs are responsible for the administration, operation, reparation, custody, defense and protection of the local WSS system. They actively participate in devising the new internal rules proceedings and in co-writing along with AyA's officials the delegation agreement whereby roles, tasks and responsibilities of both institutions are established.
- **Community Participation:** ASADAs have to actively promote community participation in the construction and operation of the WSS system consolidation process. ASADAs meet the participation requirement by getting the community directly involved in the construction phase or once in operation with annual calls for general assembly meetings and periodic reports of operation, maintenance and development. Participation is also required with regard to the protection of water resources requiring that community members be invited to training activities that allow them to pursue environmental conservation practices.
- **Execution of Projects and Works:** ASADAs are obligated to comply with AyA's standards in the construction of a new local WSS system or an extension of the current one. ASADAs are also entitled to strategic planning that may result in new works to upgrade the local WSS system involving AyA's participation as supervising or consulting agent.

¹⁵ Reglamento de las Asociaciones Administradores de Sistemas de Acueductos y Alcantarillados (2005)

- **Control Mechanisms:** Control mechanisms are three-fold in relation to ASADAs. First, ASADAs must implement control management practices once in operation. Second, ASADAs are obligated to comply with water quality and sanitation standards set by the MINHEALTH and supervised by the WNL; AyA- programs such as the Blue Flag Ecological Program (BFEP) and the Sanitary Quality Seal (SQSP) are options for ASADAs to pursue. Third, ASADAs have to deliver equitable and timely service making no difference among users in terms of the efficiency, quality, reliability and timing of the service.

A review of AyA's obligations with regard to ASADAs operation reveals the institution's active and strictly controlling role becomes apparent. The ASADAs Rules Proceeding delineates four areas of AyA responsibility in connection with the ASADAs' operation:

- **Delegation and Consultancy:** AyA is entitled to enter into a delegation agreement with ASADAs that have the capacity to operate the local WSS system; but where they do not, AyA may arbitrarily terminate the contract. Alternately, AyA can choose to provide consulting services to assist ASADAs in achieving better management in different operational areas.
- **Norms and Tariffs:** AyA is responsible for setting the norms – construction, organizational, technical, and quality - upon which ASADAs build and operate their local WSS system and to review and modify ASADAs tariffs before submitting them to ARESEP examination.
- **Control:** AyA possesses varying control mechanisms over ASADAs. To ensure the fulfillment of AyA's guidelines and norms, the agency is entitled to intervene

in ASADAs either by convening a general assembly to remove members of the ASADA board or to mandate the integration of one or more ASADAs into a single entity to improve performance. Second, AyA periodically audits ASADAs regarding different aspects of their operation, and ASADAs are obliged to submit annual reports of the previous year's activities during the last week of January, and the next year's financial planning by October 31 each year. Third, AyA reviews and approves any of the ASADA's debt/loan applications; thus local financial decisions are subject to approval by national officials.

- Training: ASADAs draw upon AyA's capacity and knowledge to obtain training for their community members. AyA's officials visit ASADAs to provide training sessions on varying aspects of the local system's operation, management or environmental concerns.

Additionally, ASADAs are required by the delegation agreement to pursue water resources protection including water quality control, reforestation, ecological conservation and even prevention of forest fires. Further, once AyA has evaluated new WSS operation, it is obliged to consider the situation of the indigenous population, with particular regard to the social, cultural and environmental impact the new local WSS system may have for them conformance with the guidelines of the International Labor Organization Convention N°169 on Indigenous and Tribal People.

E. Private Operators

According to the ARESEP Law, private providers are entitled to operate in the CR-WSS system, although the legislation does not clearly set out the guidelines applicable to the implementation of a privately-run WSS system. Scholars have even

concluded that a private,for-profit service is permitted by the law, despite the substantial social opposition to the idea (AyA-PAHO 2002). Currently, private operators are limited to private urbanization or small systems in both urban and rural areas.

Despite these legislative gaps, it is apparent that any privately-run WSS project must follow the general institutional structure for WSS. Therefore, a new private operator would be subject to the supervision and control of MINAET with regard to water resources exploitation; ARESEP, with regard to the setting of tariffs and efficiency supervision; MINHEALTH, with regard of water quality control; and AyA, with regard to the technical control that it has to exercise to ensure the service provision.

4.3.4 Evaluation of CR-WSS system

Scholars cite the lack of inter-institutional coordination, the low investment rate, the absence of regular water-quality monitoring, the obsolete legislation and no political will to invest in new facilities and human resources as barriers for the future development of the national WSS system (AyA-PAHO 2002; Espinoza, Morera et al. 2004; Morales 2010). The common criticisms may be grouped into the following three categories:

A. Institutional and Legal Framework

Although coverage indicators are high, barriers still exist that prevent the improvement of current WSS system performance. First, the role of AyA is not clearly defined and carries an operator-regulator duality. AyA's legally granted position as the main national operator often fails to complement its regulatory role, particularly the regulation of ASADAs and CAARs in rural areas. The diversity and level of responsibilities imposed on the agency has led to the sacrifice of its strategic CR-WSS oversight duty in favor of its day-to-day chores. The variety of AyA's functions has

weakened the national WSS system by promoting a loose regulation for private operators and an overlap of operating roles between AyA and the municipalities. (AyA-PAHO 2002). Although efforts have been made to harmonize the legal definition of the respective roles, duties and responsibilities of each national WSS agent, the administrative scheme has yet to be unified under a common umbrella. The current legal framework has created not only the “duality of roles” discussed above, but also has led to a lack of enforcement of certain legal obligations. For instance, MINHEALT lacks the human and physical resources to fulfill its public mission of preventing water pollution, and thus it relies upon the WNL to perform that task. As another example, ARESEP is the public body legally responsible for setting tariffs for all WSS operators, but the legislative gaps resulted in the Constitutional Court’s determination that the OCGR had the authority to set tariffs for local WSS systems operated by municipalities. Thus, OCGR, a public entity with no other WSS role is tasked with setting tariffs for a subset of WSS operators, which has the effect of diverting resources that otherwise may have been allocated to OCGR’s regular activities and creating a new bureaucracy that must involve itself in activities beyond its original mission. A third example is evident from the institutional overlap in setting norms for WSS systems. Although INTCO is generally responsible for setting norms, AyA has established norms governing raw materials used in new WSS facilities. Thus, a fuzzy legal and institutional definition prompted AyA to undertake a duty outside its area of responsibility. Despite these drawbacks, the participating institutions must play an important role in improving the current state of the WSS national system, and collaborative initiatives are paving the way. For instance, the Wastewater Reuse Proceedings resulted from an inter-institutional agreement between

MINHEALTH, AyA and NGOs that has contributed to a reduction in water pollution. The National Environmental Network in Water Supply and Sanitation (RANAS), in which the University of Costa Rica (UCR), the National University (UNA), the Costa Rica Institute of Technology (ITCR), the State Open University (UNED), AyA, MINHEALTH and MINAET participate, is a joint initiative aimed at promoting WSS research & development (R&D) and learning and at improving the quality, access and use of WSS information.

B. Finance

The current institutional structure may also limit future investment. For instance, AyA is obliged to comply with budget restrictions set by national authorities; thus, if the agency plans to increase capacity or to upgrade facilities with an investment that exceeds its savings, it must obtain approval from the budget authorities before reaching out to banking institutions. AyA, like all public bodies in Costa Rica, is under the financial supervision of the Ministry of Treasury and thus any credit decision is subject to the ministry's review and approval. AyA-PAHO (2002) also found these limitations to be detrimental to the operation of local WSS systems, limiting the available technical and management expertise. The report found that the WSS staff in larger municipalities includes more than one engineer and a multidisciplinary team; the systems identified as medium size municipalities include at least one multifunctional engineer and a minimum professional staff; but most of the smaller municipalities have no engineer and sometimes even no staff able to undertake technical chores.

C. Urban and Rural Areas

In urban areas, the decentralization of authority and water quality control are reported as major CR-WSS strengths. The decentralization refers to AyA's internal operation, in which decision-making and other authority can be transferred to regional offices scattered around the country; but any new organization should supplement this decentralization by granting additional resources to the regional offices that will allow them to comprehensively assume their new functions. Although water quality control is a MINHEALT responsibility, AyA performs the task in the field through the WNL, one of its operational units with enough resources to control water quality not only at AyA-run operations, but at any other operational unit. But the CR-WSS contains serious sanitation limitations; sanitation systems in some of the large cities have no treatment at all and are on the verge of collapse, with only 34 percent of the national urban population having access to sanitation and only 4 percent of wastewater receiving treatment (AyA-PAHO 2002).

Although no significant difference appears from a comparison of WSS urban and rural coverage, the way in which "improved drinking water" and "improved sanitation" are defined may impact those indicators. Even taking with these definitional problems the national government has been proactive in addressing the WSS rural challenge, at least with regard to proposing new schemes and approaches. The implementation of the ASADAs since the turn of the century has resulted in more autonomy and participation by local communities in designing and operating their own systems. In addition, this higher degree of participation has driven an influx of new financial resources, which has facilitated the extension of WSS coverage and has improved systems already in

operation. Participation also extends to water resources and environmental protection. Two WNL programs, the Blue Flag Ecological Program (BFEP) and the Sanitarian Quality Seal Program (SQSP), have promoted protection and conservation through community participation. Local community members self-organize to comply with a set of requirements required for a certification that the community fulfills the programs' standards and thus is entitled to receive either a blue or a white flag. In addition to the flag, communities may achieve higher levels of certification reflected by the number of stars the flag carries. The greater the number of stars appearing on the flag, the higher the certification awarded to the community's water and environmental protection. To retain a high certification, communities are prompted to work diligently to maintain the good standards achieved in previous evaluations. WNL conducts annual reviews to determine compliance and may drop the number of stars or even the flag itself in the facing of a bad local performance.

Moreover, a consideration of the legal and institutional framework, financing, and the difference between urban and rural areas reveals a common problem in the availability and management of information. Information is a valuable asset when planning and defining long-term strategies; therefore, significant improvements in the collection of CR-WSS information and the establishment of new systems to manage it will prove pivotal in improving WSS coverage. AyA-PAHO (AyA-PAHO 2002) cites planning, cost accounting, water metering¹⁶, and pollution sources as areas, which will require major efforts toward ordering information and providing easy access to it.

¹⁶ Estimates are that 50 percent of water consumption is not metered (AyA-PAHO 2002)

4.4 Summary

Over the years, Costa Rica has become a nation that proudly promotes the protection of its natural resources. Citizens are granted a constitutional right to a healthy and ecologically balanced environment, a right that currently requires a wide array of public institutions responsible for the promotion and monitoring of the protection of the environment. To complement this system, the country's legal framework also establishes several venues for civil participation, allowing citizens to be part of the decision-making process and makes the consideration of public opinion mandatory for policy-makers. In that sense, self-organization and self-administration are tools available to local residents in addressing the problems that directly affect them in their immediate surroundings.

CHAPTER 5 SETTING THE CASE STUDIES

5.1 Introduction

The present chapter refers to the description of the three case studies upon which the theoretical model proposed is applied. The research goal is to identify the dynamics of innovation in rural Water Supply and Sanitation-Community Based (CB-WSS) systems. The Water Innovative Event (WIE), i.e. the unit of analysis, is the implementation in rural organizations of the Blue Flag Ecological Program (BFEP) and the Sanitarian Quality Seal Program (SQSP) both run by the Water National Laboratory (WNL). The process is reviewed in regard to the variables included in the theoretical model in three rural ASADAS selected through a two-criteria process based on varying sustainability and learning capacity, thereby I wound up with a sample formed by three rural ASADAS: Puente Salas, Pejibaye, and Santa Rosa de Aquiares. The chapter goes as follows: first, a BFEP review is in display including goals, historical review and current organizational setting; second, a description in similar terms of SQSP; and third, the presentation of the case selection process with emphasis on describing variety on sustainability and learning capacity.

5.2 Blue Flag Ecological Program (BFEP)

BFEP is a publicly run program pursuing the protection of natural resources by promoting the protection of natural resources. The program counts with seven different categories, each one pointing to a different territorial target. As of the establishment of rural WSS systems, there is one BFEP category that fits better the description of community-based dynamics: the BFEP Community Category (BFEP-CC), established for

the single case of hinterland communities. This section presents BFEP going through a brief historical review, and the description of organizational, institutional and operational aspects. Likewise, following a similar structure and making emphasis on the particularities of the category, a review of BFEP-CC is displayed

5.2.1 BFEP History and Operation

In the late 1970s, WNL started off seawater sanitarian evaluations in coastal areas first in the Limón Centro and Puntarenas Centro regions and lately to several beaches in the Pacific and Atlantic coasts. As time went by, WNL was able to set sound microbiological standards and proceedings. However, a major turning point took the whole process to a new institutional level. AyA's authorities, namely the WNL Director, visited in 1995 the Province of Alicante in Spain. During the trip, AyA's professionals witnessed how the local Blue Flag Program, an initiative to control water quality in seawater, has become an asset in promoting public health and tourism. Therefore, once back in Costa Rica, WNL worked on the design and implementation of a similar program based on local community participation but with a major difference with its Spaniard version: there would be no fee to charge for executing it.

In light of those experiences, AyA's Board of Directors decided to create BFEP in 1996 to incentive the development of coastal areas in conjunction with the protection of their respective beaches¹⁷. At the time, there was an increasing worry across the country that the tourism boom in coastal areas could damage natural resources and landscapes whether there is no control over it. At the beginning, BFEP set out to promote: a) the organization of local coastal communities to manage and control the sanitarian quality of

¹⁷ AyA's Board of Directors Agreement N°96-160, June 4th, 1996

their own beach; b) the establishment of potable water supply systems in coastal areas; c) the treatment of industrial and domestic waste discharged in seawater; d) environmental training in local coastal communities; and e) a better quality of life for local residents and tourists.

BFEP pursues to encourage the self-organization of local committees in coastal areas, communities, educational centers, natural protected zones and other touristic and environmental niches to promote their development in conjunction with natural resources protection, better sanitation-hygiene conditions and public health improvement. A National Commission formed by AyA, MINAET, MINHEALTH, the Ministry of Public Education, the Costa Rican Institute of Tourism, the Costa Rican Natural Reserve Network, and the Costa Rican Institute of Electricity –ICE Group-, heads the program. The Commission is responsible for the coordination of BFEP technical staff, the definition of the annual working program, and the evaluation and selection of the awarded entities each year. Meetings occur in a monthly base and there is no salary for those attending them. In regard to the program operation, a team of WNL professionals is responsible for promotion, evaluation, training, sanitation monitoring, collection of water samples, and measurement of inorganic waste, and is accountable to the National Commission. There is also a limited participation of ICE staff in regard to the monitoring of some specific activities. Overall, any BFEP professional is required to act with responsibility, objectivity, honesty and perseverance (Mora and Chavez 2007).

In 2001, in an extended meeting, the National Commission and BFEP professionals set a new strategic plan covering the 2001-2006 period. Achievements, strengths, opportunities, weaknesses and threats were analyzed to redefine the program's

goals, targets, policies and strategies for the coming five years span. The evaluation resulted in the addition of a new category, “Community”, in an effort to provide better hygiene-sanitarian conditions to local hinterland settlements and to protect water resources on their way to the sea. Later on, following a recommendation of then President of the Republic, Dr. Abel Pacheco, the program was re-extended by creating a third category “Educational Centers” in order to take the whole BFEP philosophy of hygiene and environmental well-being to schools and classrooms with an active and learning-promoting participation of teachers and students (Mora and Chavez 2007). Nowadays, seven categories are part of BFEP portfolio: Beach, Community, Educational Centers, Natural Protected Areas, Hydrological Micro-Basins, Actions to Face Climate Change, and Neutral Climate Community.

The implementation of BFEP follows a six steps annual process going from local residents self-organizing into local committees responsible for the program operation to the presentation on behalf of the community of the final report to BFEP officials (see Table 11). The formation of the local committee precedes the community approaching BFEP to inquire information about the program or BFEP approaching the community to present the program emphasizing its benefits. Once the decision to apply comes about, the local committee proceeds to register at BFEP offices, normally between January and March. Next, the local committee is responsible for establishing a thorough diagnostic of the current situation regarding the parameters included in the BFEP evaluation, a step that usually takes the whole month of April. With the diagnostic in hand, an annual working plan is prepared to address each of the gaps noticed during the previous phase. During both the diagnostic and planning phase, local residents are allowed to call out BFEP

professionals either for training or technical assistance purposes in topics where there is no local relevant knowledge. However, it is worth noting that once the program has been in operation for a period of time, BFEP professionals participation deals more with their monitoring role than with their initial supporting role, as local residents expand their expertise on administration and technical issues. Either way, with the working plan on the table local committees concentrate on bridging the gaps detected during the diagnostic phase having a their disposal a 7 months period before going through the final evaluation. Thus, local committees close each year with BFEP officials reviewing on the field whether they comply with the program's requirement and evaluating how many stars the community should be awarded. The number of stars local committees may have obtained the previous year is not considered as an input of BFEP professionals' evaluation thereby the evaluators are entitled to leave a community with no flag at all.

TABLE 11 Blue Flag Ecological Program Phases

PHASE	ACTION	DATE
Step 1	BFEP Local Committee Establishment	Previous Year
Step 2	Registration at BFEP Office	January - March
Step 3	Initial Diagnostic	April
Step 4	Annual Working Plan	April
Step 5	Application Working Plan	May - October
Step 6	Final Annual Evaluation	October - November

In regard to the evaluation parameters those vary in accordance to the category though natural resources protection and conservation are common to all of them (see

Table 12). Water for human consumption receives significant weight through the evaluation particularly in regard to those categories more directly related with human interaction –community, beach, and educational centers-. To be granted with BFEP certification, local committees must comply with the program’s requirements and obtain a score of 90 percent. The number of stars varies in accordance to the category and to the annual performance of the local committee supervised by BFEP staff (see Table 13). Albeit WNL and ICT professionals participate of BFEP operation, the ones most actively engaged, particularly in regard to reaching out to local committees and later monitoring their work, are WNL professionals. As WNL authorities were the ones that imported the idea of BFEP and that hardly worked in BFEP promotion during the first years of the program’s operation, there is no surprise about them being the major promoters and supervisors. According to a WNL official the hardest task the BFEP team had when launching the program was to convince local residents to be part of program as there was no major knowledge on what the benefits would be.

TABLE 12 Blue Flag Ecological Program Evaluation Parameters by Category

BEACH		COMMUNITY		EDUCATIONAL CENTERS		NATURAL PROTECTED AREAS		HYDROLOGICAL MICRO-BASINS		ACTIONS TO FACE CLIMATE CHANGE		NEUTRAL CLIMATE COMMUNITY	
Parameter	Value (%)	Parameter	Value (%)	Parameter	Value (%)	Parameter	Value (%)	Parameter	Value (%)	Parameter	Value (%)	Parameter	Value (%)
Water for Human Consumption	15	Water for Human Consumption	20	Water for Human Consumption	20	Forest Protection	25	List of Pollution Sources	15	Fossil Fuels Use Reduction	30	GHG Identification	20
Seawater	35	Water Resources Protection	10	Sanitation Service	20	Water Resources Conservation and Use	25	List of Water Uses	15	Savings on Potable Water Use	20	BFEP Beach or Community	10
Coast Quality		Solid Waste Disposal	10	Classroom Hygiene	20	Environment al Protection	20	Water Quality	15	Electricity Use Reduction	15	BFEP Education Center (at least 1)	10
Inorganic Waste	10	Liquid Waste Disposal	15	Environment al Education	20	Solid and Liquid Waste Management	20	Advance in Water Quality	20	Wastewater Treatment	10	BFEP Natural PA and Hydro Micro Basins	10
Industrial Waste	5	Highway Signage	10	Security and Administr.	20	Site Management	10	Solid Waste 30% Reduction	15	Damaging Aerosol Use Reduction	5	20% participation in Actions to face CC	15
Domestic Water	15	Health Service	10					Reforestation in the Micro-Basin Area	10	Reforestation and Paper Use Reduction	10	Actions to Reduce GHG	10
Environment al Education	10	Environm. Education	10					Environm. Education	10	Environm. Education	5	Promotion of Adaptation Actions	5
Security and Administr.	10	Industrial Waste Management	10							Hygienic Biodegr. Products Use	5	10% Compensation of GHG	20
		Security and Administr.	5										

TABLE 13 Blue Flag Ecological Program Requirements by Category

Nb of Stars	Beach	Community	Educational Centers	Natural Protected Areas	Hydrological Micro-Basins	Actions To Face Climate Change	Neutral Climate Community Score of 100% + 20% GHG compensated reduction
1	Score between 90-100%	Score between 90-100%	Score between 90-100%	Score between 90-100%	Score between 90-100%	Score between 90-100%	
2	Score of 100% + signage of turbulent waters, dangerous animals + vigilance and lifesaving during weekends and summer season	Score of 100% + Sanitarian Quality Seal Program	Score of 100% + Environment Protection Campaigns	Score of 100% + Emergency Plan + Reforestation Communal Cooperation Plan	Score of 100% + Organic Fertilizer/Pesticide Campaign + Good Practices to Reduce Erosion	Score of 100% + Reduction, Recycling, and Reuse of Solid Waste + Biofuels Use to diminish GHG effect	40% GHG compensated reduction
3	2 Stars requirements + showers and sanitation service + special zones identification maps + touristic services	2 Stars requirements + Emergency Plan +5 years Human Development Plan	2 Stars requirements + Environmental Emergency Campaign + Solid Waste Recycling Campaign	2 Stars requirements + Planned Development of Natural Protected Areas + Social Responsibility Campaign	2 Stars requirements + Participation in at least 3 BFEP categories	2 Stars requirements + Collaboration in Health Fairs + Plan and Implement Emergency Plans	60% GHG compensated reduction
4	3 Stars requirements + permanent vigilance and lifesaving + local emergency committee + territorial/urban plan + MINAET-approved Environmental Management Plan						80% GHG compensated reduction
5	4 Stars requirements + handicap parking spots + handicap services at beach + Touristic Police Service + Sanitarian Quality Seal Program						100% GHG compensated reduction

In the 1996-2007 period, 571 BFEP local committees were created thereby improving sanitation conditions in 59 beaches, 33 communities, 402 educational centers and 10 natural protected areas (Mora and Chávez 2008). The program's list of achievements includes various community-driven initiatives in terms of infrastructure, water supply, and public health with new water quality control and solid waste disposal mechanisms and new environmental education programs implemented in the awarded beaches and communities (Mora and Chávez 2008). BFEP success holds on the communities' participation, the goodness of its goals, the mix of public and private organizations, the volunteering promotion, the simplicity of its organization, and the seriousness of its annual evaluations in accordance to each category's parameters (Mora and Chavez 2007). Local participation has followed a steady increasing trend going from 10 local committees participating in the beach category in 1996 to 308 applying to the program in 2007 through all BFEP categories (see Figure 18).

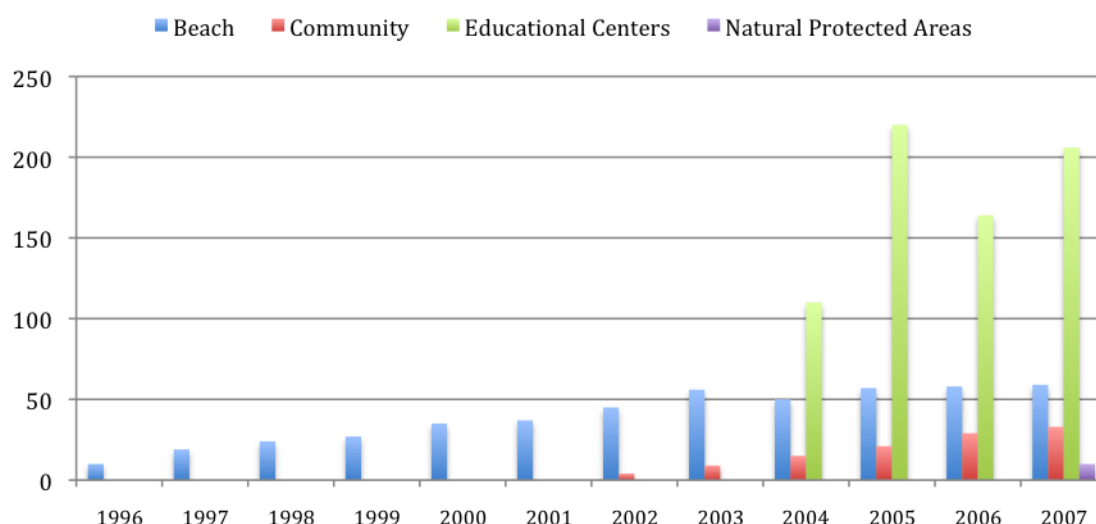


Figure 18: Number of BFEP Awarded Local Committees 1996-2007
Source: Mora and Chávez (2008)

As part of the program's 2007-2012 Strategic Planning, a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was set to define the challenges to address during the next five years (Mora and Chavez 2007). The assessment cites the consolidation of the program as a national hygiene-sanitation-environmental certification initiative promoting self-organization among local residents and reductions of pollution in rivers and beaches along with the improvement in water quality as the most noticeable contributions BFEP has made thus far. However, there are other major ones that may be cited as organizational innovations. The program has contributed to the decentralization of public decision-making favoring communities and the civil society in light of simple and not bureaucratic administration (Mora and Chavez 2007). In struggling with funding limitations to operationalize the program, volunteering comes up as another major BFEP asset. Having people self-organizing and working with no salary implies a significant distinction in regard to similar initiatives and thereby the program is able to reach cases that otherwise would remain unaddressed due to funding constraints. In addition, BFEP volunteering-based administration results not only in a greater number of local residents participating of the local BFEP organization but also that those participants are emotionally driven in their work as their actions affect directly their quality of life. Nevertheless, the analysis goes on citing weaknesses and threats. The explosive boom of the program along the whole country put BFEP in needs of greater resources in regard to both staff and funding. Those gaps have constrained BFEP growth thereby affording to address a less-than-presented number of applications. In addition, Mora and Chavez (2007) point to the rotation of democratically elected authorities at national and local

level as factors affecting the cohesion of BFEP administration as decisions made in one political period may be modified by coming authorities.

The review has also resulted in proposing a new strategic plan for BFEP operation. According to those new guidelines, the program should not deviate from self-organization but make a greater emphasis on ex-post evaluation. Therefore, the plan proposed for BFEP to comply with new targets covering financial, institutional, and organizational aspects. In terms of financing, BFEP is expected to integrate private organizations to add new resources and logistic support to the program's operation. The "BFEP Godfather" initiative whereby industry will be invited to participate of BFEP by contributing with new financial resources and organizational knowledge is a good example. With regard to institutional targets, the plan proposes to implement new collaborations with public agencies and Non Governmental Organizations (NGOs) to work on the promotion and evaluation of local committees in each category currently in existence. It also includes major organizational modifications ranging from renaming the program to the creation of new categories -health and recreation centers-, and the discussion of a BFEP Law. The success of such strategy is proposed to be measured in terms of the growth of BFEP local committees: that is how BFEP expects a 5 percent annual increase for BFEP Beach Category local committees; a 20 percent for BFEP-CC and Educational Centers local committees; and a 25 percent annual increase for BFEP Natural Protected Areas local committees. The three other BFEP categories – hydrological micro-basins, actions to face climate change and neutral climate community- were not in operation at the time.

5.2.2 The Community Category

The BFEP Community Category (BFEP-CC) started out in 2002 as part of the execution of the 2001-2006 strategic plan. It set out to meet new targets not previously covered by BFEP with the general objective of extending self-organization in relation to water resources protection and improving hygienic-sanitary local conditions to hinterland communities. The MINAET Decree N°31610 defines the following goals for BFEP-CC operation:

- a. To organize communities to manage and integrally monitor natural resources by means of the promotion of basic sanitation programs, environmental education and health service at local level.
- b. To promote an adequate disposal of solid and liquid waste at BFEP communities.
- c. To foster signage within the community, particularly in touristic locations, thereby to guide and orient local residents and tourists.
- d. To promote domestic and industrial liquid waste treatment.
- e. To promote water and natural resources protection.
- f. To foster security and safety within the community through a stronger police body.
- g. To develop environmental training programs to create a local environmental awareness among residents and visitors.
- h. To make an inventory of local water resources and to define their use in each community.
- i. To promote local health service to improve the well-being of local residents and tourists in all BFEP communities.

During its first five years of operation, the category had an explosive growth going from 4 applications in 2002 to 33 in 2007. According to BFEP officials several factors drove such pattern. To achieve better water resources protection was the regular one, particularly at the time the program was launched. However, as times went by communities related the program to a sense of proud not only by addressing an environmental challenge but also by overcoming their previous performances. That is, once local residents reached a certain number of stars their next target was to increase such number to show how skillful the local community is and how high the environment protection is on their list of priorities. In addition, as the number of communities participating of BFEP has grown, BFEP officials have noticed a rising inter-communities competition. When local residents observe that their neighboring community is excelling at BFEP they are driven to outdo themselves thereby pursuing higher standards for their next BFEP application. Even more, those not participating of BFEP-CC feel prompted to be part of the program when noticing the success and recognition their neighboring communities are receiving for applying and succeeding at BFEP. Recognition results from various activities. Once the community is awarded with BFEP certification, an open-to-the-public raising-the-flag ceremony is held with local residents attending in high numbers. Those types of ceremonies are reported on the local media contributing to raise a the-neighboring-community-is-doing-very-well buzz thereby both installing a competitive and self-improving spirit in local residents that prompt them to reach and surpass the other communities' performances.

The category's evaluation parameters are the greatest in number in relation with the other categories and refer to water human consumption, water resources protection,

waste disposal, environmental training, health service, and security administration. Although the range is wide and one might think at first that there may be no commonality among them, there is a crossing pattern: each parameter was designed to address the program's target of pursuing water resources protection and hygienic-sanitarian conditions improvement. Even in regard to security administration, the role of the local police has conservative purposes in order to avoid the excessive exploitation of natural resources or them being polluted by illegal activities. Each evaluation parameter has its own sub-parameters that shape the whole assessment (see Table 14).

TABLE 14 Evaluation Parameters

PARAMETER	VALUE (%)
WATER FOR HUMAN CONSUMPTION	
-The aqueduct provides water continuously	25
-The aqueduct provides potable water	50
-The supplied water received treatment or disinfection	12.5
-The supply system counts with water quality control mechanism	12.5
WATER RESOURCES PROTECTION	
-List of water uses at community level	20
-List of pollution sources upon rivers, aquifers, and streams	20
-Identification of aquifers recharge areas	10
-Microbiological and physical-chemical evaluation of rivers, streams and wells	20
-Reforestation on water resources bordering areas.	30
SOLID WASTE DISPOSAL	
-Waste collection twice a week	40
-Waste recycling campaign	10
-Waste treatment	40
-Cleaning of streets, parks and other buildings	10
LIQUID WASTE DISPOSAL	
-Domestic liquid waste evacuated by sewer system	25
-Liquid waste evacuated by septic tanks	50
-Sewer system on the run	25
-Waste dumped into rivers, streams, and sea with no treatment	25
HIGHWAY SIGNAGE	
-Services and health signage	25
-Conservation signage	25
-Touristic signage	25
-Road signage	25
HEALTH SERVICES	
-Emergency service	20
-Health area management commitments	60
-Diarrhea records	20
ENVIRONMENTAL EDUCATION	
-Conferences (minimum twice per year)	40
-BFEP promotion at local schools	20
-Rivers, streams, and parks cleaning campaigns	40
INDUSTRIAL WASTE MANAGEMENT	
-List of industries operating in the community	20
-Evaluation of industrial discharge (every three months)	20
-Wastewater treatment in each industry	40
-Evaluation of the impacts of the discharges upon water resources	20
SECURITY AND ADMINISTRATION	
-Policy control in the community	20
-Police control for tourists	20
-Control and protection for natural resources	60

The application process is similar to the general one described in the previous section that is the local residents self-organize in a local committee, approach BFEP authorities, set a diagnostic, propose a working plan, set out to comply with it, and at the end of the year BFEP staff visit the community to deliver their evaluation granting a certain number of stars to the local committee or rejecting the application upon which there is no flag to raise. The review does not take into account previous performances thereby evaluators concentrate their analysis only on the current year operation, been entitled to reduce the number of stars to a last-year-highly-successful committee in case local residents have not been able to comply with BFEP requirements during the present year.

The number of stars goes from one to three provided the local committee is awarded with a blue flag, otherwise if the community's performance does not meet the minimum standards required, BFEP does grant no flag to the local committee. As mentioned above when doing the current evaluation there is no consideration of past performances thus BFEP is entitled to withdraw the blue flag to a previously successful community. The requirements go as follows: to obtain one star, the local committee should be able to score between 90-100 percent at BFEP evaluation; to receive two stars, the local committee must comply with the one-star requirements and apply and obtain Sanitarian Quality Seal Program (SQS) certification; finally to get the maximum approval of three stars, local residents should be able to meet the two-stars requirements and design and implement a five years local human development plan. Community is part of the three-stars-maximum category group, which gathers most of BFEP categories with the exception of Beach and Neutral Climate Community that reach a five-stars maximum.

5.3 Sanitarian Quality Seal Program

In 2001, WNL created the National Program for the Improvement of Water for Human Consumption in view of the stagnancy noticed in water for human consumption coverage. As part of such initiative, the Sanitarian Quality Seal Program (SQSP) was established to encourage local WSS operators to self-organize and secure the supply of potable water in a sustainable and environmentally friendly manner. SQSP does follow a similar philosophy than BFEP's as both programs award an annual flag-stars-based certification provided local residents meet a set of requirements. Even more, the BFEP blue flag is replicated by the SQSP white flag. Nevertheless, the similarity goes beyond the recognition system. Crossing several BFEP categories, the requirement of improving the quality of water for human consumption –the core of SQSP evaluation- is essential to succeed at BFEP's review. Even more, in regard to the BFEP community category to obtain more than 1 star, local committees are obliged to have previously being awarded with SQSP certification. During its first year of operation, SQSP awarded 13 certifications to local committees around the country. An explosive growth followed as the initial number boosted to reach 135 awardees in 2005. Overall, the program pursues the following targets:

- To motivate local providers to protect and improve, in an integral manner, water quality.
- To promote the protection of water sources drawn upon for human consumption to provide potable water to current and future generations.
- To achieve a sustainable water service based on excellence, continuity, quality, and cost and tariff optimization.

- To promote environmental protection and water quality training among local operators to secure a sustainable improvement in water quality.
- To collaborate in maintaining and improving coverage and quality indicators.
- To improve Operation and Maintenance (O&M) of aqueducts by promoting annual working programs, sanitarian inspections and sanitarian risk evaluations.
- To establish the importance of disinfection mechanisms and methodologies at aqueducts in accordance to the legislation currently in force.

In regard to evaluation parameters, there have not been major modifications and the structure is conceptually pretty much the same than that at the launching of the program (see Table 15). The assessment considers varying parameters to oblige local residents to secure potable water supply, thus the verification of protection and training programs, risk evaluations, and strict water quality control mechanisms is part of the SQSP review.

TABLE 15 Sanitarian Quality Seal Program Evaluation Parameters

PARAMETER	VALUE (%)
To set a water sources protection program	15
To set a tank and pipeline maintenance program	10
To apply residual-within-the-norm amounts of chlorine	10
To set environmental and water quality training programs	15
To apply water quality control mechanisms	20
Water have to abide with Water Quality Regulation	15
Sanitarian risk assessment	15

The number of SQSP stars is greater than BFEP's: six versus five than BFEP awards to those local committees applying to the Beach and Neutral Climate Community categories. To determine how many stars should be awarded SQSP has set the following proceedings:

- White Flag Type A: Awarded to those local operators scoring between 90-99 percent at SQSP evaluation
- White Flag Type AA: Awarded to those local operators scoring 100 percent at SQSP evaluation, and that, as part of their application, present their weekly chlorine reports and label their storage tanks and fee collecting facilities.
- White Flag Type AAA: Awarded to those local operators complying with Type AA requirements and establishing reforestation campaigns and keep the aqueducts facilities painted.
- White Flag Type AAAA: Awarded to those local operators complying with Type AAA requirements and setting environmental campaigns along with educational centers, communities and beaches participating of BFEP.
- White Flag Type AAAAA: Awarded to those local operators complying with Type AAAA requirements and obtaining a "Good Quality" evaluation at the Assessment System of Potable Water Quality Service (ASPWQS) and fulfilling the obligation of installing and maintaining hydrants at population centers. Rural aqueducts are mandated to sign a Delegation Agreement.
- White Flag Type AAAAAA: Awarded to those local operators complying with Type AAAAA requirements and excelling at ASWQS by obtaining an "Excellence" evaluation.

There is a graphic display difference between the first four evaluations -A to AAAA- with the last two –AAAAA and AAAAAA-. When local residents are awarded with a one-to-four-stars flag, the flag carries blue stars in similar number that the number of As. However, when awarded five of six stars, golden stars are added to the previous four blue ones. SQSP authorities have added a red star to their evaluation in case local committees come up with a Water Security Plan that reinforces the protection of water resources and emphasizes potable water quality.

To apply to SQSP communities have to self-organize in local SQSP committees for then approach WNL. The registration process closes the last working day of March, after which local committees have at their disposal two months to present their working plan. They spend the rest of the year on the implementation of the measures they proposed to comply with SQSP requirements before presenting their final report on January 30th, the subsequent year. With the report in hand, SQSP officials review on the field whether the local committee was able to meet the targets they proposed and whether they complied with SQSP requirements. The awardees receive their flag-based prizes the third week of March and afterwards organize the local raising-the-flag ceremony inviting the whole community to attend. To go through SQSP any local committee ought to be open to establish and run a local water quality control program and to be obliged to fulfill SQSP recommendations. In regard to funding, the program differs from BFEP non-fee policy. The rural aqueducts applying to SQSP are mandated to pay 50 percent of the WNL analyses, whereas private operators are required to cover 100 percent of such cost. In case applicants decide to hire an external laboratory –not the WNL-, the one approached must be accredited, and either way results must be presented to AyA.

Likewise, the local committee has to pay for an annual WNL evaluation. The evaluation results are public thereby local committees are not entitled to complain if a third organization requires access to their evaluation.

5.4 Case Selection

For case selection, I define different sampling criteria. First, in order to control for organizational asymmetries sampling is constrained to WSS community-based systems operated under the ASADA scheme. Second, I focus on the dependent variables of each set of hypotheses. The first one infers about how local participation and local capacity contribute to sustainability, whereas the second one refers to the effects of the same two independent variables onto local learning. Therefore, I set out to have variability on both: sustainability and learning.

I define sustainability as the sustained operation of the local WSS system whereby community members are not downgrade to a lower level of water in terms of quantity and quality and not left with unmet needs (Schouten and Moriarty 2003). To operationalize sustainability I draw upon both BFEP-CC and SQSP number of stars during the 2009 operation. BFEP-CC stars are granted in accordance to the local performances in regard to water-related parameters: water for human consumption, water resources protection, and industrial and domestic wastewater. There is a second set of environmental-related parameters including solid waste disposal, environmental training, health service, and public signage. In regard to water for human consumption, to obtain BFEP certification BFEP-CC local committees cite regularly analyses and information included in their SQSP reports, therefore there is a sound and steady interrelation between both programs. When going through BFEP and SQSP evaluation parameters, one notices an overlap with

both programs reviewing similar activities and demanding from local residents reports on the same issues. Such duality results from the similarities on the missions of both programs, BFEP pursuing local self-organization to promote water resources protection and better hygienic sanitarian conditions and SQSP on a similar path but with greater emphasis on water quality. Even more, to reach a two-stars BFEP-CC flag, local committees are required not only to apply to SQSP but also to have being awarded with a white flag. However, in the middle of this inter-dependence, there is a single fact to take into account. The BFEP-CC white flag requirement does not refer in any case to the number of stars the white flag should carry thereby for BFEP-CC evaluation purposes there is no difference in obtaining one or six SQSP stars. It may be the case that a local committee excels at SQSP even presenting a Water Security Plan, but in terms of BFEP-CC water-related parameters there would be no difference with a one-star awarded SQSP local committee. In view of that situation, a star-based sustainability proxy should not be exclusively based on BFEP-CC stars as the water for human consumption section demands just to have SQSP approval, not making any difference in terms of SQSP evaluation variety.

Therefore, I propose to build up a sustainability indicator upon adding up both BFEP-CC and SQSP stars thereby to address all the gaps BFEP-CC presents in regard to the water for human consumption parameter. By including both programs star-based evaluation in a unique sustainability indicator I am coming up with a construct that covers the whole set of BFEP-CC evaluation parameters and that adds greater variety to water quality issues. In case I would have constrained the analysis to BFEP-CC parameters, case selection would have occurred upon a misleading base as though

evaluation would have taken into account a sustainability indicator built up in a dichotomous manner ignoring the variety of one of the parameters that directly affects it.

In regard to learning variety, the target is to select local committees with diverging learning performances, therefore, as there is no feasibility in measuring early learning in each single local committee, I point to factors that I hypothesize drive diverging learning performance, one of them being diverging learning capacities. As proxy for learning capacity I use the secondary education rate at district level that is the share of the local population over 5 years old that have completed secondary education in each district. I draw the information from Costa Rica's National Institute of Statistics and Census (INEC) databases. I do not consider tertiary education in light of its low national share¹⁸ -even lower if studying rural areas- therefore by concentrating on the population with college education there is a risk of ending up with a case study sample where the differences among local committees may have been set using a variable that in view of its small size shall have a reduced impact on local learning capacity thereby selection may have been done using a wrong comparative base. As mentioned above, I use district-level data, as it is the smallest administrative level to find education coverage information.

Consequently, I proceed to case selection with information about number of BFEP-CC and SQSP stars by local committee and district-level secondary education rates. The selection criterion is to pick three ASADAS: a first one with high sustainability and high learning capacity, a second one, with high sustainability and low learning

¹⁸ Share of national population with college education: 11.83 percent
Share of rural population with college education: 5.45 percent
INEC database., www.inec.cgo.cr

capacity, and a third one with low sustainability and high learning capacity.. The process resulted in a group of three rural BFEP-CC local committees: Punta Salas, Pejibaye, and Santa Rosa de Aquiares. Each one of them participates in BFEP-CC and SQSP in 2009, and are headed and managed by the local ASADA. In Table 16, I present data regarding the case selection parameters by local committee.

TABLE 16 Case Selection Parameters by Local Committee

Local Committee	BFEP-CC Number of Stars*	SQSP Number of Stars*	Total Number of Stars*	Secondary Education Rate (%)**
Puente Salas	2	6	8	29.5
Pejibaye	2	5	7	13.3
Santa Rosa de Aquiares	2	1	3	21.3

Source: * WNL Database
 ** INEC Database

5.5 Summary

BFEP and SQSP are programs that have been proposed to promote natural resources protection by means of the self-organization of communities and thereby making them locally responsible for it. The programs differ from each other in that BFEP requires an autonomous administration, whereas SQSP depends largely from the local operator,. In regard to case selection, the methodology demands variety in sustainability, measured by the number of BFEP-CC and SQSP stars the community has been awarded, and in learning capacity, measured in terms of the local secondary education rate. The

outcome is the selection of three communities _Puente Salas, Pejibaye, and Santa Rosa de Aquiares- all them with WSS systems organized under the ASADA scheme.

CHAPTER 6 PUENTE SALAS

6.1 Introduction

The chapter refers to the first case study, Puente Salas, a rural community located in the Heredia Province, that in 2009 was awarded with two stars at BFEP and six stars at SQSP, and that presents the highest secondary education rate of all three cases studies, therefore Puente Salas responds to the high sustainability-high learning capacity profile. The chapter follows the structure of the dissertation's theoretical model, thus in addition of a general description of the community and of BFEP and SQSP local implementations, reviews of each variable of the model are included. That is, sections addressing dynamics referring to the capacity of the community –skills and leadership-, the participation of the community –participation, interaction, and sense of ownership-, local learning and collective choice are in display.

6.2 General Description

Puente Salas is a rural community located in the District of San Pedro, County of Barva in the Heredia Province. Though the area is recognized as rural, the former head of the Puente Salas ASADA Board recognizes that the expansion of neighboring urban areas as well as the growing number of local residents has prompted external observers to question at first sight the rural profile of Puente Salas. However, the community is still recognized as a rural locality particularly in regard to public services implementation. Local residents do have access to electricity and telephone services; children attend the local public school and there is a public local health clinic, the so-called Basic Team of Integrated Health Care (EBAIS). In addition, visitors notice that drawing on public

transportation they are able to reach Puente Salas from the city of Heredia in 45 minutes paying less than \$1 per ticket. Local residents have at their disposal recreational and social gathering sites as the Community Room and the Sports Square, both have resulted from local fundraising efforts.

The origins of the ASADA are in the efforts of the so-called “pioneers”, local residents who wanted to contribute to their community by increasing the well being of their neighbors. To this day those pioneers are recognized with pride by the local community and recently each one of them have been awarded a life achievement award in view of their contribution to the Puente Salas local community. Until the mid-1970s the Municipality of Barva was the one responsible for the local WSS system operation, administration that resulted in a long list of complaints as the Municipality was not able to meet the requirements of local residents. Therefore, the local community self-organized and started, in words of a member of the ASADA Board, “a long and hard struggle” to set up an autonomous and locally-run water supply system. Negotiations between the self-organized local residents and the Municipality of Barva went on for several years until they agreed to hand the WSS operation to the Local Development Association (LDA), with AyA playing the role of intermediary, as a direct transfer from the Municipality to LDA was not legally feasible.

At first, local residents participated actively with a large group of volunteers going up to the mountains during weekends to build the new aqueduct with the materials AyA provided them with. Local residents were so highly motivated that they worked for 8 years to complete the construction of the local aqueduct. With the advent of the ASADAs in the early 2000s, LDA decided to establish the new WSS operator: the Puente

Salas ASADA. A seven-non-paid-members-Board that includes the President, Vice-President, Secretary, Treasurer, and three further trustees, all elected at the General Assembly on a biannual basis, heads the ASADA. When a new Board takes over, they are obliged to present a two-years working plan of which a mandatory advance report should be presented at the next General Assembly. At the end of their period, the Board ought to have met 90 percent of the targets initially proposed.

The local water supply system draws water from two streams: Tina and Guacalillo, with both of them referring to a water supply subsystem. The Tina subsystem works with a flow of 7.5 l/s and is formed by two storage tanks, Amada Grande and Amada Redondo. The Guacalillo subsystem presents a higher flow, 12 l/s, and also counts with two storage tanks, Lomas and El Mirador. Nowadays, the ASADA provides water to 1,006 households thus reaching more than 4,500 people.

6.3 BFEP and SQSP

The participation of the community of Puente Salas at BFEP started in 2006. Then a group of local residents, members of the ASADA Board, attended an AyA's training session where they heard about BFEP, and thought what a good match to the community needs the program would be. Therefore, local residents decided to work on BFEP local implementation by gathering the first BFEP local committee formed by six members, all of them local residents. Most of them sit at the board of different local organizations; that is how of those 6 members, two also sit at the ASADA Board, one at LDA's, and one at the Board of the local school. During the first two years of operation, the BFEP local committee received a one-star flag, which motivated local residents to work harder to obtain a better score in the following years. Thus after three years of BFEP local

operation, and given their first SQSP application, the local committee left behind their one-star performance, raising with pride a two-stars blue flag. Nowadays, Puente Salas is cited by BFEP national authorities as one of the most successful national experiences

BFEP and SQSP share some common features. Their flag-stars-based award systems and their evaluation targets of securing water service quality and continuity set a resemblance pattern between both them. However, there is a major organizational difference: whereas BFEP requires to gather a new BFEP local committee, SQSP is run by the local water operator that is the local ASADA. At Puente Salas, the role of the ASADA at SQSP is exemplified by the leadership of the President of the Board and the role of the ASADA Administrator responsible for the regular monitoring of WSS facilities and for the presentation of the annual SQSP report. As with BFEP, members of the ASADA Board were the ones that heard first about the program and visualized the benefits its application could have for the local community. Those locally working at SQSP are driven by their motivation to secure potable water, but also to learn about new technologies and approaches that help them in diffusing locally a new “culture of water”. Those targets have been met by means of the adaptation of new-to-the-community technologies –metering and chlorination are two good examples-, the regular maintenance of local water infrastructure, and the organization of collective and social activities reinforcing the notion of a rational and sustainable use of water. The success of Puente Salas is conceived of not only in terms of their six-stars flag –far up of their first two-stars flag- but also in regard to the cross-age and cross-social learning that has taken place, which has led the ASADA President of the Board to define it as a “beautiful” initiative.

6.4 Capacities of the Community

The variable is defined as a combination of two variables: skills and leadership. Skills refers to the capacities and competences local residents have, and leadership to the type of leadership ruling the community. The dynamics associated to each variable are described in the following sections.

6.4.1 Skills

There is no official information on educational level at the community level. However, in view that the whole population of the District of San Pedro is 8,560 inhabitants and that up to date the ASADA supplies water to 1,006 households, a good proxy for communitarian educational background are the official district records. San Pedro presents a literacy rate of 97.12 percent; in addition of the whole population over 5 years old -7,712 inhabitants-, 4,073 attended only primary school -52.81 percent of the population over 5 years old-, and 2,275 did complete both primary and secondary education -29.49 percent of the population over 5 years old-. In regard to tertiary education, the numbers are lower with only 8.46 percent of the population over 5 years old declaring having a college degree. The district's performance does not deviate that much from national records: shares of the national population over 5 years old with primary, secondary and tertiary education reach 52.84 percent, 25.09 percent and 10.19 percent, respectively. It is worth noting that when required to identify the community's average educational background local interviewees point out that most of local residents did complete secondary education.

In regard to the skills of members of the ASADA administration, of those sitting at the Board, one works at the Municipality of Heredia, one does it as a preacher, one as a

driver, one as housewife, and the other three are pensioners having retired from administration jobs either at public offices or at private firms. The President of the Board is 73 years old, has completed primary and secondary education and attended college for 2 years -he dropped out for personal reasons-; he lives on a pension from his work at the Ministry of Public Works and the Municipality of San José. The ASADA Administrator who has been in office for 10 months completed secondary education and is currently attending on his second year the State Distance Learning University where she studies Education. She also has a second job working as a secretary in a local garage.

Capacity building encompasses dynamics occurring at the local primary school. The significance comes about not only in view of local children having access to education but also of the BFEP activities in which they participate of. The BFEP local committee interacts regularly with the school in order to motivate children to be part of different initiatives they organized, thus promoting learning and honing their environment-related skills. There are various examples. Children are the ones leading the group, when the BFEP local committee convenes local residents to garbage collecting sessions. At the school they are taught regularly about recycling, practice they take home and thereby motivate their parents. Their enthusiasm does not diminish during the reforestation days, that is when the BFEP local committee calls upon the school to bring the children to plant their own trees in areas next to the streams that provide water to the community. They also participate of the Water Fair the committee organizes every year where they have the chance to present their class work –drawings and writings- in relation to water use. The whole set of skills rise in line with the participation of the local school in BFEP. During the last 4 years, the school has decided to be part of the program,

taking children to the BFEP activities mentioned above and including in their own curriculum methodologies that increase the environmental knowledge the children may have. However, there is no specific environmental class, as professors incorporate practices and knowledge in regular courses. For instance, at math class, children are taught about water consumption when they learn about addition and subtractions or about multiplication and divisions. The only regular sessions children have during their academic year are two talks, the BFEP leading professor gives twice a year where they have the opportunity to learn about water resources protection practices. Such an active participation has resulted in children having a new set of environmental and water use skills that before BFEP they did not have.

The case of the local plumber is worth highlighting. Ten years ago, according to the former President of the Board, the ASADA was in a stagnant position. Local residents complaints about the quality of the service, particularly in regard to infrastructure, were piling at the ASADA headquarters. At the General Assembly local residents voted a new Board with a new President taking over who decided to fire the then plumber and hire a new one to undertake various infrastructure initiatives. The new plumber interacted actively with WSS suppliers that came to the community to train him, his assistant, and those interested in learning about WSS techniques and materials. In addition, the plumber participated of two projects that resulted in sizeable benefits for the ASADA: the metering system and on-the-field chlorination. Metering was introduced as a response to the problems the ASADA was having with fee collection and took six years (2003-2009) to complete. On-the-field chlorination was pursued to meet water quality SQSP requirements and its implementation was the plumber's responsibility. Therefore, along

the ten years he has been at the ASADA, the plumber has honed his WSS skills, thereby he is able nowadays to handle the administration of two systems that did not exist at the time he was hired and that he did not know much about it.

6.4.2 Leadership

Local leaders are not only concentrated in what we may recognize as the formal local organizational bodies that is the boards of the ASADA or of the BFEP local committee. People working at varying entities also exercises a leadership in line with the protection of the natural resources. Therefore, the analysis encompasses the role of formal leaders, that is those been part of the ASADA and the BFEP local committee boards, and social leaders that are pursuing different types of sustainability-oriented activities.

The first leader within the community is the President of the Board of the ASADA. In Puente Salas, the former President held such position until 2010, a middle age woman with secondary education, owner of a local store/restaurant where she interacts on a daily basis with local residents. Her store is on the main street, one block away from the ASADA headquarters and a popular local meeting place. She is borne and raised in Puente Salas, where she also got married and raised her family. As a member of the Board for the last 10 years, she points out that her job has allowed her to be on constant training, an opportunity she defines as “wonderful”. She is an active member of the community; in addition of being President of the Board, she is a member of the Board of the BFEP local committee and of the Board of the LDA.

Local residents easily identify her as the head of the ASADA. Her role is even recognized beyond Puente Salas borders. She, in another example of her social

commitment, has been working with the Red Cross for the last 4 years, though in the neighboring community of San José de la Montaña. Once, in the middle of a public collection, she knocked on the door of a local resident whose son used to spend a lot of time at his aunt's home in Puente Salas. It turned out that the boy opened the door and called his mother saying loud: "Mom, the lady from the aqueduct is here!"

Her leadership is tested regularly either at dealing with disagreements between neighbors or at calling out to national public agencies. Couple of situations confirms her leadership. Years ago a group of local residents could not agree upon a common waste management system resulting in liquid waste being dumped on the open field with the consequent threat of attracting mosquitoes thereby to spread dengue. She remembers talking to the neighbors for one year until they opened their proprieties to do the needed reparations, putting on the table the alternative of calling out to the Ministry of Health if no agreement was settled. On the other hand, her leading role also considers dealing with good-will neighbors who estimate they are contributing to the environment protection, but they are not and may be even damaging other local residents with their actions. An example of it is an up-the-hill neighbor good at sweeping and cleaning the street but who dumped waste and garbage into the drainage system. Problem was that once the rain came, the sanitarian facility collapsed and the neighbors living down the hill were greatly damaged. Talking regularly with the neighbor she convinced him to leave behind such practice thereby avoiding major environmental harm to the rest of the community.

In spite of ups and downs, she estimates that the local community has been fortunate enough to have good leaders heading the ASADA and BFEP. However, she points out that one of the greatest difficulties that the President of the Board has is that

local residents have great expectations on her/him requiring her/his presence everywhere and at any time to solve different types of problems. Overall, she is the President that has served for the longest time, been in office for 6 years. During the 1998-2010 period, 7 biannual elections have regularly been held; the only exception was in 2000 when the low attendance obliged the Board to postpone the election for the next year. Overall, 4 different Presidents and 31 members of the Board –including the Presidents- have been elected, with an average time in office of 3.25 and 3.03 years, respectively. Two of the three Presidential rotations were due to differences between local residents: the first one in 2001 in view of the complaints about infrastructure and the service quality and the last one, in 2010, due to differences that a group of local residents had with the former administration. The one left corresponds to the time the former President took over and was due to the decision of the previous President to retire from social work.

Nevertheless, as mentioned above leadership expands to other dimensions than formal administrative positions. That is how the pro-environmental teaching and learning at the local school have resulted from the active leadership of one of the local professor. The professor lives in Puente Salas and has been working for 8 years at the school. He is responsible for motivating his students to participate of BFEP social activities by means of teaching them environmental practices and knowledge. He deems that the environmental awareness he is building in the children will prevail in their future for the benefit of the whole community. In addition of such capacity building, he is forming new local leaders, as children are prone to be the first ones in achieving handling or learning about new environmental practices thereby consequently to teach their own classmates or even their parents about those new habits.

6.5 Participation of the Community

The variable is defined as a combination of three variables: administration, interaction and sense of ownership. Administration refers to the participation of local residents in the administration of the ASADA and BFEP either as holders of administration positions or participants of local decision-making; Interaction describes the dynamics of the participation of local residents in BFEP activities not related with holding administration positions nor the decision-making process, thereby ranging from interaction with solution providers to participation in BFEP social gatherings; Sense of Ownership refers to the perception local residents have over their local WSS system that is whether they perceive it as their own with willingness and ability to pay the service fee and the enforcement of collection rules as dynamics to consider.

6.5.1 Administration

As mentioned above the ASADA's organization is based upon a three level scheme. At the top of the whole structure is the General Assembly responsible for electing the Board, including the President, and for the approval of major initiatives proposed by the Board. Among those initiatives, SQSP, metering and pipeline replacement are the types of initiatives that ought to go through the General Assembly's approval. The General Assembly convenes once a year; however, reasons for gathering differ from one year to another, as the Board is elected for two years periods. Therefore, during an election year, the General Assembly will deal mostly with the election itself and the final report the leaving-office Board ought to present to local residents; the next year, the discussion at the General Assembly will refer mostly to the report the new Board deliver to members of the Assembly in regard to the activities undertaken that far

and whether those activities meet the targets set by the new Board's working plan presented a year ago.

Members of the General Assembly are identified as "associates". Not all local residents are associates. To become an associate, they have to go through an application process, filling out a form they can pick at the ASADA headquarters that is reviewed and approved by the Board. Though such a process is described as "simple" by the ASADA staff and the local residents, the number of associates is not high in consideration of the local population. The Puente Salas ASADA recognizes 1,006 households as part of the local WSS system; only 92 are associates who have already completed the application process thereby are entitled to participate of the General Assembly and vote. Of those 92 associates, a low share attends the General Assembly each year. During the 1998-2010 period, 12 General Assemblies were held with an average attendance of 30.8 people; the numbers differ when splitting out the records in regard to election years: 35.6 local residents attended General Assemblies when Board elections were held, a much higher indicator than the 24.2 local residents recorded at General Assemblies with no election occurring. Either way the participation rate of local residents at General Assemblies is low: on average 30.8 out of 1,006 ASADA households, i.e. 3.06 percent, have attended on average the General Assembly during the last 12 years. The explanation of such low participation rate goes in line with the behavior of local residents in regard to the ASADA. Community members do complain at ASADA headquarters about failures of the local aqueduct particularly when those failures affect them directly and demand a fast response. However, they are not prompted to be part of the solution, and they expect others to solve their problems. As there is an organization in place to run the aqueduct

they are responsible for it, therefore local residents would rather not participate of the whole formal organization in any manner. As a former President of the Board states: “There is no herd” when participation is required and the “same 25” are the ones attending the General Assembly along the years. It is worth noting that the Board send personal invitations to each associate that are delivered at their home previous to the General Assembly, therefore there is no such excuse as not have been notified of the new gathering.

In terms of the members of the ASADA, President, Board and staff, all of them are local residents. Both the former and current President have lived at Puente Salas their whole life and have been part of other local organizations. The former President sit also at the LDA Board and BFEP local committee, whereas the current President has participated of the Local Education Board and Sports Committee and used to attend regularly the General Assembly. The seven members of the Board are all local residents, even some of them did sit previously at the Board or are active members of other social organizations; even more, of the 31 people that have sit at the Board during the 1998-2000 period, are all local residents. There is no major difference with the staff. The administrator lives at Puente Salas and is also a member of the LDA Board, whereas the plumber and his assistant have spent their whole life at Puente Salas. Therefore, the first impression that given that local residents barely attend a local decision-making venue such as the General Assembly makes one to question that higher sustainability demands great local participation. However, such premise does not go in line with the high local participation that comes with all administration positions being held by local residents. An unresolved dichotomy seems to rise.

BFEP follows a simpler pattern. The organization is set upon a 6 members local committee, all of them local residents and as mentioned above sitting at the board of other local social organizations. The committee is responsible for the local BFEP operation and for appointing a coordinator. The coordinator is selected among local residents interested in been part of BFEP thereby to contribute to their community by means of promoting the protection of natural resources. Again, in response to the question of the local participation in the administration of local organizations, all holders of administration positions are local residents. However, there is a novelty. The democratic pattern of voting for local authorities is not replicated at the BFEP local board, as those sitting at it are selected in view of their individual interest and institutional precedence. However such organizational simplicity has not prevented BFEP from complaints. A local resident dissatisfied with BFEP local administration demanded to be part of it. The coordinator who was also the President of the ASADA Board at the time, decided that the best option was to quit her position at BFEP and to propose the local resident complaining about her role to take over. It turned out that after a month of been in charge, the new coordinator resigned and the former coordinator was asked to retake her position.

6.5.2 Interaction

To determine interaction dynamics of local residents at BFEP the review starts at the local inception of the program. In 2006, the then-President of the ASADA Board along with a group of local residents attended a presentation about BFEP at AyA's headquarters. The idea of taking the program to Puente Salas did need to overcome high skepticism, as local residents did not have heard much about it. Therefore, BFEP officials

visited Puente Salas several times to introduce the program to local residents, who after several gatherings, self-convinced of the benefits the program would bring to the community. A BFEP local committee was created, and was responsible for reaching BFEP's offices to fill out the forms required to present the community's application. In the aftermath of such decision, BFEP officials keep visiting the community, giving several talks at the Communitarian Room on BFEP procedures and how the local community should self-organize to run the program.

On the other hand, as to SQSP the path was similar. ASADA's officials learned about the program at an AyA's presentation, and noticed the benefits of the program for their community. However, in view of the at-the-time WSS infrastructure deficit, they estimated they were not ready to be part of the program, thus they decided to postpone their application until several infrastructure issues were resolved. Once the solution came about, AyA's officials visited Puente Salas to introduce local residents to the program. Those meetings were held at the Communitarian Room. Again, once local residents confirmed the benefits of the program, the implementation process started off. Although both programs follow a similar vein in terms of their inception, the programs procedures require different types of organization. That is how, BFEP ends up being running by an autonomous local committee, and SQSP by the local WSS operator, that is the Puente Salas ASADA. Though the ASADA-based administration may at first sight slows down SQSP decision-making as it is only one of the ASADA tasks, the program does have an advantage over BFEP in regard to financial resources. SQSP can reach out to the ASADA General Assembly and Board to obtain resources to meet the program's

requirements; BFEP cannot, and draws upon its autonomy in organizing fundraising initiatives and calling out to LDA.

In both cases, as mentioned above, local residents “feeling” and “living” the program are the drivers of their local implementation. In addition, the programs are recognized as contributing to the well being of local residents. Those aware of BFEP identify it as a valid entity to report any environmentally threatening situation. The case of a group of neighbors reporting a landlord keeping open septic tanks with the subsequent risk of a rapid spread of waterborne diseases is a good example. Local residents affected by the landlord’s actions report him to the BFEP local, which in turn required him to solve the situation; otherwise they would report him to MINHEALTH. The next day he was covering the septic tanks and stopping any leaking. The program has contributed in empowering local people in protecting their right to a better environment by addressing reports of the threatening issues. As such BFEP has come to enforce new local environmental standards, thereby addressing a long-held requirement of local residents.

The BFEP local committee’s target is, in addition of securing natural resources protection, to promote a “culture of water” which refers to moving the community to a new phase in terms of water resources protection and use. To achieve such goal, local residents are introduced to new practices and habits, and are invited to participate of several communitarian activities organized by the BFEP local committee. The Water Fair and the Annual Water Parade are two examples. Both aim to motivate local residents to get knowledgeable about water issues and practices and thus far have convened a significant amount of people. However, there is an interesting point to make. BFEP has

built a sound relationship with the school. As mentioned above, given the leadership of a local professor, children are motivated to participate of BFEP activities by attending reforestation journeys next to the local streams, being part of the Annual Water Parade disguised in water-related costumes, or learning about water use practices at school. Children are so enthusiastic about it –normally they plant 400 trees during the reforestation journey- that they bring their parents along who in turn wind up as enthusiastic as their children in regard to learning about and promoting the environment protection. Such a high motivation among children responds to the active role of the school within the program. Early on, the school was invited to be part of BFEP and decided to establish its own BFEP committee, “Jacinto Basurilla”, named after a character of a TV public environmental campaign.

6.5.3 Sense of Ownership

The sense of ownership refers to the perception local residents have over their own WSS system. In that vein, three aspects are reviewed: historical behavior, social initiatives and the fee collection system.

The exploration follows an historical path going back to the group of “pioneers” responsible for the creation of the local water committee. The construction of the local aqueduct took 8 years to complete, and demanded strong participation from local residents. Those filled different roles either dealing with technical issues or even going up to the mountains in their quest for new water sources, work local residents did for free with the only goal of contributing to their community. A good example, is the pioneer Aníbal Villegas who, in the late 1970s, in light of the pollution recorded at local streams at the time voluntarily set out to the mountains for long periods of time to find a new

water source. His quest ended when he came across with the stream “El Guacalillo” which turned out to be a better water source in view of its 12 months per year flow. The fact that at that time, volunteering drove participation of either residents or leaders marks a point of difference with the current situation, where there is paid staff in charge of the operation of the local aqueduct and to convene a high number of users is a difficult task.

BFEP and SQSP social initiatives have contributed in bridging the identification gap between historical local residents and immigrants, Those arriving to Puente Salas, as expected, may not identify themselves with the local community as strongly as historical local residents do, therefore by promoting initiatives the such as improving communitarian facilities, organizing social gatherings, or working closely with the local school, local authorities try to increase the sense of identification the whole community has, including those for which Puente Salas is not their hometown. A special should be made in regard to local students. When participating of the reforestation journeys or been part of the Annual Water Parade, students feel they are making a contribution to their own community, initiative prompted by the sense of identification they may have. Such rationale can be expanded to all those local residents participating of BFEP or SQSP activities; their participation at both programs is greatly driven by their sense of identification –thus of ownership- they have over their own community.

In regard to the water fee collection, the system operates as follows: there is a monthly fee, set in accordance to ARESEP proceedings that is a marginal cost per cubic meter of 90 colons is added to the basic tariff of 1,600 colons; the President of the Board estimates an average monthly bill of 3,500 colons per household. In comparative terms, the cost of water is cheaper than that of electricity, even more considering that, as a

member of the ASADA staff points out, “how important water is for human well-being” and “there is no replacement for water”. Each household receives on the day ten of each month its water bill, delivered at their home by the plumber. With their bills at hand, local residents have until the day 20 of each month to pay; if they do not on such date they have three further days, otherwise their service is cut off. Although there is a monthly control of fee collection, there is no historical record of how many people have been in default of payment each month. However, at the moment of the interviews, the ASADA administrator mentioned that 200 people were in default; then with the threat of cutting off the service, in three days, only six out those 200 still remained in default. To cut off the service, the administrator hands a list of those households in default to the plumber who after the three days extension proceeds to cut off their water service. Albeit there is no historical record of payment, the Administrator concurred with the President of the Board in that the stricter control of the last 5 years has contributed to improve fee collection; previous of it, there were users in default of payment for more than 5 years. Nowadays, the household with the longest time in default spans 4 months.

6.6 PSOs and KIOs

In this section, I present a description of the interactions the community of Puente Salas has with both Problem Solving Organizations (PSOs) and Knowledge and Information Organizations (KIOs) given BFEP and SQSP. In regard to PSOs, AyA is the main body the community interacts with. In both cases, the interaction occurs at the design and implementation phases, that is at first AyA’s officials visit the community to introduce local residents to the program or a group of community members, mainly local leaders participating of local organizations’ boards, learned about the programs attending

a special presentation at AyA's headquarters. The first AyA's visits brought along presentations by programs' officials introducing either BFEP or SQSP procedures to motivate local residents to participate of the programs. In Puente Salas, AyA professionals visit Puente Salas six times to explaining the benefits of both BFEP and SQSP and their presence contributed greatly to convince the local community of locally implementing both programs. Once the community decided to be part of both programs, the interaction with AyA gets into different dynamics. In regard to BFEP, the interaction with AyA deals with annually reviewing the local community's performance to define the number of stars it will be awarded. However, as of SQSP, AyA's role goes beyond supervision. In view of SQSP target to secure potable water, the agency is not only responsible for reviewing the local community's performance but also for monitoring water quality 4 times per year.

On the other hand, KIOs do interact with the local community in regard to both programs. Local residents have been constantly invited to attend WSS-related talks at Universidad Nacional (UNA), particularly at the Interdisciplinary Program of Water Research and Management (PRIGA). Presentations attended by local residents –mainly members of the ASADA Board or of the BFEP local committee- refer to sanitation and environmental issues such as pit construction, compost and organic matter production and use. In addition, college students have been of great help. Recently a group of UNA students focused their thesis on a three-ASADAS-comparative-study, all located in the district of Barva. The study has provided the ASADA with useful information for their local decision-making in terms of social and economic indicators. In addition, various WSS infrastructure projects have demanded topography analyses that have been provided

by engineering students who have come to the community to contribute in improving the local infrastructure.

6.7 Governance

In regard to Governance, in their description of Global Systems of Innovation (GSI) Cozzens and Catalan (2008) refer not only to norms, rules, laws and how public bodies may be organized, but also to voluntary consensus formation among non-governmental groups. Therefore the analysis of Governance in regard to the WSS Community Based System of Innovation (CB-WSS-SI) covers national laws and organizations dealing with the protection and administration of water resources, and legal norms in regard to the creation and operation of ASADAS and both BFEP and SQSP.

In Section 4.3.3, a description of the legal framework currently ruling Costa Rica's WSS system is displayed. The system, from a legal point of view, does define administration issues –Water Law, General Potable Law, AyA Law- crossing with sanitation and environmental issues –Health General Law, Environmental Organic Law- and regulation –ARESEP Law-. In line with Costa Rica's promotion as a highly respectful of biodiversity nation, laws addressing conservation and protection of natural resources are part of the local WSS legal framework. The Forestry, Wildlife, and Biodiversity Laws all deal with the issue of water resources protection, and enforce environmental legislation that considers the role of water in natural and sustainable contexts. As of organizational bodies, the array is wide, going from the most directly involved in operation as AyA, Municipalities, private operators, and the ASADAS themselves, in addition of those responsible for regulation and management issues the such of the MINAET, MINHEALTH, ARESEP, National Service of Underwater,

Irrigation and Drainage (SENARA), Technical Norms Institute of Costa Rica (INTECO), the Ministry of Treasury, the Ministry of Labor, Institute of Municipal Promotion and Advise (IFAM), the Constitutional Court and the Office of the Comptroller General of the Republic (OCGR).

When analyzing the case of the community of Puente Salas, and particularly the cases of BFEP and SQSP, the main interaction in regard to Governance results from the relationship the local community has with AyA. The public agency is responsible for running both programs at national level, thereby the norms that currently rule them and those that give them origin are considered as part of WSS-CB-SI. BFEP was created by means of the AyA's Board Agreement N°96-160 of June 4th, 1996, and later on the MINAET and MINHEALTH Decree Law N°25636, published at La Gaceta on November 18th, 1996, established the first operation proceedings for the program. SQSP started out by means of AyA's Board Agreement N° AN-2002-150 of April 16th, 2002. Both programs have gone through several modifications that have been enforced by different means –Decree Law, Internal Proceedings, Manuals-. In regard to BFEP, the decree laws have dealt with creating further categories in addition of the beach original one, and with setting a new orientation as a social-well-being and public-interest-based program. As mentioned in section 5.1.1 BFEP does has its own national organizational structure formed by one representative of each of the following public bodies: AyA, MINAET, MINHEALTH, the Ministry of Public Education the Costa Rican Institute of Tourism, the Costa Rican Natural Reserve Network, and the Costa Rican Institute of Electricity. All them meet once a month to address different issues raised either by the

communities participating of BFEP or by themselves in regard to the modification of the operation or direction of the program.

6.8 Learning

At Puente Salas, BFEP and SQSP have driven learning in different venues. For example, the promotion of a local “culture of water” has resulted in a new water consumption behavior that in turn has modify previous practices in regard of taking a shower, watering the yard, or washing the dishes, practices that the BFEP local committee promotes actively by means of regular training sessions and brochure distribution. However, the implementation of metering at each household made a greater impact in improving those water practices. As though local residents did have a record of their consumption and started to be charged in accordance to such consumption, their behavior changed and the amount of their water bill decreased. Nevertheless, when asked about how those new patterns came about, local ASADA officials point not only to public campaigns supported by BFEP or SQSP local organization. As the billing system incorporated new technologies -metering-, local residents realized that the ASADA was able to charge them for what they were really consuming, therefore those old practices of been entitled to consume water with no constraints as long as they pay a monthly fixed amount of money were left behind. In words of a member of the ASADA staff “people react when you touch their pockets”. That pressure led local residents to learn about new water consumption practices at home and to change their habits. An interesting case is the one brought up by the former President of the ASADA Board and current head of the BFEP local committee. With the metering system in operation, they were able to check in greater detail the consumption patterns of local residents. One case drew their attention in

view of the low bill thereby low consumption of one of the local residents. When visiting him, they realized that he had decided to build himself a water reuse system at his home to decrease his consumption and to contribute in taking care of the environment. The water that he uses in washing his dishes at the kitchen is channeled to his bathroom to be used in evacuating waste.

In addition of the dynamics resulting from the promotion of a new “culture of water”, local residents identify further learning venues that have helped them in trying to get better results. Regular invitations from PRIGA to attend training sessions at Universidad Nacional (UNA) have allowed them to learn about new environmental practices such as producing compost and organic material from waste or about pit techniques in regard to the use of septic tanks. Such new knowledge has afforded them to improve their personal environmental performance and to contribute to the sustainability of their community. New environmental practices also include reforestation. Nowadays residents of Puente Salas participate regularly of reforestation journeys promoted by the BFEP local committee, and thereby have learned how to plant, take care and maintain trees. Furthermore, their environmental knowledge has expanded even more by means of their participation at a Meteorological Institute’s project about a National Development Plan where they learned about climate change and Green House Gas (GHG) emissions through very didactical methodologies.

Other learning dynamics deal with the interaction with the firm supplying materials and equipment that has given rise to further learning dynamics. To ameliorate future performances those suppliers have trained a group of local residents, namely the plumber and his assistants, in several Operation and Maintenance (O&M) techniques that

have helped them to avoid possible failures of WSS facilities. Additional learning comes about with recycling practices promoted at BFEP that have resulted in initiatives that may have not been identified at the launch of the program. That is how handicraft did also find a place at BFEP as local residents realized that garbage could be recycled into handicraft work that in turn could be put for sale at the events organized by BFEP. A group of local residents is nowadays involved in that kind of activities and is able to generate a modest income from it.

In view of the participation of the local school at BFEP, learning encompasses children. As they actively participate of BFEP activities organized by their professor along with BFEP staff, children are encouraged to be part of drawing and writing contests whereby they learn about different water issues. They are introduced to new habits and practices that shape their future water consumption patterns and preferences. They are so enthusiastic about it that regularly they take their new knowledge home and there describe them to their parents who also learn about it and put them into practice. Children participate also of cleaning and recycling journeys where they are responsible for collecting garbage in the streets of Puente Salas and hand it to the Municipality that put it into its recycling system. At school, children go through “The Natural Resources Week”, time span during which they are taught about specific water resources and environment protecting practices; for instance, they wind up with great knowledge about recycling and the decomposition time of several products. In addition, BFEP along with the school organize reforestation journeys attended exclusively by the school’s students. The students visit up into the mountain the streams that supply water to Puente Salas, streams they protect by planting trees in the bordering areas.

6.9 Collective Choice

The collective choice review follows the IAD theoretical framework, therefore the Water Innovate Event (WIE) dynamics -BFEP and SQSP local implementation- are described in accordance to the IAD components. That is how in regard to the *action arena* WIE fills in as the *action situation* and the definition of *actors* responds to the succession of events that resulted in BFEP and SQSP operating locally. As mentioned above, local residents learnt about programs at AyA venues, self-convinced of their benefits, and next had BFEP officials visiting the community to introduce their fellow local residents to both programs. Thus actors are grouped in three categories: a) the local residents that participated of the collective decision to implement locally BFEP and SQSP; b) members of the ASADA administration that convened the community; and c) AyA officials responsible for promoting the programs.

As mentioned in section 3.3, in regard to the present dissertation IAD contributes to review the institutional setting that affected local residents when they confronted the decision to participate of BFEP and SQSP. In that sense, local residents at Puente Salas did address problems proper of groups struggling to self-organize and self-govern in their quest for a collective benefit: a) the problem of supplying a new set of institution, b) the problem of making credible commitments, and c) the problem of mutual monitoring (Ostrom 1990). Therefore the helpfulness in considering the three clusters of variables that IAD proposes: a) physical/material conditions, b) attributes of the community, and c) rules-in-use. For physical/material conditions, the point to make is to refer to Puente Salas as a rural community, located in the Province of Heredia, with a high sustainability performance. In relation to the attributes of the community, Puente Salas is a skillful

community with a high educational background and regular capacity building processes that has been governed by a strong and stable leadership.

Albeit IAD is valuable in describing those dynamics, its greatest contribution comes about in regard to the rules-in-use, and the differences that rise by going through its multilevel structure covering constitutional, collective choice, and operational ruling. Let us start with the constitutional level. The National Constitution set the right of every Costa Rican to a healthy and ecologically balanced environment¹⁹. Further, a national legal framework -including a long list of natural resources administration and protection laws²⁰- has resulted in the establishment of a network of public organizations responsible for setting and monitoring rules and standards. Therefore, at this institutional level, both the Constitution and the natural resources legal framework in operation do set an incentive to Costa Rican –including local residents at Puente Salas- to self-organize to obtain a collective benefit: greater sustainability.

The collective choice level responds to an array of rules enacted by AyA and the community itself. First, as of AyA's role, the agency is responsible for BFEP and SQSP creation, and through WNL the agency has set the proceedings ruling both programs including the requirements to meet to obtain the star-based sustainability certification they award. Nowadays, in view of the greater number of BFEP categories, from hinterland communities of which the present study is about to natural protected areas, communities are confronted with a wider array of alternatives. Although they are able to participate of each one of them, their final decision depends upon the preferences of local

¹⁹ Constitutional amendments have been proposed recently to define water access as a fundamental and inalienable right and water resources as of public domain

²⁰ Health General Law, Environment Organic Law, Biodiversity Law, Forestry Law, Wildlife Conservation Law, Water Law, General Potable Water Law, AyA Law and ARESEP Law

residents. In this regard, the community of Puente Salas decided to participate of the BFEP community category, as local residents deemed that the implementation of the program would increase local sustainability in terms of promoting new environmental protecting collective and individual habits. Nevertheless, it is worth noting that the adopting decision came about as a collective one, i.e. the community of Puente Salas in a participatory manner decided to locally implement BFEP. In that sense, the analysis of collective rules follows the scheme proposed by Madrigal, Alpízar and Schlüter (2010). The approach explores the self-organization of the local community and whether local decision-making is based upon a sovereign supra governing body. At Puente Salas, the response comes about with the establishment of the ASADA itself and the General Assembly. Then, the inquiry goes down to the rules governing the operation of the local water committee, of particular interest is the ruling of the General Assembly, periodicity and voting system, and the ASADA Board, members election and removal and internal voting rules. At Puente Salas, the General Assembly gathers annually convening associates to either make a decision in regard to local operation issues, or to vote a new ASADA Board; the Board has periodical meetings and the mechanisms and procedures to elect and remove its members are known and accepted by local residents. Decisions at the Board are reached by the majority rule among its members. BFEP was not an exception. The decision to participate of it was presented at the Board, discussed and approved.

In regard of IAD operational level, Madrigal, Alpízar and Schlüter (2010) based their analysis of the performance of drinking-water community organizations upon three categories: tariffs; infrastructure, maintenance and protection; and water treatment. For tariffs, the framework requires three conditions to comply with: a metering system to

measure consumption at each household; definition of place, day and mode of payment; and the establishment of sanctions for default in payment and the subsequent reconnection cost. At Puente Salas, there is a metering system in place; the place, day and mode of payment are well known as local residents are aware that every day 20 of each month they have to be at the ASADA headquarters to pay their bill, otherwise they have a three days extension before their service is cut off; and the reconnection cost those in default of payment have to pay is 2,500 colons. For infrastructure, maintenance and protection, the framework explores the ruling of facilities maintenance and repairing, and natural resources protection with a special emphasis on areas near intake points. In this regard, at Puente Salas, the plumber and his assistants are responsible for regularly monitoring the WSS facilities, do any reparations needed on the field, and for responding to local residents' requirements when they have a problem at home. Natural areas nearby intake and storage points are protected in accordance to local rules that require all of them been fenced and establish as prohibited to enter into the tank areas. For water treatment, the framework inquires about the control of water quality and the periodic maintenance of the storage tanks. To control for water quality a system based on the application of chlorine pills was implemented, with the local plumber monitoring chlorine content with handheld artifacts. In addition, WNL experts visit 4 times per year the ASADA to control water quality -one of SQSP requirements- with the community obliged to present the results as part of their annual report. All those dynamics have resulted from the application of BFEP and SQSP and have had a noticeable impact on the local sustainability performance.

Nevertheless, the question in regard to collective choice dynamics is how rules have affected local residents at the time of the decision to apply to BFEP and SQSP. The response comes from the non-existence at the time of most of those rules. For instance, the metering system was implemented in the afterwards of the community getting into BFEP, thereby the tariff system missed greater quality and was based upon a single-fixed-amount charge; infrastructure was outdated at the time due to the inexistence of a clear definition of the rules governing the plumber's chores –there was no obligation of regular inspections- and intake and storage areas were not protected and open to the public with the consequent pollution and damage; water quality was monitored not as regularly as today and the chlorination system in operation had not been implemented yet. It is worth noting in this respect that that infrastructure was highly outdated was one of the reasons of the community's one year postponement decision in applying to SQSP. All this issues were widely discussed at both the General Assembly and the ASADA Board in view of the local residents' complaints, discussion that resulted into the collective decision to apply and implement BFEP. Therefore, IAD comes to respond the question of how institutions did contribute to the local decision of participating of BFEP and SQSP, decision that was driven by different rulings, going from the constitutional right that Costa Rican have to a healthy and ecologically balanced environment, to operational ruling previous BFEP arrival where rules were not as strict as nowadays in demanding and monitoring the WSS behavior of local residents. Further, the three problems faced by groups self-organizing to obtain a collective benefit –the supply of new institutions, credible commitments, and mutual monitoring- were all addressed at Puente Salas. Local residents did have previous experience in self-organizing thereby

BFEP and SQSP mandate of self-governance was no new challenge for the community of Puente Salas. With local social organizations in charge of the implementation and administration of both programs, the previous experiences participants of those organizations had were of great help in setting new institutions. That various social organizations are in operation at Puente Salas previous to BFEP and SQSP contributed in building up a greater sense of responsibility among local residents making them aware of their role within their community and the significance of being open to collaborate and play by the rules. Confirmation of such statement comes from the low WSS default in payment, rate that has been achieved in part given the locally run monitoring system. The system mandates those in default to pay a reconnection cost and charges local residents for their single consumption –there is non-common general fee- thanks to its metering feature. Overall, Ostrom’s self-organizing problems were addressed at Puente Salas, a community that was capable of supplying their own new institutions, get local residents committed to follow the new ruling, and to establish a mutual monitoring system given their local trust, sense of community and social capital built over the years.

6.10 Summary

Puente Salas turns out to be a successful BFEP and SQSP case, and that have resulted from great participation dynamics, not only dealing with holders of administration position, but also with great attendance and interaction at the various social initiatives that both programs organize locally. In addition, participating is driving by the high sense of ownership local residents have over their local WSS systems confirmed by the historical dynamics that led to the creation of the first local water committee and the current low default in payment rate. In terms of the capacity of the

community, the local school has contributed to the already high learning activity by training students and making them to actively participate of BFEP and SQSP initiatives. Local leaders do play a major role in diffusing and organizing the programs locally, and in gathering and convincing their fellow local residents of the benefits for the community their operation brings along.

CHAPTER 7 PEJIBAYE

7.1 Introduction

The chapter describes the case of Pejibaye, a rural community located in the Province of Cartago. Pejibaye has been part of BFEP and SQSP for several years before the year under study –that is 2009- and local residents have been relatively successful at both programs. The community has been awarded with two stars at BFEP and five stars at SQSP, and presents the lowest secondary education rate of the three case studies. Therefore, Pejibaye responds to the high sustainability-low learning capacity profile. The chapter follows a similar organization than the previous one, thus to the general description of the community and of BFEP and SQSP dynamics, reviews deal with the dependent and independent variables of the theoretical model, and of the local collective choice decision-making.

7.2 General Description

Pejibaye is a rural community located in the District of Pejibaye, County of Jiménez in the Cartago Province. Unlike Puente Salas, there are no major doubts on defining Pejibaye as a rural community; the town is in the middle of the country, and to get there is no easy task. However the rural profile of Pejibaye, local residents do have access to basic services that is water supply and sanitation, telephone, public transport, and a public local health clinic, the so-called Basic Team of Integrated Health Care (EBAIS), works in town. Although access is not easy, public transportation reaches town allowing local residents to move around particularly to the city of San José or the city of Jiménez, the county capital. Self-organization has afforded several social facilities to

Pejibaye's residents: remarkable examples are the local Central Square and Boulevard, main social gathering places for local residents. In economic terms, Pejibaye depends greatly on agriculture with coffee, sugar cane and cacao as the main crops, and on cattle farming; lately, local residents have self-organized to promote rural tourism to receive mainly foreigners interested in participating of their daily activities and stay at their homes.

The District of Pejibaye covers an area 209 km², extension that makes of it the largest district in the whole country. Founded in 1967 by then President José Joaquín Trejos, the origins of Pejibaye are in the arrival of Franciscan Missionaries to the area in the nineteenth century. However, it was not until the "Gran Finca de Pejibaye" – Pejibaye's Great Farm- was established in the early 1900s that local economic development boosted based upon banana and coffee exploitation. The first half of the twentieth century witnessed the arrival of varying Finca's new owners, mostly American or European businessmen, giving rise to a small agro-based town as company's employees settle down in the vicinity. It was not until a Costa Rican entrepreneur, Florentino Castro, bought the Finca and decided to sell it to the then Land and Settlement Institute (ITCO) –nowadays the Agrarian Development Institute (IDA)- that the whole farm land was subdivided among the 72 Finca's workers with each been awarded with similar pieces of land.

In the mid 1960s, local settlers self-organized in the Agricultural Industrial Cooperative of Pejibaye (COOPEJIBAYE) thus reaching higher production and distribution performances that ending up affording higher social and economic local development. Such new scenario brought about an increase of the local population along

with the demand for more and better basic services. Water supply and sanitation was one of them. In the late 1960s, the Municipality of Jiménez was running the local aqueduct, though in view of the low coverage and bad water quality, local residents decided to self-organize to demand a better service. With the support of the Local Development Association (LDA) they complained before local authorities at the city of Jiménez, extending their demand for a better service to the passing of the administration of the local aqueduct to the community of Pejibaye. Therefore, the Municipality decided to work out a solution whereby local residents would be the ones in charge of the operation of their local WSS system. At the time those dynamics occurred, AyA was promoting nationally the establishment of the Rural Aqueducts Administration Committees (CAARs) pursuing to make local residents responsible for the administration of their own WSS systems. Therefore, that local residents stood for their right to self-manage their WSS system, the readiness of the Municipality to address their demand, and the promotion of CAARs by AyA concurred in making possible the establishment of the first locally run WSS system. At first, due to legal barriers, the local WSS administration was handed to LDA and later LDA created the first local CAAR and made it for securing potable water for the then Pejibaye's 70 households. Local residents enthusiastically took up their new obligations and worked hardly in upgrading their WSS system. However, the challenge was not exempted of problems. They started facing their first challenges. A growing population and natural phenomena –floods- put up severe hurdles to their job; however, to cover such a growing demand, they rapidly set out to come across with new water sources with no profitable motivation in doing so. With the advent of the ASADAs, the community of Pejibaye decided to establish their own. That is how 10 years ago they

signed the corresponding Delegation Agreement with AyA that created the now ruling ASADA of Pejibaye. The current members of the ASADA Board recognize that the establishment of the ASADA has contributed to meet higher quality standards and that in reaching those standards AyA's support and supervision have been pivotal.

Nowadays the local water supply system is formed by 4 subsystems: El Ceiba, Plaza Vieja, Pangola, and La Veinte, each feeding a different area of Pejibaye. The El Ceiba subsystem is located one kilometer east of town, works with a flow of 24 l/s and is formed by one storage tank that goes also under the name of El Ceiba. The Plaza Vieja subsystem feeds the southern area of the town though with a lower flow than El Ceiba, 9 l/s: it also counts with one storage tank: the Plaza Vieja tank. The Pangola subsystem is located 800 meters north of Pejibaye, runs with a flow of 7.02 l/s, and includes a single storage tank. Finally, the La Veinte subsystem is found 2 kilometers west of Pejibaye, and follows the same one storage tank pattern than the other subsystems with its flow being the lowest of all: 6.85 l/s. The ASADA has nowadays about 600 associates that is it provides water to 600 households.

7.3 BFEP and SQSP

The dynamics that gave rise locally in Pejibaye to BFEP and SQSP do not differ greatly from the one that ruled their implementation in Puente Salas. That is how in 2005 a group of local residents, members of the LDA, approached AyA asking for information about BFEP after hearing about the program operation in other communities. Their goal was to come across with a novel approach that affords better protection for natural resources, touristic attractions, and improve the local sanitation, hygiene and public health systems. In response to such demand a group of BFEP professionals visited the

community to introduce local residents to the program, describing BFEP's requirements and benefits. As soon as the local community approved to participate of BFEP, a six members local committee was gathered, and started working on their first application. Nowadays, members of such committee do not only sit at it, yet also at the board of various local social organizations, such as the ASADA, Ecological Group, the Chamber of Tourism and the School Board. Pejibaye is one of the best national examples of successful BFEP's application, as the town not only participate of the community category, but also of the educational center and natural protected area ones. Thereby to the 2-stars flag waving at the ASADA headquarters in view of their performance at the community category, they add a 3-stars flag at the secondary school –the so-called Environmental School-, a 2-star flag at the primary school, and a 1- star flag in relation to the natural protected area “La Marta”. The case of the Environmental School is a notorious one as having 3-stars is the greatest number of stars an educational center is able to obtain. In view of Pejibaye's good performance, a Panama delegation interested in learning about BFEP implementation visited Pejibaye inquiring about the dynamics that have driven Pejibaye's successful participation at BFEP.

In regard to SQSP -under which the community has been awarded a 5-stars flag- the following year to BFEP implementation the local community decided to explore first and apply later to the program. The driver was the pursue of securing potable water to local residents, a point highly noticed at the preparation of the first local application to BFEP. In response to SQSP requirements, the local operator, the Pejibaye ASADA, ran the program from the beginning; therefore before getting into it, the application was largely discussed at the ASADA Board and at the General Assembly. The first challenge

was to upgrade the local WSS facilities that were not up to meet SQSP requirements at the time the community set out to participate of it. Therefore, storage tanks, intakes and pipelines went through intensive reparations for which the ASADA did not have funding, thereby they decided to apply for banking loans they are still paying until this day. The physical upgrading was complemented with the introduction of new-to-the-community innovations. A good example is chlorination. A water quality control methodology operates nowadays to secure potable water to local residents, based on the regular application of chlorine in prescribed quantities to the water drawn from the nearby streams. However, budget constraints have not allowed the ASADA to replicate innovations already operating in other towns. Metering is an example. Noticed as an excellent supporting tool to ameliorate WSS fee collection, metering is not part of the local picture, as the ASADA does not have the funds to implement it locally. The application is limited to a reduced number of cases, selected in accordance to their higher water consumption. Nevertheless, though not all innovations that one may expect should be in operation actually are, local residents do recognize the contribution of both programs, BFEP and SQSP, and identify strongly with their goal of protecting natural resources; in words of a local residents “if we cut the last tree, kill the last bird, and pollute the last river, we have no reason to live”.

7.4 Capacities of the Community

As mentioned previously the variable is a combination of two variables, skills and leadership, thereby the review goes as follows: first, a description of dynamics referring to local skills, and second, a display of those related to local leadership.

7.4.1 Skills

In view of the absence of official data on educational level at community level I replicate the rationale proposed for the previous case, that is I use district records to infer about communitarian educational record. In Pejibaye, such alternative does have greater soundness in light of the district's population of 3,375 inhabitants, a number slightly higher than the population of 600 households covered by the ASADA operation, but mainly because the ASADA itself targets the whole district as its field of operation. The district of Pejibaye reports a literacy rate of 92.19 percent, lower than Puente Salas' and Costa Rica' rates of 97.12 and 95.21 percent, respectively. In regard to the number of local residents having completed primary, secondary, and tertiary education, the numbers goes as follows: over the whole population over 5 years old -3,078 inhabitants-, 2,150 have attended only primary school -69.85 percent of the whole population over 5 years old-; 409 inhabitants have completed both primary and secondary education -13.29 percent of the whole population over 5 years old-; and only 77 have completed a college degree -2.50 percent of the whole population over 5 years old-. Those numbers describe a community with lower education background than Puente Salas, in view of Pejibaye's larger share of local residents with only primary education and its lower shares of inhabitants having completed secondary and tertiary education. The secondary and tertiary rates differences are not neglectable and should be considered in responding to the question whether educational background may have a significant effect in local sustainability and learning. A point aside should be made calling the attention on that the differences between both communities are replicated in similar terms when comparing

Pejibaye's educational indicators with national numbers, that is Pejibaye's performance put it below the country's average education level.

The role of the local schools is noticeable. However, Pejibaye does not replicate Puente Salas' model. It goes beyond it. Two schools are in operation, a first one going under the name of "La Escuela" and a second one identified as "El Colegio"; La Escuela is actually the primary school, whereas El Colegio, the secondary school. The difference with Puente Salas is that both schools have decided to apply to the BFEP educational centers category and both have been awarded with a blue flag, a two-stars one for the primary school and three-stars one for the secondary school. Such success has resulted from a constant work in upgrading and honing their local skills to meet BFEP requirements. For instance, the secondary school –locally dubbed as the "Environmental School"– applied three years ago to BFEP, and awarded with a one-star flag. The award only ignited the yearning for excelling among members of the school's community; thereby they decided to go for a higher number of stars. Three years later, the school is one of the few schools at national level having received a three-stars flag, and is often visited by either national or foreign actors interested in learning about the organization and management that has afforded them such success. In regard to internal dynamics, children do have an environmental class where they are taught about environmental practices such as garbage collection, recycling and water use. The class has resulted in children applying their new knowledge either at the school, by telling off and teaching classmates failing in following the environmental guidelines they learn at class, or at home, by sharing and promoting their new habits with the rest of their families. In addition, students participate in regular socio-environmental initiatives. They are very

active at the Environmental Festival organized by BFEP local committee, presenting their environmental-oriented drawings and writings; they visit with their professors the WSS local facilities, particularly intakes and storage tanks, where they realized the efforts needed to bring water to the community; and constantly they go up the hill to be part of reforestation journeys to protect their natural water sources.

In regard to the skills of members of the ASADA administration, at the Board only one of the local residents sitting at it has completed college education; the rest of the group has varying occupations. The President of the Board lives on a pension, the Vice President runs his own business, three members of the Board work at different firms or public organizations as a clerk, whereas the remaining member works at home as a housewife. The Administrator of the ASADA, who also work at the University of Costa Rica, also has college education, he majored in accountancy, and the other members of the staff, the plumber and the secretary, completed secondary education.

7.4.2 Leadership

Local leadership is not limited to the organizational borders of the ASADA. An interesting note about Pejibaye is the high number of social organizations operating on the field which though pointing to different targets can be gathered under the common umbrella of ameliorating the quality of life of local residents. That is how the number of local social organizations goes beyond 40 including among others the Ecological Group, the Chamber of Tourism, the Local Development Association, the Basic Team of Integrated Health Care (EBAIS), the Sports Committee, the BFEP local committee, and the ASADA. Having in mind that Pejibaye's population reaches 3,375 inhabitants, that 40 social organizations are in operation in town is a noticeable example of the yearning

for contributing to the well being of the community. Such a high number might respond to a high rate of participation by local residents but also to the local capacity of self-organizing to pursue a common social goal. Self-organization in turn results from the leadership of local individuals who are able to convene local residents, make their case about a specific challenge to address, and convince their neighbors of the significance of solving a particular issue or promoting certain ideas or practices locally. In simple terms that has been the path followed when a new local social organization has been established, actions that in some cases, as the creation of the local CAAR confirms, have been accompanied by the community strongly calling out to public authorities

The existence of such a high number of local social organizations makes one at first to think that a high number of local leaders move around in Pejibaye. However, such a guess may not be right. Constraining the analysis to members of the ASADA Board, it turned out that several of them participate of other organizations, and not only attending open meetings, but sitting at the boards of such organizations. For instance, the President of the ASADA Board, a middle age man who has spent his whole life at Pejibaye, sits also at the Ecological Group, the Chamber of Tourism, EBAIS, the BFEP local committee, and is a former member of LDA Board. At the same time, he feels very proud of the work they are doing at the Chamber of Tourism in designing and implementing a new rafting route drawing on the natural landscapes and resources the community of Pejibaye has, he is worried about not having been able thus far to locally implement a metering system to monitor and control water consumption. The Vice President of the ASADA Board is another good example, a middle age man, born and raised in Pejibaye, who in addition of sitting at the ASADA Board participates of EBAIS. The list goes on

with the President of the Ecological Group, a young woman who participates of the Chamber of Tourism, the BFEP local committee, and LDA; even more the current ASADA Administrator is also the coordinator of the BFEP local committee. Therefore as people repeat themselves as members of the board of local organizations or as holders of administration positions, the feature of leadership seems to be constrained to a reduced group of local residents who driven exclusively by their yearning to contribute to the welfare of their community have been the ones pushing hardly for the establishment of such a high number of local organizations. The President of the ASADA Board came across with a good response when required about identifying the driver prompting those participating the most by stating, "where one may help, there we are".

The local school is another good location to keep going with the identification of leadership dynamics locally. There, a local professor has spent most of his teaching time promoting among students environmental practices and habits. He designed a new environmental course for secondary students with contents directly related to natural resources protection prompting students to become individuals respectful of the environment. In addition, he regularly organizes activities for students to either visit water supply facilities to make them understand the work needed to bring potable water to their homes or taking them to reforestation journeys to learn how to protect their local streams by planting and taking care of trees. His work has had an effect. Graduates of the local school and former students of his have gone to college to pursue degrees in majors such as Environmental Engineering, Environmental Management and Marine Biology. Besides his current students give credit to his teaching, as they recognize new patterns in their own behavior in regard to their environmental practices: they are much aware than

before getting into his class of the significance of respecting the environment and of contributing to natural resources protection. Overall, the School Professor expects of his students to become environmentally literate citizens that may head in the nearby future the struggle for a better environment and thereby inherited to future generations a society that grows in a respectful manner towards natural resources.

7.5 Participation of the Community

As mentioned previously the variable is defined as combination of three variables: Administration, Interaction, and Sense of Ownership. Administration refers to the dynamics regarding the participation of local residents as holders of administration positions or actors of local decision-making; Interaction to their participation at BFEP and SQSP activities not dealing with administration positions nor decision-making; and Sense of Ownership to the question of whether local residents perceive the local WSS system as their own.

7.5.1 Administration

Pejibaye is no exception to the three-level scheme ruling nationally the ASADAS organization. That is how the ASADA is headed by the General Assembly responsible for electing every two years the seven members of the ASADA Board by means of an open and democratic election. At the election, only those local residents that have gone through the application process to become an “associate” are entitled to vote. To reach such position, local residents do have to fill out a form they pick up at the ASADA headquarters; next their application is reviewed and submitted to approval by the ASADA Board. Though the process is not a complex one, not all local residents carry the “associate” category: of the 600 users, that is household receiving potable water from the

local system operate by the ASADA, about 60 percent are “associates”. The General Assembly convenes once a year, though reasons for gathering differ from one year to another. As elections are held every two years, in their second year in office a new Board is mandated to present a report of the activities undertaken thus far in their administration thereby they are accountable to the members of the General Assembly. Participation at the General Assembly responds to whether there is a problem or not. According to the current President of the Board if things are going well, the attendance rate is low, whereas if there is a problem drawing the attention from local residents, associates show up in higher numbers. The President also estimates that on average 100 associates attend the General Assembly every year, a number that may be high in consideration of those witnessed at Puente Salas, but is still low in regard to Pejibaye’s whole population of 3,375 inhabitants.

In regard to the Board, all seven members are local residents and ASADA associates. It is mandatory to fulfill such requirements. Several of the ASADA Board members are borne and raised in Pejibaye, and are prompted to participate by a give-back-to-their-community driver one that is so high that for most of them their social participation goes beyond the ASADA Board. A good example is the President of the Board, who, in addition to his job at the ASADA, sits at the Boards of five different local organizations. When coming to the staff, there are particular aspects of the administration to be highlighted. The administrator does not work on a 24/7 regime. The ASADA hired what they call an “external” administrator who comes to the ASADA headquarters on a regular weekly basis to sort out files and papers and to take care of the fee collection system. The administrator is a local resident that works at the University of Costa Rica

during the week and organizes his schedule thereby to have time to focus on his duties at the ASADA; the pattern is replicated with the accountant the ASADA hired to support him with all the accounting work the ASADA demands. Members of the Board recognize that by following such premise they deviate from the regular practice at other ASADAs, that is hiring full time local residents to hold staff positions; however, they estimate that they have a point in making such decision. When they started their work at the ASADA they were immediately called out by local residents to solve all different kind of problems related with water supply that is fixing pipelines, upgrading storage tanks or collecting water fees. At that moment, they thought of themselves as unable to respond to all those requirements in an adequate manner, a reason they deemed as right when reviewing other ASADAs cases where members of the Board were, in their opinion, overwhelmed with the working load they had. Therefore they went with the option to hire “external help” by means of having part-time, but more experienced, local staff in order to deliver a better service and free more of their time to spend on more strategic decisions.

BFEP responds to a similar pattern than at Puente Salas. There is a local committee headed by a five members Board in charge of the operation of the program. Those sitting at the Board are all local residents interested in contributing to the community by means of promoting the protection of natural resources. All members of BFEP local committee Board do sit in other communitarian organizations that is how members of the Chamber of Tourism, the Ecological Group, the Environmental School and the ASADA, are also members of BFEP local committee. The operational crossing between BFEP and the ASADA operations is smoothly set as the President of the

ASADA Board and the ASADA Administrator sit both at the Board of the BFEP local committee, and the Administrator holds the BFEP local coordinator position.

7.5.2 Interaction

The dynamics related to the variable Interaction deals with those not referring to holders of administration positions nor to participation in decision-making but with the ones that convene local residents willing to contribute to the well being of the community. One of those initiatives is the process of implementation of both BFEP and SQSP. With regard to BFEP, the idea came about as in 2005 local residents learned about the program from other communities' experience at BFEP and the benefits the application of the program have brought along. A group of local residents participating of LDA at the time attended a lecture about the program by WNL officials and thought that to apply the program locally may be a good idea to promote natural resources protection among local residents. Next, the process went along with those WNL official visiting Pejibaye to introduce the program to the community; before such first approach, there was not much of an interaction between local residents and AyA in general. The story behind SQSP arrival is similar. At the time BFEP was in its first year of operation and the community was struggling with the program's water quality requirements; therefore to apply locally SQSP sounds as a good match to keep improving local sustainability. Nevertheless, SQSP mandatory requirements demanded an in-depth upgrade of local WSS facilities. Intakes, storage tanks, and pipelines went through substantial reparations, and new water quality control methodologies and artifacts were introduced to the local WSS system.

The list of BFEP and SQSP activities at local residents' disposal is not short. For instance, in conjunction with other local organizations –the ASADA and the Ecological Group- BFEP organizes the Local Environmental Festival where local residents, particularly students of both primary and secondary schools, attend lectures by MINAET, the Ministry of Education, and AyA officials about environmental practices and habits. Furthermore, students are allowed to put in display part of the work –drawings and writings- they do at their school in relation to environmental-oriented issues. Their motivation and the leadership of their professors have made of the local schools BFEP boosting nodes, promoting their participation in a wide array of activities such as visits to local water supply facilities, reforestation journeys, or the local celebration of Environment Day. To address such motivation, professors draw upon novel approaches to introduce students to natural resources protection. For example, when visiting the local water supply facilities, students are required to carry a bucket of water in their way back to the school. In view of the weight of the bucket most of them were reluctant to volunteer thereby the professor made them aware of the effort needed to take and secure potable water to their homes. The enthusiasm keeps going with garbage collection, A local competition is organized at the school, with students required to run against each other in order to be the one collecting the highest amount of garbage to be recycled. The experience has been so successful that students have collected in a two months span six tons of paper with two of those six tons corresponding to bad paper quality phonebooks. In view of such bad quality, the school is planning to submit a requirement to Verizon, the phonebook supplier, to avoid delivering phonebooks to each household, thereby constraining their targets to highly-attended public locations that is local stores, public

offices and schools. Overall, the school's work in regard to BFEP is done in great coordination with the local ASADA, as many activities organized at the school demand the ASADA's participation, and many activities organized by the ASADA are part of the school's plan. In words of one of the school's professor "The school and the ASADA cannot work separately, they have to collaborate to contribute the most to the local community."

7.5.3 Sense of Ownership

Local residents feel proud of their local WSS system. However to reach that point of identification, the path has been long and with not few hurdles to overcome. That today local residents do feel themselves as obliged to protect their local WSS system responds to the various historical dynamics that have ended up reinforcing the significance of having a WSS system driven by a regular demand of coverage and quality. Going back to the origins of the locally-run WSS system in the late 1960s, there was a constant effort to self-organize in upgrading the then-conditions of the system, effort that resulted from local residents volunteering in presenting their demand before district and national authorities or from their work in improving their local WSS facilities. There was already a yearning for contributing to the well being of the local community as there was not such a thing as paying for their services. As time goes by, the local community adopted new WSS organizations schemes that mandated higher participation from local residents; that is how the implementation of the ASADA implied not only local residents volunteering as members of the Board but also greater obligations for the local community towards AyA in relation to their work as WSS operator.

In addition of the participation and roles local residents hold, the so-called Environmental School has become an active BFEP actor whose range goes even beyond its own borders as the School awards every year an outstanding-contribution recognition to local residents in light of their actions to the benefit of the community. At the school students, as mentioned above, participate of BFEP initiatives the such of reforestation journeys, the Environmental Festival, visits to local WSS facilities, and environmental-oriented drawing and writing contests, all of them contributing not only to their environmental knowledge but also to their identification with their community. For instance, students do recognize that visiting local WSS facilities up in the hill has made them realize how much effort is needed to operate and maintain the local WSS system thereby to provide potable water to all households at Pejibaye. That kind of initiative has given rise among students to a sense of obligation of protecting both local natural resources and local physical facilities. That is how, at the school when noticing a classmate turning on the tap for more time than needed or drawing graffitis on the walls, they report her/him immediately to avoid future similar behavior. In regard to the graffitis, they adopted an innovative practice by leaving a tear-shaped positive paper-message on the same wall asking for not drawing over it. Overall, due to their training students are more knowledgeable on environmental-related issues, new knowledge that brought along new competences that have allowed students to contribute to the protection of local natural resources. Consequently, new knowledge and new competences have prompted students to contribute to the well being of the community for which they feel a greater identification, thereby they feel obliged to comply with their obligations as

members of the community as protectors of its assets, being one of them the local WSS system.

In spite of such participation, members of the ASADA Board recognize that they have worked hard on leaving behind the thought among local residents that “water is of public domain” thus there would have non obligations for local residents to pay for the WSS service. Such dilemma is confirmed when reviewing the local fee collection system. Nowadays, the fee collection system grants local residents the chance to pay any day of the month their water bills –which on average amount to 2,100 colons-; in case neighbors do not reach the ASADA headquarters before the end of the month, the administration give them 3 further days before their service is cut off. Tough the rules are much alike than those used in other communities, the local ASADA has had to struggle hard to achieve high payment rates. Causes of the low fee collection are in the economic and social problems the community of Pejibaye has faced due to the constraints the agricultural sector have been through, making their water bills payment not of first priority for local residents. Therefore the local administration has set up a more flexible fee collection system allowing local residents to pay their bills any day of the month, that is not asking for payment during the first or last five days of the month, but whenever people do have money in their pockets to pay their bills. To cut off the service is not an easy task for members of the Board. As Pejibaye is a rural community, most of local residents, including those currently holding administrations positions, know each other for a long time, thereby to cut off the WSS service to someone in default of payment turns out to be preventing a friend from having a basic service at home. Besides the flexibility of moving paying days along the month, the administration also innovated by

means of an incremental paying system, that is to the bills of those neighbors not able to afford paying their whole charge, a monthly additional 100 colons are added until they reached the 100 percent of the fee. In words of the Presidents of the ASADA Board such innovation afforded a lower default in payment rate, and, on the other hand, an increase from 2,000 to 5,000 colons in the reconnection fee the ASADA charges to those users missing complying with the fee ruling. The local residents of the community of Pejibaye are in the long term the main beneficiaries of a greater collection, so as in light of the better finances of the local ASADA, they will have at their disposal a better and more upgraded WSS service, reinforcing, what in words of a member of BFEP local committee is one of their proudest saying :“We have potable water”.

7.6 PSOs and KIOs

Due to BFEP and mainly by means of the local ASADA, the community of Pejibaye interacts with various Problem Solving Organizations (PSOs). The first public body that rises in such review is AyA. As the leading agency promoting and supervising nationally BFEP and SQSP, AyA has visited the community for different reasons. The interest of local residents to apply to BFEP brought to town AyA’s officials to introduce the community to the program. Those officials gave several talks to local residents focusing on BFEP requirements and methodology. As BFEP was being implemented, the interaction turned more regular with AyA’s officials guiding local residents in learning in-depth about complying with BFEP requirements thereby local residents learned about how to establish the BFEP local committee or how to set water quality control methods locally. With the program in operation, AyA constrained itself to a supervising role, controlling once a year the fulfillment of the targets set in the BFEP guidelines, and been

entitled to withdraw the blue flag that may have been awarded the previous year if the community did not fulfill with the program's requirements. In regard to SQSP, the dynamics have been similar with the further detail that the program's implementation responded to the previous year community's application to BFEP, particularly in relation to the set of BFEP requirements dealing with water quality control.

The National Institute of Learning (INA) is another example of interaction with PSOs for the community of Pejibaye. INA, a public organization, has given different types of training regarding handicraft and accountancy, sessions that at first sight may not be directly related with the natural resources protection, but that in the long term do converge into a capacity building that facilitates local recycling habits and administration practices. In addition, INA has been an active promoter of the "Parcelas Modelos" program that brings INA officials to Pejibaye to teach local residents on the use and production of organic material and compost. The work of INA officials is complemented by professionals of the Municipality of Jiménez who come to town to give various talks responding to the requirements of local residents who despite such venues still defines the interaction with Municipality as "low".

The University of Costa Rica (UCR) is the only Knowledge and Information Organization (KIO) that interacts with local residents under capacity programs they give in regard to recycling and the production of organic material and compost in line with INA local initiatives. Therefore there is common ground between the two cases reviewed thus far in regard to interacting dynamics with KIOs: in both cases interaction is driven by capacity programs that KIOs give locally, with no mention of any effort of a locally designed and developed WSS technology.

7.7 Governance

Governance dynamics at Pejibaye follow a similar path than at Puente Salas that is a three-level scheme -already described in section 6.7- rules the local BFEP institutional operation. The first step deals with the national WSS institutional framework that includes legislation crossing administration, sanitation and environmental, and regulation issues, in addition of laws promoting and securing the protection and conservation of natural resources. It also considers the public organizations responsible for operation, regulation and management at national scale, that is all those national public bodies with direct effect on the local natural resources protection. The review goes on with the description of institutional dynamics driving the operation of ASADAS, BFEP and SQSP, that is Decree-Laws, Internal Proceedings and Manuals setting rules and guidelines to be enforced. The final level, the one directly related with local governance in regard to BFEP and SQSP, responds to the institutional dynamics described in section 7.5, that is both programs do have their own governance scheme one autonomous of the ASADA's operation -BFEP- and the other one depending directly from it with all the decision-making going through the Board or the General Assembly. In regard to participation both programs are based upon volunteering prompted by the yearning of contributing to the well-being of the local community by means of working on the implementation and promotion of new natural-resources-protecting practices and habits.

7.8 Learning

Learning covers different dimensions at Pejibaye. Although members of the ASADA Board state that BFEP is having a greater effect on Pejibaye's youth particularly

due to the participation of both local schools, primary and secondary, at BFEP, other segments of the local population have been reached by its promotion of natural resources protection. Let us start the review by focusing on the implementation of new technologies locally. The first example that comes up is the adoption of new water quality control techniques based on the application of chlorination and the use of two new handheld chlorine artifacts. The approach works as follows: the plumber introduces chlorine pills at the storage tanks, and then, on a weekly base, controls for water quality drawing on the two handheld devices that though do not carry major complexity, needs a minimum knowledge for their operation. Learning came about as to be up to the challenge, the plumber had to acquire new competences. However, there are some missing opportunities. If comparing with the case of Puente Salas, one noticed that Pejibaye has not thus far implemented a metering system to control water consumption and to ameliorate the fee collection system. The reason, in words of members of the ASADA Board, is that due to its weak finances the ASADA is not able to cope with the cost of such a system. Not having at disposal consumption metering withdraws a further pressure to local residents to modify their current consumption behavior, thereby though the efforts of the local ASADA, there is still a risk that the local population feels entitled to operate in a non-limit-to-water-consumption context. Such an option postpones major learning events dealing with daily practices and habits that may result in reducing and optimizing local water consumption.

To behold the blue flag waving at ASADA headquarters ignites a feeling of pride in local residents and also prompts those with no knowledge about the flag itself to question about her meaning thereby when coming across with her natural resources

protection promotion, local residents start wondering about the actual effect on their daily life of a cleaner environment and their own role in contributing to such target. That is how many of them end up learning about natural resources protection at the various training sessions several organizations organize locally. For instance, INA comes to town to give training in environmental-related topics such as organic material, compost production and recycling complementing the initiatives of other organizations such as the Municipality of Jiménez and the University of Costa Rica which participate of training local residents by means of courses related with the protection of natural resources. Those attending such training have also at their disposal other training this time in regard to issues that at first sight may not seem directly related with those mentioned above, but that in the long term do have an effect on improving the local management of protecting the environment. That is how handicraft and accountancy courses given by INA have been locally organized with the subsequent effect on local residents' recycling practices and the management of the local ASADA. In addition, on a more infrastructure, the Costa Rica Institute of Technology Housing and Construction Research Center (CIVCO) has given courses to local residents about building techniques in regard to septic tanks in line with the massive use of such option throughout Costa Rica, with Pejibaye been no exception to the rule. Overall, given the local BFEP operation, local residents have had at their disposal various venues igniting their learning about different issues related with the protection of natural resources. The result is their greater knowledge and new competences have afforded to put into practice their new habits directly affecting local sustainability. A good example is the new recycling business that a local handicap resident runs nowadays. Due to the new promotion of recycling that BFEP brought along,

he thought what a good idea would be to open a business that collects locally the garbage on the streets and later hand it to the major recycling firms located in the city of Alajuela. The idea thrive and nowadays business is doing so well than his whole family is helping him as his firm's employees.

Young students at the local schools, both primary and secondary, do have learnt by means of BFEP. In addition of environmental courses, students participate of reforestation journeys visiting the areas nearby natural water sources that is rivers and streams thereby learning about planting and taking care of trees and protecting water resources. Their learning keeps growing when visiting the local WSS facilities, a first approach for local students to the technologies driving water to their homes. There, students realize how hard it is to settle and operate the local WSS system and the efforts needed to secure potable water for their families. Learning continues at the school where students are taught about garbage collecting and recycling practices and participate of different initiatives organized locally by BFEP the such as the Environmental Festival, Earth Day, and the Recycling Program. The school even encourages their participation by making them running against each other to determine who is the greater garbage collector at the school. All those initiatives are targeted to modify the students' behavior thereby to make of the today-students the future leaders of the community, leaders who will turn out to be the greatest environment keepers.

7.9 Collective Choice

The collective choice review at Pejibaye mirrors the one at Puente Salas that is I draw upon IAD to describe how institutional rules affected local residents when making their decision to participate of BFEP and SQSP. Again, in regard to the *action arena*,

WIE fills in as the *action situation* and *actors* are defined following the dynamics that led to the local implementation of BFEP and SQSP. As mentioned earlier, such a process started with local residents hearing about the benefits of the program from the experience of bordering communities, and then deciding to learn about it. As in Puente Salas, local residents attended AyA's BFEP open lectures whereby they ended up becoming knowledgeable about BFEP and set out to convince the community of the positive impact the program may have for local sustainability. The story kept going with AyA's official visiting Pejibaye to introduce the program to local residents and those making the final decision to apply to BFEP by drawing upon their local institutions. Therefore, BFEP's officials, members of the ASADA Board and staff, and local residents attending the local decision-making gatherings were the actors that participated of the decision-making process that brought BFEP to the community of Pejibaye, a decision that, though there were external actors involved, was a local one.

The IAD three clusters of variables are again helpful in figuring out how local residents addressed the problems of supplying new institutions, credible commitments and mutual monitoring. In regard to physical/material conditions Pejibaye is a rural community, this time located in the Province of Cartago, with a high sustainability performance; the attribute of the community responds to a strong leadership, though the educational performance is not as high as in Puente Salas, it is compensated by the capacity building process occurring at the local school, a boosting node of learning for those students in attendance.

Again, the greatest IAD contribution comes down the rules-in-use and the framework's three tiers multilevel structure –constitutional, collective choice, and

operational-. The constitutional and collective choice rules do not deviate from the previous description of Puente Salas' collective choice dynamics in section 6.9, that is the right to a healthy and ecologically balanced environment is established in The Constitution of Costa Rica with recently proposed amendments in line with the definition of water as of public domain. In addition, there is a national legal framework that sets standards, norms, and institutions responsible for enacting and monitoring the protection of natural resources. With regard to collective choice rules, the review follows the scheme proposed by Madrigal, Alpízar and Schlüter (2010) that concentrates on the establishment and enactment of various types of rules that are reviewed as follows. First, Madrigal, Alpízar and Schlüter question whether the community self-organizes and whether there is a local supra-body responsible for decision-making in a sovereign manner. At Pejibaye the community is self-organized under the ASADA, and the General Assembly is the entity sovereignly responsible for decision-making. Once the existence of such a body is noticed, questions jump into a second set of ruling requirements dealing with the operation of local institutions. In particular, the framework inquires about the operation of the local water committee, that is the local ASADA, with an emphasis on the proceedings ruling the ASADA Board. Therefore questions rise about the periodicity of the Board meetings, the proceedings for electing and removing its members, and the ruling decision-making. In regard to Pejibaye, the current administration system copes with each point, that is meetings are held on a weekly base; members of the Board are elected every two years at the General Assembly with all associated entitled to vote; they can be removed if the majority of the General Assembly agrees upon; and decisions are reached by the majority rule. BFEP went through this whole institutional framework,

thereby the program was discussed at the ASADA Board and then presented before the ASADA associates, though it was the Board which made the final decision upon the program's local implementation.

When the review goes down to the operational level, Madrigal, Alpízar and Schlüter (2010) draw upon three categories to achieve their IAD analysis: tariffs; infrastructure, maintenance and protection; and water treatment. For tariff, the approach demands a metering system in place to control for consumption; place, day, and mode of payment clearly established; and sanctions for default of payment and having set the reconnection cost. In this regard, at Pejibaye the situation is the following. First, there is no metering system with the local administration calling upon the lack of resources to finance the implementation of one, which in turn results from the socio-economic problems the local population is dealing with in view of a current agriculture crisis. Therefore the ASADA has decided to set up a flexible fee collection system that calls for payment during five days each month with three further days for those unable to pay in the preliminary span of time, otherwise their service is cut off. The novelty comes with moving those five and three days along the month, adapting the payment date to each local resident's pockets that is whenever he/she has the money to pay, he/she is entitled to pay. In addition, as mentioned above, the administration gradually increases by 100 colons the amount of the bill of those in financial need until they reach the whole amount of their debt. Those dynamics correspond to the second analysis criterion described by Madrigal, Alpízar and Schlüter (2010), thereby conceiving of the local fee collection system as one partly meeting the requirement of the fee collection proceedings been "clearly established". The question of sanctions for default in payment is also affected by

the financial problems already mentioned, as the flexibility promoted in view of the wants of the local population affords setting a 2,000 colons reconnection fee that has just been increased to 5,000 colons. For infrastructure, maintenance and protection, the approach demands rules- and their enforcement- for facilities maintenance and repairing, and natural resources protection particularly dealing with areas near intake points. At Pejibaye, those rules have been implemented. For instance, the plumber is obliged once a month to wash storage tanks and pipelines and to repair any failure he may come across; in addition the intake areas are fenced with walking over them strictly prohibited. For water treatment, the approach requires regular monitoring of water quality and washing periodically the storage tanks. The maintenance of tanks is, as mentioned above, done once a month whereas to control for water quality, the local administration has implemented a monitoring system based upon chlorination and two handheld control artifacts handled by the plumber. In addition, WNL visits 4 times a year Pejibaye to control water quality by means of their microbiological regular analyses.

The review comes to question how all the rules described thus far may have affected local residents in their decision regarding BFEP implementation. At first, there is a general context, mainly at national level, that prompted local residents to deem the promotion of natural resources protection as an initiative of high benefit for the community of Pejibaye. The constitutional right of a healthy and balanced environment and the establishment of environmental-protection-oriented programs, such as BFEP and SQSP, encourage local residents to make the decision of adopting an innovation pointing to increase sustainability locally. In addition, in operational terms, most of the current rules governing Pejibaye's WSS system were not in place at the time of BFEP

implementation. For instance, the reason of the low fee collection rate was not only that the agriculture was going through difficult times, but also not having in place a collection system with clear rules, not as the moving-dates-based one operating nowadays, that should be complemented with metering tools that contribute in monitoring water consumption. In regard to infrastructure, before BFEP and SQSP, local residents used to complain regularly about the bad shape of the WSS system which should not come as a big surprise as, at the time, the local administration did not pursue clear rules setting the obligations of the local plumber and his staff to hard and regularly work on local facilities maintenance. The issue of water quality did affect the collective decision of adopting BFEP and SQSP. Before the decision of participating of both programs, the low interaction the community had with AyA turned out to be a constraint for better infrastructure and greater water control quality, as AyA's professional teams did not use to visit the community as often as needed. With the advent of the programs, those officials came to town regularly and supported the local community in setting not only a system that mandates upgrading the local WSS facilities but also that demands a strict water quality monitoring. Therefore nowadays WNL visits Pejibaye 4 times a year to control for water quality, and the local administration has implemented a water quality control system run by the local plumbers operating on a weekly base.

The decision to participate of BFEP and SQSP responded to a collective process whereby the institutional setting –constitutional rights, the natural resources legal framework, and the local operational ruling- motivated local residents to implement both programs at the expense of other options. Along such process local residents dealt with the regular problems social groups face when self-organizing to obtain a collective

benefit: the supply of new institutions, the making of credible commitments and mutual monitoring (Ostrom 1990). In this regard, the community of Pejibaye was skillful enough to come up with a new ruling to govern both programs locally in light of the previous self-organizing experience local residents had. That background came from the establishment of other social organizations, including the first Water Committee, where local residents had participated actively either by heading the organizations themselves or by being part of the social movement that resulted in the new entity. That same pattern contributed to spread a sense of community that reinforced in local residents the significance of their participation to succeed at communitarian initiatives and therefore to be willing to conform to the new ruling the programs have brought along. Confirmation of that statement comes from the low default of payment local rate. Local residents do not free ride massively as they are committed to pay their WSS monthly bill since fulfilling such obligation results in the better shape of their WSS system, therefore everybody is better off. Nevertheless, success has not come easily. A monitoring system that punishes those in default, though that needs to get upgraded to the metering feature, affords the mutual profile that Ostrom demands to succeed at self-organizing, as those responsible for running it are local residents themselves. Overall, Pejibaye succeeded in addressing the typology of problems Ostrom cites for groups self-organizing, given the background and previous experiences local residents have that have built over the years a sense of community and social capital that have made them aware of their responsibilities over their own community.

7.10 Summary

Pejibaye turns out to be a successful case at both BFEP and SQSP. The dynamics driving that success do not differ much of those driving the high performance of Puente Salas. That is, great participation at decision-making positions and at BFEP and SQSP social initiatives organized locally resulted in high sustainability and learning; sense of ownership do have a similar effect and leadership has ended up becoming pivotal in struggling with status quo by enticing and igniting local residents to participate actively of both programs. However, there is a deviation from Puente Salas' case. At Pejibaye, the secondary education rate is not that high, and actually by expanding the review to all educational background levels, that is including primary, secondary and tertiary education, one observes that Pejibaye is far from the national average. In spite of that, they have been able to compensate what should have been a serious comparative disadvantage by having their local school very active at BFEP, thus students due to their training at school end up greatly knowledgeable in new environmental practices and habits, and to the benefit of their community, are more than glad to teach and put into practice their new skills.

CHAPTER 8 SANTA ROSA DE AQUIARES

8.1 Introduction

The chapter puts in display the description of the case study referring to Santa Rosa de Aquiares, a rural community located in the Province of Cartago, but this time in the County of Turrialba. Santa Rosa de Aquiares has been awarded two stars at BFEP and one star at SQSP, and among the three case studies, it scores second to Puente Salas in regard to secondary education rate; therefore the community responds to a low sustainability-high learning capacity profile. The chapter is organized following the same structure of the two previous ones that is descriptions of the community of Santa Rosa de Aquiares and both programs are included and the dynamics referring to each variable of the theoretical model and to the collective decision-making process are reviewed.

8.2 General Description

Santa Rosa de Aquiares is a rural community located in the District of Santa Rosa, County of Turrialba in the Province of Cartago, seven kilometers North of the city of Turrialba, the nearest urban settlement, and one-and-half-hour drive away from San José. In the middle of a natural protected area, Santa Rosa de Aquiares lies in the slopes of the Turrialba Volcano and does count with a rich ecodiversity in terms of flora and fauna. The local community origins are in the arrival of British farmers in the late 19th century who gave rise to the local coffee industry by establishing the so-called “Hacienda Aquiares”. The Hacienda, owned by three different but closed families during the last 32 years, covers nowadays 971 hectares, of which 675 are planted with coffee while 381 are

natural protected forest, thereby turning to be the largest coffee farm in Costa Rica up to date.

Coffee has made of Santa Rosa de Aquiares a well known location nationally in view of its high standards and quality²¹. Nowadays, the Hacienda produces on average annually about 1,000 tons of coffee, of which 95 percent is exported to the gourmets markets in North America, Europe and Japan, and 5 percent is sold locally²². The community is in the middle of the Hacienda thereby is not hard to draw that the rise of the community is closely related with the Hacienda and the coffee company. Such a relationship has turned in that a significant share of the 1,487 people living at Santa Rosa de Aquiares does work at the Cafetalera Aquiares -80 percent of the population depends upon the coffee industry during the harvest season- and thereby the influence of the firm reaches economic and cultural aspects. The company has already donated to the community the land for the school, a day-care center and several sports fields and other recreational areas. In addition, years ago they sold their houses to a large share of the local residents by means of a communitarian housing project developed by the company itself: as today, 94 percent of the whole local population are house owners.

In regard to the supply of drinking water, the story deviates from the two previous cases as of the community-self-organizing-and-demanding-local-administration-before-the-Municipality pattern. In this case, it is not hard to figure that Cafetalera Aquiares was responsible for running the local WSS system before local residents self-organized to take over. However, there was a yearning for heading the operation locally among local residents, therefore in 1994 after a period of negotiations, Cafetalera Aquiares decided to

²¹ Cafetalera Aquiares has been certified by the Rainforest Alliance and meets the CAFÉ Practices Standards of Starbucks.

²² <http://www.cafeaquiares.com/cof-eng.htm>

hand the administration to a local water committee gathering local residents under the umbrella of the local Administrative Committee of Rural Water System (CAAR). Years passed and in 1997, in view of the new institutional WSS rural framework promoted by AyA, local residents moved to the new administration scheme proposed, the ASADA, therefore they self-organized this time to fulfill with the responsibilities the new institution demands which were much higher than the previous CAAR obligations. As of today, the local WSS system draws water from a nearby stream with a flow of 17.5 l/s, higher than at the Puente Salas' WSS system, and higher than all except one of the Pejibaye's subsystems.

8.3 BFEP and SQSP

Santa Rosa de Aquiares' approach to BFEP and SQSP does not deviate much from Puente Salas' and Pejibaye's, that is local residents participating of local social organizations, at Santa Rosa de Aquiares the ASADA and the Local Development Association (LDA) heard of the good experience of other communities at both programs, particularly in regard to the promotion of protecting natural resources and securing potable water, thereby they decided to reach AyA's headquarters to inquire about both initiatives. In view of the local interest, WNL professionals came down to Santa Rosa de Aquiares to introduce formally the neighbors to the programs, describing to them their requirements and future impacts. There, local residents learnt about BFEP and the obligation to self-organize to promote locally natural resources protection by setting a six-members Board, each one of them providing hands-on support in a volunteer manner. There is no surprise in noticing that all Board members participate of other local social organizations such as the ASADA or LDA. The novelty comes about in light of local

residents identifying themselves as employees of Cafetalera Aquiares, which should not be a major surprise given the active local role the firm has in economic and social terms.

The path Santa Rosa Aquiares has followed in regard to SQSP has been not an easy one. As the other two case studies, once the local community started working with BFEP, local residents thought of as a natural next step to participate of SQSP. It turned out, local residents realized, that dealing with SQSP whole list of evaluation parameters would help them in reaching the highest score in regard of BFEP water for human consumption evaluation parameter, therefore both programs would complement each other in granting a better sustainable performance to the community of Santa Rosa de Aquiares. However, SQSP implementation was harder than BFEP's. Though in accordance to SQSP guidelines the administration of the program was in the ASADA hands thereby financial support and human resources were already in line to launch the program locally, the state at the time of the local WSS infrastructure turned out to be a great challenge for the local promoters of the program, especially in light of the financial constraints the local ASADA faced then. Therefore, despite the good will of local residents and their high interest in promoting SQSP, their own local dynamics drove them in not reaching a higher performance at SQSP than have been awarded a one-star flag, far behind the six and five-stars Puente Salas and Pejibaye have proudly raised during the last years. Nevertheless, an interesting point should be made: Santa Rosa de Aquiares it is the only case among the three rural communities under study that specifically defines the protection of the local fauna as one of their BFEP target. The effort to eradicate the hunt and capture of local birds is one of the programs' local targets in addition to the common ones of water resources protection, environmental training and the promotion of new

practices of domestic and industrial waste treatment. In the previous cases, the natural resources protection BFEP driver seems to be mostly constrained to botanical and water resources, not including the protection of the local fauna, despite BFEP targets and the ecologically-protecting-driven economic development strategy Costa Rica is currently pursuing.

8.4 Capacities of the Community

The section describes dynamics referring to the two variables, Skills and Leadership, whose combination gives rise to the variable of Capacities of the Community.

8.4.1 Skills

As mentioned previously there is no official information at community level in regard to educational background, therefore I draw upon district data as a proxy to infer about the topic into question. The District of Turrialba presents a population of 32,004 inhabitants of which 7,333 lives in rural areas, as do Santa Rosa de Aquiares local residents. Turrialba's literacy rate reaches 95.17 percent, lower than Puente Salas' but higher than Pejibaye's. Of the whole population over 5 years old -29,488 inhabitants-, 15,233 inhabitants attended primary school, 7,510 secondary school, and 3,456 tertiary education, amounting for 51.66, 25.47, and 11.72 percent of the whole district's population. Those numbers picture a community with almost no difference in regard to the national numbers. However, the comparison with the other two cases under review shows the District of Turrialba's population carrying the greatest education background, if the analysis includes college education. Noticeable is the difference with the District of Pejibaye, with the District of Turrialba outperforming it in regard to secondary and

tertiary education. The reason of the greater Pejibaye's primary education performance goes in line with the fact that as not a significant share of the local population is able to attend secondary education nor to go to college, most of local residents constraint their educational background to primary education. In regard to Puente Salas, the District of San Pedro shows relatively similar performances in regard to each of three categories with a slight difference in favor of San Pedro over Turrialba and of Turrialba over San Pedro when the review comes down to secondary and tertiary education, respectively. The point to notice here is that despite the educational background of the District of Turrialba –where the community of Santa Rosa de Aquiares lies- is greater than the District of Pejibaye's –where the community of Pejibaye lies-, and presents almost no difference in relation to the District of San Pedro's –where the community of Puente Salas lies-, there is no correlation with their performances at BFEP and SQSP. Both Pejibaye and Puente Salas outperforms greatly Santa Rosa de Aquiares in number of BFEP and SQSP stars, therefore there is more than higher local educational background that may be affecting the local sustainable performance.

At Santa Rosa de Aquiares, there is no such an active role for the local school as it was noticed at Puente Salas and Pejibaye. The school does not interact directly with the program by means of a local BFEP school committee as in Puente Salas or does not participate of the BFEP Educational Centers category as in Pejibaye. Therefore, the environmental training that students go through at Puente Salas and Pejibaye is not replicated at Santa Rosa de Aquiares. Even more, in terms of environmental training, the occurrence constraints itself to the promotion of BFEP at the local school whereby local BFEP promoters introduce students to topics related with natural resources protection and

to talks on the same topic given to the Nicaraguan community that comes to Santa Rosa de Aquiares to work at Cafetalera Aquiares. Those types of sessions that follow a regular and periodical schedule at Puente Salas and Pejibaye take place only once and twice a year respectively at Santa Rosa de Aquiares, therefore local students are not as highly exposed to environmental courses as their counterparts in Puente Salas and Pejibaye, with the subsequent effect on the comparison in regard to their environmental knowledge and habits.

8.4.2 Leadership

To constraint the review of leadership dynamics to the ASADA Board ups and downs results in noticing no major changes in the names of its members. As a matter of fact, the current Board has been in office for the last seven years, being reelected 3 times in a row, thereby there is a certain governance stability over time in regard to the body of people responsible for the operation of the local WSS system. The pattern is replicated when expanding the review to other local social organizations; for instance, members of the Board of the local Saving and Credit Cooperative, some of them also sitting at the ASADA Board have been reelected several times during the last years. Santa Rosa de Aquiares is no exception to the bloom of social organizations noticed in previous cases. Though numbers do not reach Pejibaye's 40 organizations, there are 14 of them operating locally in different topics. To those regularly expected promoting economic and social development based on a natural-resources-protection strategy, the such of LDA, ASADA, BFEP, and the Training Center for Aquiares Cleanliness (CELCA), a further set is added grouping organizations responsible for public services or the promotion of recreational and educational activities, the types of the Health Committee, the Sports Committee, the

Police Communitarian Group, or the Saving and Credit Cooperative. The novelty comes about from organizations established in relation to locally based initiatives such as the restoration of the local church which responds to a long-standing wish of local residents. Participation at those organizations replicates patterns noticed in the two previous case studies, that likely those sitting on the board of one then participate on other organization that may be not even related to former one in regard to its range and focus. A good example is drawn by reviewing the composition of the BFEP local committee, which by the way expands its responsibilities to the local operation of SQSP, as 5 of the members of the Board complemented their work at BFEP with them sitting on the ASADA Board. Just the ASADA Treasurer sits on the ASADA, BFEP local committee, and the Saving and Credit Cooperative Boards.

A further point also noticed at Puente Salas and Pejibaye is the role of professors at the local schools. At Puente Salas, the enthusiasm of a local professor was the driver in getting students motivated to learn about natural resources protections and to participate of BFEP local activities. Even more, to channel their participation the school established a BFEP internal committee responsible for organizing all activities related with the program. At Pejibaye, the leadership was that great that the school not only participates of BFEP in regard to the community category, but applies itself to BFEP Educational Center obtaining the maximum of three-stars. Such performance concurs with a highly active professor leading the school participation at BFEP and encouraging students to learn about new environment-protective practices and habits. Those dynamics do not occur at Santa Rosa de Aquiares. Though students have a chance to learn about BFEP and SQSP by means of the presentations promoters give at the school, there is no such

thing as a permanent BFEP organization, and one does not find the type of enthusiastic and environment-evangelist professor found at Puente Salas and Pejibaye.

There is another novel factor that one comes across when reviewing leadership dynamics at Santa Rosa de Aquiares: the role of Cafetalera Aquiares. As mentioned above, the company has had a pivotal role for the economic development of the community either through employing local residents or through the different donations it has made to the community. In this regard, the firm has played the “Big Brother” part that is when in need local residents do have the option to call out to the firm expecting her to solve their problems. To have a big company building new recreational areas, providing housing solutions, and even organizing social campaigns, in addition of her employing role, creates a different dynamic not recorded in the previous cases where local residents in their struggle for a better well being do not count with the type of help Cafetalera Aquiares is willing to provide to Santa Rosa de Aquiares’ local residents. In that sense, the question of whether the rise of leaders is postponed in view of the alternative to draw upon the company to solve local wants is up. As the company is always going to be there to rescue local residents, those do not feel hardly prompted to take up new responsibilities in leading the community in their quest for a better quality of life.

8.5 Participation of the Community

This section describes the dynamics regarding the three variables – Administration, Interaction, and Sense of Ownership- that combine to give rise to the supra-variable Participation of the Community that refers to patterns of local residents’ participation at their local WSS system in regard to administration position, their participation at BFEP activities, and their perceptions as owners of their system.

8.5.1 Administration

Santa Rosa de Aquiares is non-exception to the governance scheme ruling the ASADAS at Puente Salas and Pejibaye. That is, the General Assembly is the highest body governing the ASADA and is responsible for the election of the Board and for voting upon major initiatives proposed by the Board. The Assemblies are held every year, with Board elections occurring every two years; the mid-term Assemblies deal mostly with the approval of the in-office Board's report and other WSS issues of relevance to the community. As in both previous cases, not all users are entitled to be part of the General Assembly; users are mandated to register as associates to participate of and vote at the General Assembly. The procedure is simple: users go the ASADA headquarters, they fill out a form and their application is reviewed and approved by the ASADA Board. However, though the task is not a hard one, the number of associates is not as high as one could have imagined. Of the 400 users, only 80 are registered as associates and out of those, in words of a member of the ASADA Board, 40 on average attend the General Assembly. Either way, that the share of associates attending the General Assembly is greater than at Puente Salas and Pejibaye does not go in line with a greater sustainability performance at Santa Rosa de Aquiares; that is to have local residents attending in greater number the General Assembly at Santa Rosa de Aquiares than in Puente Salas and Pejibaye does not result in raising blue and white flags carrying a greater number of stars.

Nevertheless, that Santa Rosa de Aquiares is the ASADA with the highest attendance rates at its General Assembly does not diminish that participation is still low. In order to infer about the reasons of such a low participation, the ASADA Board applied a survey to local residents making the central question of why not becoming an associate.

The response was simple. Local residents do not feel encouraged to complete the whole procedure because they do not see major benefits for them in becoming an associate. There are more obligations than benefits coming with the responsibility of being an associate, obligations that the majority of local residents feels as a burden they are not willing to carry. In the meantime, others are called upon to take up the job of working on the operation of the local WSS system, which, in their opinion, will wind up operating well whether or not they become associates.

The ASADA Board is the second WSS local body of decision-making. The seven members serving on the Board are elected at the General Assembly for a two-years period, and are all local residents. They run the operation of the WSS local system thereby are responsible for hiring the ASADA staff including the administrator and the plumber -both also local residents- and for the maintenance of the system. The Board includes the President, Vice President, Secretary, Treasurer, Attorney and two Trustees, and meets twice a month every two weeks, though they do it often when required. Members of the Board have played a noticeable role in learning about BFEP and SQSP and approaching WNL to bring both programs to the community. The pattern of 100-percent-of-the-participants-are-local-residents keeps going with BFEP locally. As mentioned above, at Santa Rosa de Aquiares, a unique seven-members committee, meeting on average once a month, locally runs BFEP and SQSP, a novelty in regard to the previous case studies, where the local operator, that is the ASADA, directly manages SQSP. The committee is responsible for appointing a coordinator who in this case is a local resident sitting also on the ASADA Board and working at Cafetalera Aquiares. Overall, all holders of WSS administration positions are local residents; however, the

interest of certain local residents in contributing to the community by holding such positions contrasts with the low, though higher than at Puente Salas and Pejibaye, participation rate at the General Assembly, a pattern crossing the three case studies reviewed.

8.5.2 Interaction

The dynamics in regard to interaction refers to the setting up of both BFEP and SQSP locally and to the participation of regular local residents at both programs though not including holding administration positions nor attending decision-making venues. The advent of BFEP followed what seems to be a regular path with local residents yearning to learn more about the program after witnessing or hearing about BFEP benefits for the well being of rural communities. At Santa Rosa de Aquiares, local residents sitting on the LDA Board knew about BFEP success in other communities with similar profiles than their own, that is medium size rural settlements. To infer more about the program they reach WNL officials in charge of promoting the program requiring more information on the mandatory aspects, costs and benefits of BFEP. After several visits to the community by those WNL officials, local residents self-convinced of the positive effects of implementing locally BFEP, therefore started off its implementation by establishing their own BFEP local committee. At this stage they still received support from the WNL officials, particularly in regard to guidelines regarding the application process and local self-organization. Later on, the discussion turned to whether to implement locally SQSP, particularly in regard to BFEP first evaluation parameter of water for human consumption, whose target seemed to be directly linked with the whole SQSP assessment procedure. In regard to SQSP, that local residents are prompted to

participate of the program after witnessing the success of other communities was a significant driver. A local delegation was part of a trip organized by WNL throughout the country to present some successful SQSP cases; those who participate of the initiative still remembers the effect that had on them to visit the SQSP-six-stars community of San Marcos de Tarrasú.

The review of interaction dynamics is subject to the merged administration both programs have locally, that is BFEP and SQSP deviate from the two previous experiences in that the same local committee runs both. Therefore, those responsible for their local administration often cite initiatives related to one of the program as been part of the other one. Examples of participation of local residents at BFEP and SQSP regard initiatives of varying scope and scale. For instance, unlike at the previous two case studies, garbage collection is not run locally by the Municipality, local residents have self-organized at CELCA to provide locally twice a week a garbage collecting service for which they charge 1,000 colons monthly to each household. In addition, both CELCA and the ASADA provide the community with 24 hours of work each week of a member of their staff to contribute with garbage collection.

As mentioned above, the active role of the local schools noticed at the two other case studies, with even at Pejibaye the school been awarded with the maximum number of stars at BFEP Education Center category, is not mirrored at Santa Rosa de Aquiares. However, there are some initiatives that invite local students to participate of BFEP/SQSP. At first, the BFEP/SQSP local committee convenes local students at a series of talks given by members of the committee in regard to natural resources protection and the promotion of both programs. However, those presentations do not occur as regularly

as at Puente Salas and Pejibaye, as shown by the BFEP report, which describes only 4 talks during 2009 concentrated on the months of May and December. In addition to those lectures, local residents have at their disposal and participate of a further series of presentations given by AyA's officials focused on issues such as accountancy, secretary and economics, which are targeted to provide knowledge and skills that contribute to a better local administration of their WSS local system.

Another aspect that comes up as differing from the dynamics ruling the two previous cases is the role of Cafetalera Aquiares, the local coffee company. Cafetalera Aquiares does participate of BFEP initiatives by collaborating in the cleaning and protection of rivers, streams and natural parks, by working along with local schools' students, particularly in regard to the protection of the Jesús María River and the Cecilia stream. The company's work has resulted in raising a protection area of 42 hectares surrounding rivers and streams, areas that have been mapped and do count with signage that contributes in avoiding possible damage. Those protecting initiatives resulted from reforestation journeys of which local students are the most enthusiastic participants and that in one year, 2009, recorded 5,611 trees planted just on coffee areas. To provide regularly trees to those engaged in such journeys the ASADA does have a greenhouse with a stock of 825 trees of 9 different species.

8.5.3 Sense of Ownership

Local residents refer to the ASADA as "their" ASADA which at first may lead us to think that the sense of ownership among them over their local WSS system is high. However, further points should be made before making such statement. At the roots of the origin of the ASADA, the demand for self-administration was not as strong as in the

two previous cases. To have local residents rallying before the Municipality or negotiating with a public agency the system's administration was not the pattern at Santa Rosa de Aquiares. As mentioned above, the former operator was not a public body, but Cafetalera Aquiares, the company that have employed and provided local residents with various services. Therefore, the local residents came to self-organize much later, in the mid-1990s, than settlers at Puente Salas and Pejibaye, giving rise to the question of whether there initial high sense of ownership as the expression "their ASADA" is actually as strong as for Puente Salas' and Pejibaye's residents.

A novel aspect in regard to Santa Rosa de Aquiares is the presence of Nicaraguan immigrants. The economic opportunities the coffee industry present to Nicaraguan makes of migrating a game changing options for most of them. Their presence comes about as the intertwining of two different cultures with Nicaraguan facing the challenge of adapting to the dynamics of a new home, and Costa Rican making a further effort to contribute to the adaption of those immigrants to their local reality. On this last point, it should be noticed that in words of a member of the ASADA Board, Nicaraguan's environmental practices do not match Costa Rican's nor going in line with BFEP premises; the point is made in regard to their garbage collection habits as regularly they find extensive amounts of garbage around their living areas. Therefore, Costa Rican local residents, particularly those participating at BFEP, have organized several initiatives oriented to give training and increasing knowledge of Nicaraguan in regard to natural protection issues. Those lectures are locked to Nicaraguan audiences and are extended into reforestation journeys in which Nicaraguan children learn about planting trees and taking care of them. Those BFEP local officials giving those lectures or working on the

organization of such activities pursue to increase the knowledge of Nicaraguan immigrants; however, as a side effect, a greater identification of Nicaraguan immigrants with the community of Santa Rosa de Aquiares comes about.

The effect on local students of participating at BFEP is constrained therefore it may have not reached thus far its highest impact. With the local school not sitting on the BFEP local committee nor participating of the BFEP Educational Center category, the number of activities at the disposal of local students is low. They attend BFEP presentations, but, those are not scheduled in high periodicity, and BFEP social initiatives the type of the ones noticed in the previous case studies -Environmental Festival, Environmental Parade, or contest in regard to some natural-resources-oriented topic- do not occur in great numbers. To have those activities in a higher number would prompt young students to identify themselves more with their own community, identification that is noticed by means of their garbage collecting or water use new habits which they rapidly teach to their friends and family members.

Another branch to review is the operation of the local fee collection system. Before BFEP and even before the system was run by local residents, Cafetalera Aquiares used to charge a monthly flat rate of 300 colons to each user. That is a considerably low fee compared to the current fixed cost nowadays ARESEP requires to charge in each bill. Therefore, there should be no surprise that despite the efforts of the local administration, on average 20 percent of local residents are in default of payment. The system works in a similar manner than the two previous cases that is the ASADA set a date during the month for local residents to pay their bills at the ASADA headquarters; in case they do not, their service is cut off by the plumber. To explain that 20 percent of default in

payment the economic local situation should be taken into account. In words of a member of the ASADA Board, most of Santa Rosa de Aquiares local residents, including him, live on the legal minimum wage, that is 150,000 colons, therefore to pay their average bill of 2,500 is non easy task for a regular family in light of their financial obligations and limited income.

8.6 PSOs and KIOs

The interaction with either Problem Solving Organizations (PSOs) or Knowledge and Information Organizations (KIOs) follows different patterns at Santa Rosa de Aquiares. Of course, as BFEP and SQSP are AyA-promoted programs, the local community does interact regularly with the public agency's officials. The local implementation of both programs brought along WNL professionals to town to introduce local residents to both programs and enticed a regular interaction by which the community learned about the requirements they would have to meet in order to be awarded with a blue or a white flag. Thus, the roles of diffusing and supervising agents of WNL officials already noticed at Puente Salas and Pejibaye are replicated at Santa Rosa de Aquiares. The deviation comes about with the review of the interaction with others organizations than AyA. The first complaint that one hears at Santa Rosa de Aquiares is the distant relation the community has with the Municipality of Turrialba. In words of local residents, there is no local presence of the Municipality; they seldom have Municipality's officials visiting them to take care of local problems that initially should require their presence. Even during election times, days during which they would expect to see them more regularly on the field, they still do not show up. Such absence has prompted local residents to take over certain responsibilities such as the management of

garbage collection, a regular municipal duty that at Santa Rosa de Aquiares is operated by community members gathered under CELCA.

When the review goes down to the interaction with KIOs, the response is not that different. Local residents are not able to identify initiatives whereby they interact locally with universities or knowledge organizations of different types in promoting new WSS innovations. Here there is a deviation from the two previous cases as at both Puente Salas and Pejibaye, local residents do participate of a set of activities jointly organized by the local organizations with KIOs. Those cases refer mostly to training sessions given locally in regard to natural-resources-protection issues the such as recycling, water use, or compost production, or even to addressing local challenges by means of new approaches where KIOs support and knowledge turns out to be crucial. Though the interaction with KIOs is low and that with PSOs limited to AyA, there is a further organization that local residents constantly cite as the one they mostly interacted when organizing or participating of BFEP or SQSP initiatives. Cafetalera Aquiares, as mentioned above, is actively involved at BFEP and at the local promotion natural resources protection in general. Employees of Cafetalera Aquiares sit at the board of local social organizations – the ASADA and BFEP/SQSP local committee are two examples- and the company has organized along with BFEP reforestation journeys and local rivers and streams cleaning campaigns.

8.7 Governance

Governance does not differ much from the previous schemes described in regard to institutional dynamics at Puente Salas and Pejibaye. That is, WSS at Santa Rosa de Aquiares is ruled by a three-level governing scheme covering national and local

institutions. As mentioned in section 6.7 and 7.7, nationally, the legal framework addresses administration, sanitation and environmental, natural resources protection and conservation issues. Laws included in such a set have evolved over the years with some of them been recently enacted and others in place for longer periods of time. The enforcement of those laws is a responsibility carried by various public bodies ranging from those participating of the operation of WSS systems to those in charge of regulation and management of water resources nationally. The second level corresponds to those institutional dynamics related with the operation of ASADAS, BFEP and SQSP, therefore the review covers all types of norms and rules included in Decree-Laws, Internal Proceedings and Manuals that have established the guidelines driving nationally the operation of the three governing bodies. In regard to the third level, the one dealing with local operation of BFEP and SQSP, the novelty comes about as BFEP and SQSP are managed by a unique local committee, therefore the scheme with BFEP run by a local autonomous body and SQSP by the local ASADA is not replicated at Santa Rosa de Aquiares and both programs respond to the same governing organization. With the one-body-governing approach, voting for members of the committee is out of the picture and volunteering becomes an even stronger driver in convening local residents to participate of the administration of both programs.

8.8 Learning

The learning dynamics at Santa Rosa de Aquiares follow a particular path in response to the local context ruling the local system. The analysis must take into account that the local school is not as active at BFEP as in Puente Salas and Pejibaye and that in the two previous cases there was not a local actor with a role as predominant as

Cafetalera Aquiares in Santa Rosa de Aquiares. In general terms, the community of Santa Rosa de Aquiares carries nowadays a new sense of responsibility over the environment and local residents do feel obliged to keep their community “clean”. In that sense, they have organized various initiatives that have demanded new competences and knowledge and in turn have resulted in new habits and practices. Those dynamics are exemplified by the establishment of the Training Center for Aquiares Cleanliness (CELCA), an organization that emerged as though the Municipality of Turrialba was unable to take over garbage collection thereby local residents came up with a novel manner to address the challenge -CELCA-, that resulted in greater garbage collecting and recycling learning.

In addition, local residents have had the opportunity to attend various training sessions either organized by BFEP or by AyA. Those organized by BFEP deal mainly with issues regarding the promotion of the program and natural resources protections. Sessions have been open to the community, and varying groups have attended: adults, students and Nicaraguan immigrants, for whom special and locked-in presentations have been organized to motivate them not only to learn about new environmental practices but also to ignite on them a greater sense of identification with Santa Rosa de Aquiares. Therefore, all those participating of such training have had a chance to learn about natural resources protection, water use, and garbage collection. However, the regularity of those sessions is not as high as one would have expected. In 2009, the BFEP local committee reported to WNL only 4 environmental training sessions, two of them given to Nicaraguan-only audience.

Nevertheless, the low periodicity of those BFEP sessions contrasts with the monthly training sessions organized this time by AyA. Those courses are part of the regular training that AyA gives to all ASADAS nationally, therefore they are open to the community and address a wide array of topics all contributing to a better local management and higher sustainability. That is how local residents have the opportunity to attend training on natural resources protection, accountancy, economics and management, in addition to more technical issues that may be directly related with BFEP requirements. However, attendance is not as high as expected. Nowadays, those participating the most are the members of local organizations boards that do have a greater interest in acquiring new competences helpful at their current job. Besides, as mentioned above, that local residents sit at more than one board diminishes the odds of a greater attendance, as those with the greatest interest in contributing to the local well-being represents a reduced group of local residents.

The role of Cafetalera Aquiares has been significant not only in regard to BFEP but also when referring to local economic development. As mentioned above, the company has been responsible for housing and infrastructure initiatives that have directly benefited local residents. The company's participation at BFEP has given risen to learning in regard to natural resources protection and garbage collection by means of the organization of several open talks and the company's participation at CELCA, respectively. As mentioned above, novelty in regard to learning at Santa Rosa de Aquiares comes about from both Cafetalera Aquiares' active participation at BFEP and the lower engagement of the local school in BFEP and SQSP initiatives. In that sense, students do not have the dynamic schedule that their fellows do have at Puente Salas and

Pejibaye with a long list of BFEP-related initiatives to be part of. At Santa Rosa de Aquiares, students attend presentations about BFEP and natural resources protection, and also participate of reforestation journeys, but do not go through constant environmental training at the school or enthusiastically march at the Environmental Parade or constantly visit the local WSS facilities to learn about their operation and maintenance.

Though the learning performance seems to be facing varying hurdles to overcome, there is an interesting situation to highlight: the local plumber. A local resident who has spent his whole life at Santa Rosa de Aquiares, before taking over the plumber office, he used to sit at the ASADA Board holding the attorney position. Then, once he left the Board he was hired as the new plumber though his knowledge about the job was quit limited as he did not went through any previous training. Therefore, he started learning about different WSS matters that allowed him to respond to his new obligations and thus attended all AyA's training sessions available on WSS operation and maintenance. It turns out that nowadays he is an expert on the topic and has no major problems in complying with his responsibilities that cover taking care of reparations to the pipeline, washing and cleaning the storage tanks, cutting off the service to local residents in default of payment, and operating the water quality control system. He is a good example of how learning-on-the-job and learning-by-doing dynamics may increase new competences and knowledge on individuals.

8.9 Collective Choice

As in the two previous cases, IAD contributes to describe how institutional setting affected local residents in making their decision to participate of BFEP and SQSP. The Water Innovative Event (WIE) fills in as the *arena situation*, whereas *actors'*

identification results from the process that led to the local implementation of BFEP and SQSP. Such a process started off in view of the positive comments local residents heard from other communities already participating of BFEP, which prompted them to accept an invitation from AyA to be part of a BFEP national trip where they witnessed on the field successful experiences. After the trip, a discussion started off locally on whether BFEP would contribute effectively in protecting the environmental and in building a new culture of natural resources protection among local residents. That discussion was held mainly at the ASADA Board and once a decision was made, local residents approached WNL officials to require more information about the program and to invite them to visit Santa Rosa de Aquiares to introduce the whole community to the program by means of open talks describing BFEP guidelines. With the community self-convinced of the benefits of the program, local residents set out to locally implement BFEP with the support and guide of WNL. Their visit was helpful in establishing the BFEP local committee that did not limited its scope to BFEP, but expanded it by including the SQSP administration as part of its responsibilities. Therefore, WNL staff, members of the ASADA Board and staff, and local residents that participated of the discussion by attending presentations and open meetings were the ones that drove the decision of turning BFEP into a local initiative. However, it should be noticed that as in the previous cases, though external actors participated of the whole process, exclusively local actors made the final decision.

The review of the three IAD clusters of variables deviate from the two previous case studies, that is Santa Rosa de Aquiares is also a rural community, this time located in the Province of Cartago, though with a low sustainability performance. When the analysis

comes down to the attributes of the community, the gaps widen as albeit the educational performance is similar than the highly-comparatively-educated community of Puente Salas, the similarity does not encompass the role of the local school in relation to capacity building nor leadership as the service-provider role the local coffee company has had may have postponed the rise of local leaders capable of convening the local residents to pursue a common goal.

The review of the rules-in-use in conjunction with IAD three- contributes to respond the questions that the three types of problems cited by Ostrom -supplying new institutions, making credible commitment, and mutual monitoring- pose to groups self-organizing to obtain a collective benefit. The analysis does not deviate much from the two previous cases in regard to the constitutional and collective choice level. That is how the constitutional right to a healthy and ecologically balanced environment and the recently proposed amendment to make of water a good of public domain do equally drive decision-making at Santa Rosa de Aquiares. The rationale also apply to the legal framework described in section 6.8 that is the set of standards, norms and institutions established in relation to natural resources protection. Madrigal, Alpízar and Schlüter (2010) review of the collective choice level goes with the same pattern thus the questions on the community self organization and the sovereign supra-body responsible for decision-making; the proceedings ruling the ASADA Board operation, including the election and removal of its members, the regularity of its meetings and the ruling decision-making. Responses are similar. With the community self-organized into the ASADA, the supra-body's role is played by the General Assembly. The members of the ASADA Board are elected at the General Assembly for two years period and removed

with the agreement of the majority of those attending the General Assembly; the Board meets twice a month and if needed a further meeting is included in the schedule; and the decisions are made by the majority. BFEP and SQSP were discussed at the ASADA Board, and their requirements and benefits shared with local residents; however, the final decision to apply to the program was constrained to the members of the ASADA Board.

The operational level, as mentioned in the previous cases, goes in line with Madrigal, Alpízar and Schlüter (2010) proposal that is three factors are considered in the analysis: tariffs; infrastructure, maintenance and protection; and water treatment. For tariffs, questions regard whether water consumption is monitored by means of a metering system; whether there is a place, day and mode of payment in place; and whether those in default of payment are subject to a reconnection cost. At Santa Rosa de Aquiares, responses deviate from Puente Salas and Pejibaye. There is no local metering system thereby bill calculations are done by estimating the general consumption of the whole community with a flat rate charged to each household. The reason of such situation comes with no surprise as the ASADA declares nowadays to not have the funding to implement such a system. In addition that there is no mechanism in place to determine and differentiate single consumption, there is no fixed date to pay the water bill, that is, local residents are free to come to the ASADA headquarters any day of the month to pay their bills, though if they do not, even after the three further days extension, and their service is cut off, they are obliged to pay a 2,000 colons reconnection cost. For infrastructure, maintenance and protection, rules governing facilities maintenance and repairing and the protection of natural areas near intake points are required. At Santa Rosa de Aquiares storage tanks go through disinfection every three months, and facilities

are constantly supervised thereby if repairing is needed the local plumber is in place rapidly. In regard to the protection of water sources, reforestation journeys organized locally by BFEP along with Cafetalera Aquiares added up to the demarcation, mapping and signage of protecting areas established by the ASADA, thereby putting away likely threats to natural resources. For water treatment, the inquiry goes down to the monitoring of water quality and the periodical washing of water tanks. At Santa Rosa de Aquiares, both activities respond to local rules established by the ASADA. The water quality monitoring is a responsibility shared between the local plumber who periodically draws upon a handheld device to control for chlorine content in the WSS system and WNL that, in line with its obligations, controls for water quality 4 times per year. In addition, storage tanks are washed constantly at least once a month.

As in the two previous cases, the question here is how rules in place affected local residents in confronting their decision to participate of BFEP and SQSP. The answer goes as follows. At first, in view of the constitutional right to a healthy and ecologically balanced environment, citizens of Costa Rica are entitled to set out in the quest for alternatives that helped them in reaching such target. The constitutional right is thereby brought down to the field by a legal framework that establishes laws in regard to the rights and duties citizens of Costa Rica have upon natural resources protection and public organizations responsible for the supervision of the fulfillment of those norms. Second, in their path to greater sustainability, local residents deem BFEP and SQSP as feasible and of high benefit alternatives. The programs result from institutional rules that follow down the constitutional right to a healthy and ecologically balanced environment and include all decree laws, internal proceedings, and manuals that both programs' operation

involved. Third, in making their choice, local residents weigh in their pre-BFEP-SQSP situation that is where they were standing in regard to local sustainability before the programs start to operate locally. That is how operational rules come into the picture. With no BFEP nor SQSP, local residents at Santa Rosa de Aquiares did not have major information about alternatives helping them in their quest for greater sustainability and their local WSS rules at the time resulted in a poorer performance in comparison where the community stands today. At that time, in addition of not having a metering system, there was no clearly established payment system, with no punishment if local residents did not pay their bill, and when someone fell in default of payment, the operator did not cut off the service, thereby there was not such thing as a reconnection cost in place. The maintenance of facilities did not follow a regular schedule and did mainly answer to very specific situations that could result in major damage leading to a general cut of the service. On the other hand, before the advent of BFEP and SQSP, the control of water quality worked on a biannual base that is every two years WNL professionals visited Santa Rosa de Aquiares, took their samples and did the analyses at their laboratory at San José. Therefore, overall, IAD contributes in identifying the drawbacks resulting from the pre-BFEP-SQSP operational ruling of the system, plus the constitutional right for a healthy environment enacted by means of a legal framework drove local residents into their quest for new options that allow them to reach their goal of higher local sustainability thus a better quality of life.

IAD is also fruitful to figure out how the community handled the problems of supplying new institutions, making credible commitments, and mutual monitoring. There are some differences with the two previous cases. The community of Santa Rosa de

Aquiaries has grown up in hand with the support of Cafetalera Aquiaries -the so-called “Big Brother” of the story- therefore self-organizing has responded to a slower pace than at the other two communities. Local residents thought for a long period of time that a locally-run WSS system was not required as the one provided by the company met their demand and thereby an effort to rise a new local administration was wasteful. That attitude incubated a weaker sense of community among local residents thus they did not feel prompted to follow the highly active and participative pattern noticed at Puente Salas and Pejibaye. The effect of that lesser social capital resulted over time on local residents carrying weaker commitments to the social organizations the community established, therefore the obligation local residents have to play by the rules was not as strong as in the two previous cases. Confirmation of such statement comes with the comparison of the default in payment rate, being Santa Rosa de Aquiaries’ the highest among the three communities. No metering system is in place and to pay their bills local residents have a pretty flexible schedule. Overall, the weaker sense of community and mutual monitoring system resulted both in local residents not having a credible commitment as high as their fellow local residents at Puente Salas and Pejibaye do have, so that the local ruling did not achieve a sustainability performance as great as the other two communities in the sample.

8.10 Summary

Santa Rosa de Aquiaries responds to a particular pattern where the role of the local coffee company, Cafetalera Aquiaries, as provider of varying services for local residents has to be taken into account when reviewing the local dynamics in relation to BFEP and SQSP. The company by providing those services has come to play the “Big Brother” role

thereby postponing the decision of local residents to take over a more pro-active role. In addition, the lower sustainability performance concurs with the local school not being active at BFEP and SQSP, thereby students are kept from participating of social initiatives organized locally by both programs at the same pace or with the same regularity than at Puente Salas and Pejibaye, thus constraining local learning, as students at the other two case studies have turned out to be noticeable diffusion and training agents.

CHAPTER 9 CROSS CASE STUDY COMPARISON

9.1 Introduction

The chapter presents the cross case study comparison by reviewing the dynamics referring to each variable of the logic model presented in section 1.4.1 either independent ones, participation and capacity of the community, or dependent ones, sustainability and learning, and compares patterns noticed for each community in the sample. In addition, the role of institutions, national and local, is included as part of the analysis, that is the test considers whether having rules, norms, and organizations in place has contributed in increasing either sustainability or learning at local level. The chapter goes as follows: first, the commonalities and differences in regard to the role of participation and the three variables that combine into it, that is administration, interaction, and sense of ownership, are presented; second, the review is mirrored in terms of the capacity of the community, and the variables of skills and leadership; third, the comparison gets down to the differences rising from national and local institutional dynamics; fourth, in attention to the first set of hypotheses, the effect of participation and capacity of the community into local sustainability is analyzed; and fifth, the same display is presented this time in regard to local learning and the second set of hypotheses.

9.2 Participation of the Community

The variable is defined as a combination of three variables; administration, referring to the participation of local residents as holders of administration positions and in local decision-making; interaction, to their participation this time at BFEP or SQSP initiatives not dealing with holding administration positions nor decision-making; and

sense of ownership, responding the question of the identification local residents upon their own local WSS system. The dynamics differ when the analysis crosses the three case studies.

In regard to *Administration*, the first observation made is that administration position either at the local ASADA or BFEP are held exclusively by local residents, therefore in all three cases there is no room to make the point that a low interest among local residents in taking up heading position at the local WSS system could have resulted in a power vacuum that could have led the community to a stagnant WSS performance. There is a group of local residents prompted to fill those positions in light of their yearning to contribute to their community by putting their time at the disposal of the social target of increasing local sustainability or in a broader sense to improve the living conditions of their neighbors. In all cases, there is a common pattern in regard to those holding administration positions, several of them participate of other local organizations; in that vein, there are some cases to be highlighted as the President of the ASADA Board at Pejibaye who sits on the boards of five different organizations, or the Administrator of ASADA at Santa Rosa de Aquiares who in addition to his administration position at the ASADA is a Cafetalera Aquiares' employee. A further interesting point to make is that at the three cases, the BFEP local coordinator has a role at the local ASADA; that is how at Puente Salas, the former President of the ASADA Board did fill some time as BFEP local coordinator; at Pejibaye, he shares his time at BFEP with his responsibilities as Administrator of the ASADA; and at Santa Rosa de Aquiares, the BFEP local coordinator sits on the ASADA Board, and, as mentioned above, is also a Cafetalera Aquiares' employee.

Nevertheless, the enthusiasm of those local residents filling administration positions is not mirrored when reviewing the numbers in regard to decision-making. The General Assembly, the highest local governing body, is a good parameter to assess local residents' participation in the three communities under study. To attend to the General Assembly, local residents have to become "associates", a category that entitles them to participate and vote at the General Assembly. Though the application process is simple in all three communities, numbers are low in regard to the whole users population: at Puente Salas, of the 1,006 users, 92 have turned into associates; at Pejibaye, of the 750 users, in words of the Administrator of the ASADA, 60 percent that is 450 local residents carry the associate category; and at Santa Rosa de Aquiares, the share is reduced to 20 percent, that is 80 out of the 400 users are associates. In addition, the attendance of those associates to the General Assembly is not as high as expected: on average 31 local residents have attended the General Assembly at Puente Salas during the last 12 years; 80 local residents have done it at Pejibaye during the last 7 years; and at Santa Rosa de Aquiares, estimates of ASADA members point to an average attendance of 40 local residents. In light of those numbers, one may argue that there is no correlation noticed between the performance of each community at BFEP and SQSP in regard to the participation of local residents at the General Assembly, as both the highest scoring communities, Puente Salas and Pejibaye, and the lowest scoring community, Santa Rosa de Aquiares, present all low participation and attendance rates. Therefore the motivation that those local residents holding administration positions is not replicated when expanding the analysis to the participation of the whole community in the decision-making process. The question rises if in order to establish and succeed at BFEP locally what is needed the most in regard to

participation is not a high participation of regular local residents but a reduced group of highly motivated local residents capable of leading the program.

In terms of *Interaction*, dynamics differ from one case to another. At those communities scoring higher at BFEP and SQSP, that is Puente Salas and Pejibaye, one notices a greater participation of local residents in initiatives resulting from both programs' operation that aim to promote natural resources protection. For instance, at Puente Salas, BFEP is enthusiastic about inviting local residents to participate of a new "culture of water", culture that brings along locally new habits and practices among local residents. In this regard, the local committee organizes several social activities the such as the Water Fair or the Annual Water Parade whereby local residents not only show themselves as highly concerned about water use, but also social and interactively acquire new knowledge on the topic. At Pejibaye, there is no major difference, with social activities organized in high number and local residents enthusiastically participating of the Earth Day or the Environmental Festival or reforestation journeys. In regard to Santa Rosa de Aquiares, at first, one may expect great similarities in regard to interaction patterns. However, there are some differences. An in-depth review shows that Santa Rosa de Aquiares does not match the level of interaction of Puente Salas and Pejibaye as noticed by the lower number of activities, particularly in regard to training, reported by the community. To find the cause of that divergence, one should question the role of the local school at each case. At Puente Salas, the school is highly active at BFEP, and students are the most motivated to participate of BFEP activities, teach about environmental topics to either their classmates or their own families. That enthusiasm results from the establishment of a BFEP committee at the school, which is closely

related to the BFEP local committee, and is headed by a BFEP driving leader, a local professor. At Pejibaye, there is no much difference, and the local school's participation is even greater as the school not only participate of the BFEP-CC local, but it has applied itself to the BFEP educational center category and already been awarded a three-stars blue flag. Again, there is a strong leader, and again, it is the local professor, who this time, do also sit at the board BFEP local committee. At Santa Rosa de Aquiares, there is no such commitment at school level in regard to BFEP. Though students participate of the training sessions that BFEP organizes locally –in 2009 four were reported-, and respond to the invitation the program along with Cafetalera Aquiares have made them to attend reforestation journeys, they are not as active as their counterparts at Puente Salas and Pejibaye given that locally they do not have at their disposal BFEP activities to participate in numbers as high as at Puente Salas and Pejibaye.

Nevertheless, to get a more historical point of view in regard to interaction, one may go back in time to inquire about reasons and timing of the decisions by the local communities under study to self-organize and take over their own WSS systems. Those types of decisions resulted from great interaction between local residents interested in deviating from the path of conformism and taking onto their own hand the administration of their WSS system. At Puente Salas and Pejibaye the decision was made more than thirty-five years ago, and local residents stood before public organizations to demand for their local WSS system's administration to be passed to them. In both cases, the communities were successful in achieving their target of self-management, and their success responded to a constant effort driven by the will, motivation, organization, interaction and volunteering of a group of local residents. At Santa Rosa de Aquiares, a

similar process took more time to occur, with local residents waiting until the mid-1990s to get active in raising a demand for self-management. In this case, the role of Cafetalera Aquiares as the local WSS operator have an effect of getting local residents not as driven as their counterparts at Puente Salas and Pejibaye in demanding local self-management. Therefore, much before BFEP and SQSP were locally implemented, there were differences in the interaction pattern to take notice of, as Puente Salas and Pejibaye were much more active than Santa Rosa de Aquiares in making self-management real locally, a fact that demanded great interaction between local residents and between them and public agencies.

The closing of the comparative analysis of participation dynamics comes with those ones referring to *Sense of Ownership*. In this regard, the review of the context that led to the creation and establishment of the locally-run WSS systems can also be drawn upon to shed light on the differences between the three communities under study this time in relation to their identification with their own community. That sense of identification has affected in turn the sense of pride that local residents carry in regard to their community, thereby their sense of ownership over social and communitarian assets, being one of them their local WSS system. Therefore, that at Puente Salas local residents, or the so-called “pioneers”, stood before Municipal authorities and called out to AyA to get involved in the negotiations that resulted in the administration of the local system handed to them, or that at Pejibaye local residents were brave and bold enough to rally before the Municipality headquarters in demand for the self-management of their WSS system, showed not only determination but was also the seed of a strong sense of pride, thereby of subsequent ownership, over their WSS systems. In addition, both systems, particularly

at Puente Salas, needed the work of local residents to ameliorate their facilities and to meet the needs of the whole community, thus a group of community members did the job of not only upgrading and maintaining installations but also of even going up in the hills in their quest for new water sources. That sort of initiatives contributed to build up a greater sense of ownership over their WSS system, greater than at Santa Rosa de Aquiares, where local residents were used, before the establishment of the local Water Committee, later ASADA, to having Cafetalera Aquiares in charge of their local WSS system and therefore its operation and maintenance were not a high priority for them.

It is no easy task to get numbers affording a tangible comparison of sense of ownership between the three cases. However, the default of payment rate and the operation of the fee collection system at each community contribute in getting closer to the target. In regard to the default of payment, the lower rates at Puente Salas and Pejibaye, with the rate close to null, contrast with the 20 percent rate reported at Santa Rosa de Aquiares. One may argue that the economic situation may be responsible for such difference, but that is not the case, as household incomes at both Pejibaye and Santa Rosa de Aquiares have gone serious constraints during the period under review in light of the economic crises the agriculture sector went through at the time. Therefore, the question of whether a more flexible fee collection system may have resulted in a lower default rate. Here the comparison comes down to Puente Salas and Santa Rosa de Aquiares. Two points are worth to highlight in this regard. First, the metering system at Puente Salas, not mirrored at Santa Rosa de Aquiares, affords local residents to pay for their actual consumption, therefore the likelihood for free-riding is higher at Santa Rosa de Aquiares than at Puente Salas. Second, at Puente Salas, local residents are mandated to

pay their bills on a specific date, having a span of five days to do it after such date; at Santa Rosa de Aquiares, their counterparts have the whole month to pay their bills with the three days extension coming about once the month is passed. Overall, that communities with stricter payment ruling report greater payment rates makes one to think that those communities do have a greater worry about their WSS system, therefore do have a greater sense of ownership.

A further point in relation to sense of ownership deals with the presence of moving population in each community. Though the ASADA Board members at Puente Salas do efforts in order to make part of the community people migrating from other locations in Costa Rica, those are constrained to the regular activities they organized at the ASADA or at BFEP. The situation is somehow different at Santa Rosa de Aquiares. The large Nicaraguan population that comes to Santa Rosa de Aquiares searching for a new job at the local coffee industry is the target of many BFEP initiatives, particularly those focused on environmental training. The issue here, is that in addition of receiving a large coming new population, those new inhabitants in light of the dynamics of the coffee industry, do not stay for a long period of time at Santa Rosa de Aquiares, limiting their stay to the harvest season, making difficult to create a permanent natural resources protection culture among them, as there is no certainty that those that came this year to work at the plantations will be the same ones that come next year.

9.3 Capacity of the Community

As mentioned before the variable is a combination of two variables, skills and leadership. In regard to *Skills*, the proxy by district data shows educational background as not correlated with BFEP and SQSP performances, as the community scoring the lowest

at BFEP and SQSP, that is the community of Santa Rosa de Aquiares is second to the community of Puente Salas and ahead of the community of Pejibaye in regard to the district share of the population over 5 years old that has completed primary and secondary education. The dynamic turns more interesting by addressing district data at college level: the District of Turrialba at the top of list, thereby Santa Rosa de Aquiares, the community with the lowest BFEP/SQSP performance, is located at the District with the highest concentration of college graduates. Does this mean that greater learning capacity do have no effect on BFEP/SQSP performance? The answer should not come rapidly and after taking into account other aspects.

At first, before getting into details, it should be noticed that the proxy drawn upon does a good job in shedding light about the educational background thus about the learning capacity of each community, particularly in regard to the ratio of the district and community population. Having said that, the review comes down to the local dynamics resulting into local capacity building that in turn has a direct effect on the actual skills of local residents. In this regard, the local schools are a good venue to start an inquiry. At Puente Salas, as mentioned before, the school is highly active at BFEP, with their own local committee, and students participating of several BFEP initiatives either at the school or at community. Those initiatives have granted them a new set of environmental skills through the years that have resulted in them teaching classmates and family members about new practices and habits. The dynamic is replicated even more intensively at Pejibaye in view of the participation of the local school at the BFEP educational center category which has allowed students to increase their environmental knowledge by participating regularly of the periodically organized initiatives convened

by either the BFEP community category or the BFEP educational center committee. At Santa Rosa de Aquiares, there is no such participation of the local school at BFEP, therefore though students are invited to attend BFEP training sessions and BFEP officials visit the school to promote the program, students are not as highly exposed to environmental teaching as their counterparts at Puente Salas and Pejibaye therefore their skills in this regard are not as high as theirs.

A further point to make is to focus the analysis on the skills of those leading BFEP and SQSP locally. For instance, the former President of the Board at Puente Salas attended regularly training sessions in different topics at public and academic organizations in order to increase her environmental knowledge. She recognizes that her current skills are far more ahead than the ones she used to have when she started to get involved with the ASADA and BFEP years ago. At the BFEP local committee she shares responsibilities as a member of the Board with another college-educated fellow resident, and with the Administrator of the ASADA who is on her way to complete her college degree. At Pejibaye the ASADA Board do have a college-educated local resident among its members, and the Administrator of the ASADA who is also the BFEP local coordinator majored in accountancy at the University of Costa Rica. At Santa Rosa de Aquiares, despite being the district share of local residents with college education greater at Turrialba than at San Pedro and Pejibaye, there are no college-educated professionals among the ASADA and BFEP local committee members.

Leadership dynamics do contribute in explaining gaps in sustainability and learning. The present dissertation defines leadership as referring to the manner leaders influence and contribute to the success of the establishment of the local WSS system and

also of both programs under scrutiny. That is whether leaders have been able to channel local residents efforts towards building up a well-operated WSS. In this regard, first thing to notice are the preliminary efforts of those pioneers in convening self-organization to demand self-administration from those public or private organizations previously running their WSS systems. As mentioned above, Puente Salas and Pejibaye were much ahead of Santa Rosa de Aquiares in self-organizing as at both locations local residents since the early 1970s started demanding for their right to run their own WSS systems before their respective Municipalities at the time. Santa Rosa de Aquiares responded to a different dynamics in that it was not a Municipality the one responsible for the administration of the local WSS system at the time the community decided to self-organize, but the private company of Cafetalera Aquiares; therefore local residents just in the mid-1990s felt prompted to take over a more active role in demanding to run their own WSS system. Besides, at both Puente Salas and Pejibaye, in view of some varying problems, the community, once responsible for the administration, was right away obliged to face challenging issues in regard to upgrading the outdated at the time WSS facilities and finding new water sources to supply water in an adequate manner to local residents. Those chores were taken up by local residents willing to contribute to their communities driven only by their social interest to improve the quality of life of their neighbors. On the other hand, at Santa Rosa de Aquiares, though those ones responsible for the creation of the first Water Committee were driven in their action by similar interests but got to that position much later than their counterparts at Puente Salas and Pejibaye. To explain the gap one should put attention on the role of Cafetalera Aquiares, the former operator of the WSS system, which in addition of providing water to local residents, employed most

of them –until today- and has historically supplied several services to the whole community. The scope of Cafetalera Aquiares presence at Santa Rosa de Aquiares may have given rise to some local conformism due to which local residents did not make efforts as high as their counterparts at Puente Salas and Pejibaye in reaching certain targets as they know in advance that whenever they are in need the company may show up with a solution. That dynamic has probably postponed the rise of local leadership, and subsequently entrepreneurship.

In regard to most recent leadership dynamics, there are patterns common to all three cases. One of them is the low ASADA President's removal. For instance, at Puente Salas, the former President was in office for three period, that is six years; at Pejibaye the current President is completing his second period, and previously he used to sit at the Board as Vice President; and at Santa Rosa de Aquiares the situation is rather similar with the current President in the middle of his second period. That Presidents stay in office for longer than only one period confirms that good performance comes along with governing stability thereby granting those in power more time to establish and apply their working plans. A further commonality is the high number of social organizations operating locally; however, Pejibaye's 40 social organizations are much ahead of the 14 ones working currently at Santa Rosa de Aquiares. Likely those sitting at those organizations' boards repeat themselves easily, restraining the names of those leading social initiatives to a reduced group of local residents driven by their yearning to contribute to the welfare of the community. The best case to exemplify those dynamics is the President of the ASADA Board at Pejibaye who sits at five different organizations'

board, including the ASADA's, each one covering a different aspect of the community's development.

Nevertheless, there is a further point of deviation between the three cases. That is the role of local professors. At Puente Salas and Pejibaye, as mentioned before, the local school have been pretty active at BFEP and SQSP, which has not been the case at Santa Rosa de Aquiares. In both successful cases, a local professor who ends up becoming an actual leader in promoting and heading various BFEP initiatives has been pivotal for the local success of the program. In both cases, such a professor is a local resident with a long stay at the community, who is really driven by the yearning of making a change in his students' relation with natural resources, and wants to inherit to the community better citizens by means of the children he is educating at the school. At Pejibaye, the participation of the professor goes to even having him sitting on the BFEP community category's local community and leading the BFEP educational center's one. On the other hand, at Santa Rosa de Aquiares there is no such professor at the local school, thereby a larger group of children miss the opportunity of getting involved in BFEP initiatives with the consequent effect on the community's current and future welfare.

9.4 Institutions

The institutional analysis responds to the application of the Institutional Analysis Development (IAD) theoretical framework and makes emphasis on the differences in this regard noticed among the communities under study. It turns out that nationally the three systems respond to a common institutional framework enacted by means of a constitutional mandate establishing the right of Costa Rican citizens to a healthy and ecologically balanced environment. The constitutional ruling results in a legal framework

that crosses a whole set of issues dealing with the administration of the national WSS system, the regulation of water resources use and consumption, and the protection of natural resources, in line with the national strategy to promote the protection of the environment as a social and economic driver. In addition, those regulations are currently enforced by a group of public organizations, each one of them with a role to play at the administration, regulation, and protection of natural resources. That is how, one comes across with organizations the type of AyA, ARESEP, and the long list of Ministries of which some present at first a more direct influence at the WSS system –the Ministry of the Environment, Energy, and Telecommunication, the Ministry of Health- whereas others do not exercised their influence on a high periodical based –Ministry of Treasury, the Ministry of Labor-. That long list of institutions –laws, norms and public organizations- has been already described in section 4.3.3 going in-depth in regard to their roles, duties and effects and includes BFEP and SQSP. However, the point to make, back to the cross case study comparison, is that the same common national WSS institutional framework rules each community; therefore explanations about inter-community gaps, either in regard to sustainability or learning, are not in national institutions as the communities share the same norms. Nevertheless, a different answer would come up if the analysis would be inter-country that is including as part of the sample communities responding to different national institutional frameworks. A response in such case would put a lot of ground into Costa Rica’s pro-natural-resources-protection strategy, as national institutions do build an institutional framework that promotes and enacts the protection of the environment, including in that group water resources. Therefore, that the national institutional framework makes no difference for

the cross case study analysis, do not put away the fact that its natural-resources-promoting-orientation results in making of first priority the protection of the environment and of biodiversity for Costa Ricans.

The institutional review does not end with constitutional and legal ruling. There are two further additional stages to call out. First, as the collective choice sections in each case study describe, ruling at collective choice level refers to Madrigal, Alpízar and Schlüter question whether the community self-organizes and whether there is a local supra-body responsible for decision-making in a sovereign manner. The answer comes with the three case studies being self-organized under the ASADA scheme, the General Assembly filling in as the entity sovereignly responsible for decision-making, and clear procedures in regard to the election and removal of the ASADA Board members, the periodicity of their meetings, and decision-making. Needless to say, that as with the constitutional level, the three communities show no difference in comparing their collective choice ruling.

Although thus far national and collective choice institutions make no difference in explaining the sustainability gap among the three communities, the situation is different when getting into the operational level. Madrigal, Alpízar and Schlüter (2010) propose to review operational dynamics by applying a three-level framework referring to different issues subject to local ruling and that affected the performance of rural WSS systems. Those categories as mentioned in previous sections are tariffs; infrastructure, maintenance and protection; and water treatment. What I am proposing is that differences in local ruling regarding each category do have an effect onto local sustainability, that is communities operating under norms enacting a sound fee collection system or the regular

maintenance of WSS facilities are ahead of those communities that have not been able to set that type of rules.

For tariff, the questions deals with whether there is a metering system in place, whether the day, place and mode of payment are clear to local residents, and whether the operator charges those in default of payment a reconnection cost. It turns out that Puente Salas, the community wearing the highest BFEP/SQSP number of stars, is the only one of the three cases that thus far has been capable of implementing a metering system. Therefore there is no such thing as charging a flat and equal fee to all local residents as the local operator does at Pejibaye and Santa Rosa de Aquiares, thus water consumption responds to a local new dynamic resulting from the residents' wish of not paying expensive water bills that in turn result nowadays from their actual consumption. It should be noticed that the community of Pejibaye is doing a great effort to implement metering in the next years, so that as of today they have been able to work in a very reduced area installing a pilot experience which is still far of reaching 100 percent coverage. In all three cases, there are rules in regard of the mode of payment. However, differences are noticed. For example, at Puente Salas, local residents do know that each month the day 20th they have to go to the ASADA headquarters to pay their bills; if they do not they have a three days extension, otherwise the operator cut off their service. At Pejibaye and Santa Rosa de Aquiares, the situation is different. Local residents are entitled to pay their bills in any day of the month, with the timing decision responding to the single economic situation of each resident; the three days extension rule in regard to cut off the service comes about once the month is passed. The last question referring to tariffs deals with reconnection cost. Each community does have a reconnection cost,

though in a different amount: Puente Salas charges 1,000 colons, Pejibaye 3,500 colons, and Santa Rosa de Aquiares 2,000 colons. Thus there is no major difference on the decision of charging a reconnection cost, albeit the amounts charged are different, not correlating such gaps with the number of BFEP and SQSP stars each community has been awarded.

For infrastructure, maintenance and protection, questions rise about the facilities maintenance and natural areas protection. In this regard, Puente Salas and Pejibaye seem to be ahead of Santa Rosa de Aquiares. Although at the three communities rules governing the operation of maintenance are in place, at Puente Salas and Pejibaye those are stricter and demand greater periodicity. That the main responsible is the plumber crosses the three cases; so does that he responds rapidly to local residents calls when their home-WSS facilities are broken. However, some differences come up. First, at Puente Salas and Pejibaye storage tanks maintenance is held on a monthly basis, much ahead of the three months periodicity applied at Santa Rosa de Aquiares. Second, in regard to the protection of natural resources areas, reforestation and signage present diverging performances. Santa Rosa de Aquiares does not organize reforestation journeys as regularly as Puente Salas and Pejibaye nor is able to put up signage with the same standards as the other two communities do. The divergence keeps going when reviewing the protection of WSS facilities, with those performing better at BFEP and SQSP –Puente Salas and Pejibaye- been much ahead of the one with the weakest sustainability numbers –Santa Rosa de Aquiares-.

The third issue of water treatment may at first leads one to think that there may be not major difference between the three cases, as all are obliged to go through the four

annual WNL water quality analyses and all have already in place a chlorination system based upon the application of chlorine pills and the subsequent monitoring by means of a handheld device handled by the local plumber. However, there are some differences. In regard to the periodicity of monitoring, at Puente Salas the local plumber –or someone from his staff- does his job every day of the year, whereas at Pejibaye and Santa Rosa de Aquiares monitoring is done on a weekly basis.

Overall, in relation to the present dissertation, the application of IAD reinforces the notion that the decision of locally implementing BFEP and SQSP responded to a certain institutional setting whereby local residents of all three cases were encouraged to take up the challenge of greater sustainability by a common national ruling regarding the constitutional mandate to provide a healthy and ecologically balanced environment to each citizen and a legal framework driven by the environmentally protection premise that crosses the economic development strategy of Costa Rica. Besides, weak operational rules in regard to Operation and Maintenance (O&M), previous to locally adopting both programs, resulted in a WSS deficient service that motivated local residents to set out in the quest for alternatives to address such drawbacks, being one of those options BFEP and SQSP. However, the role of institutions goes beyond the adoption. Once both programs start operations in each community, sustainability reaches diverging performances, gaps that partly respond to the institutional differences at operational level in each location; that is how, communities able to set and enforce stricter WSS local ruling are the ones performing better at BFEP and SQSP.

9.5 Sustainability

The sustainability analysis goes in line with testing the first two hypotheses of the present study: a) the greater the participation of the community, the greater local sustainability, and b) the greater the capacity of the community, the greater local sustainability. The design calls upon comparing dynamics at the three case studies, all of them rural communities with WSS local systems operated under the ASADA scheme, and that, though with diverging results, have locally implemented BFEP and SQSP. Puente Salas and Pejibaye are the ones with higher sustainability performances, reaching eight and seven BFEP-SQSP stars respectively, ahead of the three BFEP-SQSP stars Santa Rosa de Aquiares has been awarded. Therefore, the question is, based on the logic model presented and in regard of the variables part of such model, what have been the dynamics leading to such sustainability gap.

That nationally all three cases are ruled by a common WSS institutional framework makes no difference in regard to the public incentive system they face. That is all three cases are encouraged to get involved in sustainability-promoting initiatives, the such of BFEP and SQSP, by the same set of national public incentives either in regard to laws and norms or public organizations. The difference comes about at the operational level; operational rules weak in their mandates to comply with standards, periodicity of certain monitoring, or payment deadlines, result in the community not reaching sustainable performances as high as those putting in place stricter rules and make of their enactment first priority for local residents. The three cases comparison confirms the statement as at Puente Salas and Pejibaye operations are ruled by norms demanding higher responsibility from local residents in regard to the payment of their bills, greater

periodicity for maintenance and water treatment, and greater care for facilities and natural resources areas.

9.5.1 Hypothesis 1.1

To respond to the first hypothesis that refers to the effect of the participation community into local sustainability, dynamics regarding the variables of administration, interaction and sense of ownership are compared having in mind the greatest sustainability performances of Puente Salas and Pejibaye.

The first aspect to notice is that only local residents participate of decision-making bodies either by holding ASADA or BFEP administration positions or by means of their attendance at the General Assembly. Therefore, there should not be major inference to do in regard to local participation in decision-making as the three cases follow the common pattern of prohibiting the participation of foreigners in their governing bodies. However, there is an issue to highlight. That few local residents attend regularly the General Assembly contradicts the demand of greater participation that regularly bottom-up approaches promote. Even more, the community with lowest attendance rate is Puente Salas the one that carries the greatest number of stars at their BFEP and SQSP flags. Therefore one may argue that those pointing to participation as “the” factor driving higher sustainability are not on the right track. Greater care should be taken before concurring to such statement. To have a low attendance rate at the General Assembly is only one of many aspects that deals with local participation, and it only refers to participation at one of several local governing bodies. Besides, that low attendance rate that makes one to think that local participation is not that highly needed to increase sustainability contrasts with the criterion of only local residents holding local WSS

administration positions thereby restraining decision-making to be made exclusively locally.

Participation at the various initiatives organized at BFEP, that is the interaction variable, does carry greater significance. It turns out that at Puente Salas and Pejibaye, BFEP initiatives gathering different segments of the community are organized with greater regularity. In that sense, the role of their local schools, both very active at BFEP with even the one at Pejibaye participating of the BFEP educational center category, is pivotal in engaging local residents, particularly young students, in learning about new habits and new practices promoting natural resources protection. That enthusiasm differs with the lower school's engagement at Santa Rosa Aquiares where the number of training sessions or social activities organized by BFEP that students may attend is not as high as in the other two cases. Therefore, having students and regular citizens periodically participating of BFEP social initiatives does have an effect on the local sustainability performance as dynamics at the high-BFEP-SQSP-performing communities of Puente Salas and Pejibaye show in contrast with the low-BFEP-SQSP-performing of Santa Rosa de Aquiares.

The review of sense of ownership dynamics reinforces the notion that participation affects local sustainability. The one community where local residents are more reluctant to comply with their monthly payment is Santa Rosa de Aquiares, whereas at the high-BFEP-performing communities of Puente Salas and Pejibaye the default of payment rate is close to null. In addition, an historical review going back to the time that local residents stood up in demand for WSS self-management shows that at the same two communities that process took place much earlier than at Santa Rosa de Aquiares, and

that later on once the administration was in the responsibility of local residents those did not hesitate in upgrading and maintaining themselves their WSS systems. At Santa Rosa, that local residents stand up came to happen just in the mid-1990s and for a much longer period of time local residents trusted the WSS system local administration to the local coffee company thereby assuming no responsibility for its operation and postponing in turn greater sense of ownership over it.

Overall, the hypothesis is accepted under the particular context that to increase local sustainability, institutions putting up sound ruling at national and operational level must be in place, and that participation do not have to be limited to local residents holding administration position but needs of the organization of varying venues where local residents are able to interact and learn, and of a great sense of ownership prompted by the identification local residents have over their community and their yearning to contribute to its social welfare.

9.5.2 Hypothesis 1.2

The hypothesis refers to the relationship between the capacity of the community and local sustainability, thereby stating that the greater those capacities, defined as combination of the skills of local residents and local leadership dynamics, the greater the local sustainability, which responds to the number of BFEP/SQSP stars the community have been awarded.

In terms of skills, the cross case analysis shows that the District of Turrialba, home of the community of Santa Rosa de Aquiares, is the one with the highest college graduates share, however, the performance at BFEP and SQSP is the worst of all three. Therefore, one may be prompted to argue that skills do not affect local sustainability.

However, that is not the final answer. As local schools at Puente Salas and Pejibaye have been actively engaged at BFEP, local students have gone through a regular learning process in regard to natural resources protection and for a considerable period of time - more than five years in both cases-. Those learning venues have resulted that at the period under scrutiny, children did have greater environmental skills than their counterparts at Santa Rosa de Aquiares who have not had at their disposal those initiatives in similar numbers. In addition, local residents at both high-BFEP-performing communities were exposed to a greater number of initiatives locally organized by BFEP where they interacted and learnt about new environmental habits and practices. That greater periodicity of BFEP activities resulted in greater skills of local residents thereby ended up driving greater local sustainability. In addition, an in-depth review shows that at the high-BFEP-performing communities there is a greater number of college-educated local residents holding administration positions thereby at those locations those responsible for running the WSS system do present greater skills than their counterparts at low-BFEP-performing community.

In terms of leadership, the review of the three cases shows that those communities that stoop up early in demand for the self-management of their WSS system are the ones scoring higher nowadays at BFEP. In this regard, Santa Rosa de Aquiares has shown historically, in light of the role of Cafetalera Aquiares as service provider for local residents, a slower response when leadership has been needed locally, a fact confirms by the no replication of a local professor taking over BFEP leadership at the local school. Great and strong leadership contributes in engaging local residents in promoting and practicing natural resources protection thereby having a direct influence in increasing

local sustainability. That leadership in order to have a positive effect does need to go through stable periods of governance with no regular conflicts interrupting constantly the governing duties of an administration. At this point, one is prompted to argue whether those leaders are not playing the entrepreneur's role promoted by Schumpeter in struggling with the status quo at the time an innovation comes about. Those leaders, either at the ASADA or BFEP administration were obliged to confront hurdles preventing the community to have at their disposal a better managed WSS or a higher-local-sustainability-promoting program, the innovation, whose benefits were not perceived at first hand by most of local residents. Thus their leadership capacity shows up to carry on with the difficulty of convincing the local community of the initiative they promote and later to organize on the field the operation of the innovation they firmly believe in. However, there is a difference that must be put in the table. When talking about promoting and organizing BFEP, those leaders playing the roles of Schumpeter's entrepreneur do not expect an economic profit in return. Their yearning of contributing to the welfare of their community drives them to give away their time and skills to their fellow local residents in pursuing the social target of a better quality of life.

Overall, the hypothesis is accepted with a particular emphasis on the role of leadership in engaging local residents thereby having them participating of sustainability-increasing initiatives promoted by BFEP and SQSP. In addition, in regard to skills, those affect sustainability in a greater manner as though capacity building processes expand to greater segments of the local population.

9.6 Learning

The analysis of learning dynamics crossing the three case studies goes in line with

the second set of hypotheses of the present study: a) the greater the participation of the community, the greater the learning at community level; and b) there greater the capacity of the community, the greater the learning at community level. Learning is measured by means of the different examples of it noticed during the fieldwork that have resulted from the local implementation of BFEP and SQSP. Therefore, summing up sections 6.8, 7.8 and 8.8, it is feasible to infer which community performs the best in regard of learning dynamics. At Puente Salas, the promotion of a “culture of water” has resulted in new water use practices; the metering system did modify water consumption patterns locally; the regular interaction with academic institutions did grant new competences to local residents in regard to the production of compost and organic material; the local plumber and his staff respond to learning on the job and learning by doing dynamics, being particularly helpful the collaboration with private suppliers; the active role of the school at BFEP has allowed students to learn constantly and at class about natural resources protection becoming students knowledgeable about recycling and water use practices; and BFEP self-organized initiatives have had an impact on local residents prompting them to learn about recycling and natural resources protecting habits. At Pejibaye the list is shorter, though the local school has an even more active role in benefit of local students, the program is also strong in promoting recycling practices, initiative that has even given rise to a new local business, and the local plumber is also a good example of learning on the job. However, that the interaction with universities and that the community has not been able to put into operation a metering system put Pejibaye behind Puente Salas. At last, Santa Rosa de Aquiares is the last one on the list. There, though learning has occurred in regard to the local plumber role, not having the school been as

active at BFEP as Puente Salas and Pejibaye, and that BFEP training sessions respond to a not as regular schedule than at the other two communities with the program having a less pervasive profile, have resulted in a lower learning performance. Therefore, in regard to learning, Puente Salas is at the top of the list, with Pejibaye outperforming Santa Rosa de Aquiares in regard to the two remaining spots.

9.6.1 Hypothesis 2.1

As of the effect of the participation of the community in local learning, the rationale goes on as with hypothesis 1.1, that is I draw upon the logic model of the present dissertation that defines participation as a combination of the three variables of administration, interaction and sense of ownership.

Nevertheless, before going with the analysis, a point previously made for the sustainability analysis have to be reinforced that is the role of institutions in promoting learning locally. As with sustainability, national WSS institutions do not differ when crossing through the three communities under study with the three of them been ruled by the same set of laws and norms, and public organizations. Difference comes up with the operational level. For instance, that Puente Salas have been able to establish a metering system has resulted in local residents learning about water use and a modification in their behavior at the time of consumption. Local residents prompted by the new mechanism in place to supervise their consumption and to reduce the amount of their water bills have created new reuse systems that have demanded from them new knowledge and learning to implement them. The story goes on with maintenance with particularly the local plumber and members of the ASADA Board and the BFEP local committee learning about new technologies and the maintenance of WSS facilities. In this regard, those

communities with the clearer and stricter ruling in operation, that is Puente Salas and Pejibaye, have been the ones where greater learning was noticed.

In terms of the administration variable, there is no difference to notice between the three cases, as in each community under study all holders of the administration position are local residents and the attendance rates at the General Assembly were low at the three communities. The only question was that a community with a greater learning performance as Puente Salas presents the lowest participation in regard to the attendance rate at the General Assembly. The response is similar than with sustainability thus reinforcing that the General Assembly is only one of many participation venues for local residents. Therefore, interaction becomes a variable to weigh in with great care. At those communities where greater learning has been noticed, Puente Salas and Pejibaye, BFEP initiatives take place in a more regular base, that is the four training sessions or open presentations organized at Santa Rosa de Aquiares the year under scrutiny, are non good match to the BFEP pace of the other two case studies. In addition, the role of local schools makes a difference. Due to their participation at BFEP, phenomenon not mirrored at Santa Rosa de Aquiares, students are more easily engaged in learning dynamics affording them new competences in regard to natural resources protection. The closing of the participation dynamics comes with sense of ownership. Here, learning is greater at those communities that historically have been able to self-organize in demand for a better WSS service managed by the community, a service they ended up feeling as their own in view of the efforts they put in ameliorating it. As with sustainability such a greater care is noticed by means of the default of payment rate at each community, with the lowest reported at Puente Salas and Pejibaye where the rate is close to null. The response in this

regard is that when local residents care more about their WSS system, that is sense of ownership is greater, they express such care by means of complying greatly with their obligations over the system, being one of them, and the one that generates greater resources to the system's operation and maintenance, fulfilling with their payment duties.

Overall, the hypothesis is accepted. The greater participation of the community does increase learning at community level, with a special emphasis this time not on holders of administration position, but more on local residents interacting and learning at BFEP social initiatives whose participation is prompted easily as greater is their sense of ownership over their WSS system.

9.6.2 Hypothesis 2.2

The analysis focuses on the relationship between the capacity of the community and learning at community level, with the former defined as the combination of the skills of local residents and the local leadership context, and learning occurring locally at greater scope in the following order: Puente Salas, Pejibaye and Santa Rosa de Aquiares.

To refer to skills I turn back to the sustainability discussion in regard to hypothesis 1.2 to neglect that that the highest college graduate rate at the District of Turrialba, home of Santa Rosa de Aquiares, does not imply that the community does have greater skills than the other two. As with the previous hypothesis, the capacity building process that has taken place since BFEP starts operation locally has given rise to a capacity building process in regard to natural resources protection, particularly at local schools, that has resulted in more skilled students than those attending school at the moment the program started. Therefore, by expanding the comparison to the Santa Rosa de Aquiares' case with non-school as active at BFEP as to participate of the BFEP local

committee as in Puente Salas or of the BFEP educational center category as in Pejibaye, one can argue that the training that students have been receiving due to BFEP at their home school has had a positive effect in increasing the skills of the community, and, following such rationale, the communities with greater learning performances end up being the ones presenting greater skills, therefore there is a positive effect of having greater skills into the occurrence of learning. The rationale is reinforced by the greater regularity noticed of BFEP initiatives, particularly those inviting local residents to attend training sessions and to be part of interacting and learning venues.

In regard to leadership, having leaders able to convene local residents to pursue the common target of improving their quality of life does have an effect on learning. It turns out that at those communities with greater learning, Puente Salas and Pejibaye, there was no “big brother” phenomenon, as one may call the role that Cafetalera Aquiares has played at Santa Rosa de Aquiares. Local residents have been able to self-organize at Puente Salas and Pejibaye, much earlier than those at Santa Rosa de Aquiares, given the presence of local leaders that have given away time and resources to the benefit of the community, and that have struggled against the status quo in order to bring locally innovations, as BFEP and SQSP. That local professors turn out to be great leaders to engage students at BFEP and to create interacting venues whereby students have acquired new competences, has ended up being a noticeable contribution to local learning and thereby to the welfare of the whole community. In this regard, the previous discussion, brought up in section 9.6.1 referring to local leader filling the Schumpeter’s entrepreneur spot rises again, with the singularity that here the entrepreneur is not pursuing a personal economic profit but a social target reaching the community of which he/she is.

Overall, the hypothesis is accepted with the singularity that skills have to be measured in consideration of the previous operation of the program, particularly at the local schools, and emphasizing the role of local leaders in engaging local residents in BFEP and SQSP initiatives.

9.7 Summary

The chapter presents the cross case study analysis that covers the three communities part of the sample of the dissertation. The four hypotheses to be tested were reviewed and accepted, with the role of institutions, as of greater performances, being reinforced, particularly at the operational level. The participation of the community comes to have a positive effect on sustainability and learning, with local residents participating of BFEP initiatives, particularly students at the local school, and the sense of ownership local residents have over their own WSS system, having a great incidence in reaching higher standards. On the other hand, the positive effect on both variables is also confirmed when the analysis is extended to the influence of having both more skilled local residents and local leaders capable of convening and gathering the community to pursue a common goal.

CHAPTER 10 CONCLUSIONS

10.1 Introduction

This chapter presents the main findings of the present dissertation particularly in regard to the four hypotheses tested as part of the logic model. In addition, theoretical and policy implications are displayed. The dissertation has explored the dynamics resulting from the establishment of community-based systems of innovation in rural Costa Rica for the case of the Water Supply and Sanitation (WSS) sector, with a particular emphasis on inferring about the effects of the participation and the capacity of the community on local sustainability and learning. The contribution of the dissertation points to the science, technology and innovation public policy discussion by proposing various theoretical implications referring to the context of WSS interaction, learning and institutions resulting from community-based innovation, and by presenting policy implications in regard to the topic under study. The chapter is organized as follows: at first, the general findings are displayed; second, theoretical implications are presented; and third, policy implications are discussed.

10.2 General Findings

The four hypotheses tested as part of the present dissertation refer to the dynamics of innovation in the establishment of WSS community-based rural system. The study has inferred about the effect of the participation of the community at their WSS system and of their capacity in both local sustainability and local learning. In this regard, several findings have come up (see Table 17).

TABLE 17 Variables and Findings

	PUENTE SALAS	PEJIBAYE	SANTA ROSA DE AQUIARES	FINDING	EFFECT	
					SUSTAINABILITY	LEARNING
Participation of the Community						
-Administration	-Administration positions held all by local residents.	-Administration positions held all by local residents.	-Administration positions held all by local residents.	Same situation in the three cases.	+	+
-Interaction	-Low attendance at General Assembly. -Great number of BFEP and SQSP social initiatives.	-Low attendance at General Assembly. -Great number of BFEP and SQSP social initiatives.	-Low attendance at General Assembly. -Low number BFEP and SQSP social initiatives.	Interaction at local school is of great significance.	++	++
-Sense of Ownership	-Great participation of local school. -Early establishment of 1st Water Committee with active participation of local residents. -Low default in payment rate.	-Great participation of local school. -Early establishment of 1st Water Committee with active participation of local residents. -Low default in payment rate.	-No school participation at BFEP. -Later establishment of 1st Water Committee with active participation of local residents. -Higher default in payment rate.	Sense of ownership is of great significance for a better performance.	++	++
Capacity of the Community						
-Skills	-Higher educational background.	-Lower educational background	-Higher education background.	Capacity building processes affect final result.	+	+
-Leadership	-Local school active at BFEP and SQSP. -Strong leadership -Local professor active at BFEP	-Local school active at BFEP and SQSP. -Strong leadership -Local professor active at BFEP	-Local school non-active at BFEP and SQSP. -Non local professor active at BFEP- -Cafetalera Aquiares as the “Big Brother”.	Leadership in all social venues is of great significance.	++	++
Collective Choice						
-Constitutional	-Same constitutional right, national legal framework, and public organizations for all three communities			Same framework for the three cases.	+	+
-Collective Choice	-In all three ASADAS: ASADA organization, General Assembly is the sovereign decision-making entity; clear procedures for electing and removing Board members; periodical meetings; application of the majority rule for decision-making- -Strong O&M local ruling			Same framework for the three cases.	+	+
-Operational	-The strongest fee collection system -Strong water quality monitoring.	-Fee collection system not as strong as Puente Salas. -Strong water quality monitoring.	-Strong O&M local ruling -Fee collection system not as strong as Puente Salas. -Strong water quality monitoring.	Stricter rules and enforcement of those rules result in better performances.	++	++

Source: Own author

At first, there is a noticeable role of institutions in contributing to sustainability and learning. In particular, operational ruling does have an effect in both dependent variables as though those rules respond to stricter and periodical enactment and set clear deadlines and behavior norms to those been part of the system. Though that the three case studies were under a common national institutional framework did not allow to infer greatly about the diverging effect that national institutions may have over rural communities, that does not diminish that Costa Rica establishes as a constitutional right that citizens are entitled to a healthy and ecological balanced environment, therefore despite the commonality there is a national target of protecting natural resources that drives all citizens, including local residents of rural communities, in their demand for a better environment.

Sustainability is affected by both the participation and the capacity of the community. In terms of participation, as administration positions are all held by local residents in all three cases, there is no conclusion to be made, as there was no variety noticed in this regard within the sample. However, in terms of participation of regular local residents at social initiatives, the like BFEP organized, the situation is different. Those activities turned out to be great venues for interaction, with participants leaving them with greater knowledge on natural resources protection, that ends up contributing to the increase of local sustainability. In addition, that local residents carry a great sense of identification with their community resulting in a greater sense of ownership over their WSS system results in them taking greater care of the system, which has become a communitarian asset, therefore the better the shape of the local WSS system, the greater the effect on local sustainability.

In regard to the capacity of the community and sustainability, dynamics refer to the effects of the skills of local residents and of local leadership. Those communities inhabited by more-skilled local residents achieve greater sustainability; thereby decision-makers must promote those open initiatives that aim by means of greater interaction to increase local residents' knowledge thus turning them in more-skilled individuals capable of better contributing to the local sustainability of their community. Having said that, the role of local leaders turns out to be of greater significance. Local leaders able of convening and gathering local residents in the pursuing of a better environment and driven by their yearning of contributing to the welfare of their community, that is not by economic profit, do have an effect on local sustainability. As long as those leaders are able to deal with the status quo thereby overcoming various hurdles blocking the rise of novel sustainability-promoting initiatives, innovation will come about.

With learning the situation is not that different. In terms of participation, to have greater learning regular local residents must participate in great numbers of those initiatives that promote natural resources protections. At those venues, they have the chance to interact with dissimilar agents, and by means of such interaction, learn about new practices and habits in line with the target of protecting the environment. In addition, that local residents carry a greater sense of ownership over their WSS system prompt them to learn about new competences, approaches or technologies that may help them in operating, maintaining and upgrading their system. Though with sustainability that all administration positions were held by local residents constraints the study's conclusion in terms of the effect local participation has upon sustainability, in regard to learning, that pattern results in having a group of local residents, though a reduced one, acquiring new

competences that deal with either management and leadership issues or technical ones when they are faced with operation and maintenance decisions.

As of the capacity of the community, that more-skilled local residents are in greater number does result in greater local learning. With students going through capacity building processes at the local school, their skill base increases over time, thereby with more tools in hand, they are empowered enough to learn about more complex new competences and at a faster pace than before. Good leadership that is leaders able to convene and gather the community to pursue better standards of living by means of the promotion of natural resources protection also affects learning. To engage local residents in such task, those leaders organize various open initiatives of which local residents participate of, venues that through the interaction with dissimilar agents make possible to increase learning. Again, the role of those leaders makes one to think of their role as the entrepreneurs promoted by Schumpeter in regard to the establishment of innovation.

10.3 Theoretical Implications

Given the research question of the present dissertation that points to the dynamics of innovation in the establishment of rural Water Supply and Sanitation-Community Based (CB-WSS) systems, the theoretical implications resulting from the study refer to the conceptual frameworks of Systems of Innovation (SI) and Community Based/Community Management (CB/CM).

As mentioned previously the SI framework was conceptualized responding to the context of Northern countries and driven by an economic/business growth final target. That the review is about a community-based system in regard to rural settlements in a developing country and within the context of prime human need sector such as WSS

deviates from those Northern-economic premises putting into the table new dynamics that have not been part of the picture yet.

First, those participating of the community-based system are driven by the yearning to contribute to their community in solving a prime human need, and do not profit whatsoever in return for their participation. The driver behind their will and decision is nothing else that to increase the quality of life of their fellow local residents and thus their own. Therefore, innovation does not respond to a greater profit dynamic, thereby its establishment not being necessarily related to an economic perspective. Here, I propose community-based innovation, in regard to the WSS sector, to be responding to the goal of better living conditions, in the quest of higher local sustainability, or in more technical terms, to the valid aspiration for greater human development local standards. That definition is proposed not leaving out, but actually promoting and welcoming, business growth or new businesses resulting from such a human-development driver, particularly if they come to benefit local residents launching their own small business.

Second, the conceptual framework of Systems of Innovation has worked in general with a triad of actors –firm, university, government-, that have been recently renamed by Cozzens and Catalan (2008) in response to the particular characteristics of the WSS sector, thereby resulting in Problem Solving Organizations (PSOs), Knowledge and Information Organizations (KIOs), and Governance. Such a scheme is not enough to describe the dynamics of community-based innovation. The main actor of the system, that is the community itself, cannot be contextualized in none of those three categories in light of its unique characteristics. The community participates in the design and implementation of the innovation; the community establishes and enacts local institutions

that rule the rise of the innovation; the community produces and diffuses knowledge; and the community benefits social and economically from the innovation, being the system's agent that does it the most. Therefore, the community takes over diverging roles that cross each one of the categories mentioned above, then the proposal of a new level for System of Innovation dealing this time with the community level ought to put the community as an autonomous actor with its technical, governing, social, and economical own dynamics. To include community as new active agent of a system of innovation, even if the proposal regards the specific of the Water Supply and Sanitation Community-Based System-of-Innovation (WSS-CB-SI), rises the question of the representation of the civil society in the conceptual framework of Systems of Innovation. Nowadays, with the advent of new institutions and new technologies, citizens are greatly empowered to manifest their opinions in a public manner, opinions that are carrying greater weight day by day. Therefore, the framework should consider the role of the civil society not only as another PSO, yet as an agent participating of the design of the innovation as well a benefiting from it.

Third, the proposal of the community-based System of Innovation comes to highlight two issues that thus far have not been reviewed as needed in regard to the establishment of Systems of Innovation: leadership and sense of ownership. Though the concept of leadership may intertwine with the role of the entrepreneur proposed by Schumpeter, there is a novelty in regard to the community case. Schumpeter's entrepreneur responds to an economic incentive, therefore when struggling against the status quo and overcoming the inertia hurdle, he/she expects to come across with profits at the end of the road. However, within the community those leaders convening,

gathering and most of all convincing local residents to follow him in pursuing greater local human development standards, do their job for free not expecting to receive profit whatsoever in return, being driven uniquely for their yearning to contribute to the welfare of their communities. In addition, at other levels of _Systems of Innovation, particularly in regard to national and regional ones, the role of the sense of ownership participants of those systems have over their territorial unit has not been deemed. Though the present study makes emphasis that the sense of ownership refers to local residents and their local WSS system, the concept is closely related to the sense of identification local residents have over their community, therefore, in case of national and regional systems of innovation, the extension should cover the question of whether regular citizens do identify with their own countries or regions, and whether that sense of identification do affect innovation locally. The results of the present study state that at community level that local residents have a greater sense of ownership, thereby a greater sense of identification turns into greater sustainability and learning, thereby in a greater likelihood for innovation to come.

Albeit the present dissertation is set to provide theoretical implications for the SI research community, the results afford further ones in regard to CB/CM. First, previous statements that self-organization is a substantial driver in succeeding WSS systems and that needs external support comes in line with the observations made on the field (Schouten and Moriarty 2003; Lockwood 2004). At the three cases, local residents govern their own WSS system and participate of decision-making venues thereby increase local sustainability in relation to past performances. However, though self-organization is promoted, success needs of to the continuous support of external agents.

For the cases under analysis, such a role is played by the public agency responsible for running both BFEP and SQSP that is AyA; though the WSS local administration was in the hands of local residents, AyA never left the field and was constantly giving them support in different aspects. A second aspect to highlight is that interaction should reach all social segments in the community as learning occurrence is not constrained only to holders of administration positions, nor participants of decision-making. A good example comes from making of local schools learning venues resulted in turning students into great knowledge carrying and diffusing agents. Therefore to succeed at CB/CM one ought to consider all those social nodes operating at local level in pursuing a certain social target, locations that provided good and strong leadership are likely to become an asset to increase sustainability locally. At last, though innovation is commonly identified as a fruitful game-changing agent in most scenarios, the promotion of WSS dynamics giving rise it is a task that should receive greater attention from the CB/CM community. In that regard, innovation should not be only thought of in regard to high-tech solutions, but as resulting from local learning and interactive dynamics among those directly affected by the problem addressed that in turn would likely results in a simpler and more useful response.

10.4 Policy Implications

The present dissertation displays a set of findings that give insights in regard to policy making referring to the promotion of innovation in the Water Supply and Sanitation (WSS) sector in rural areas. I describe those insights in light of three categories: participation, learning, and leadership.

First, in regard to participation, for those countries in the quest for greater innovation at the WSS sector in rural communities, initiatives designed to match that goal ought to promote massive participation at all segments. Once local WSS institutions are in place that local residents hold all local WSS administration positions, though positive as decision-making is on local hands, is not enough for establishing dynamics leading to innovation. The system requires the participation of as many as possible local residents at all those initiatives local institutions may organize to reach an innovative goal. Therefore, when designing a new policy tool to increase WSS innovation in rural communities, policy-makers ought to make conditional their support not only to the participation of local residents as holders of local administration positions or at decision-making venues, but also to the periodical organization of open events where they may interact with their fellow local residents and other WSS agents and thereby learn about new habits and practices in line with natural resources protection.

Second, the review of learning dynamics makes one to conclude that much attention ought to be put into the role of local schools. Students turn out to be among the greatest promoters of natural resources protection in light of the training they regularly receive at their schools. Therefore, to have schools actively engaged at programs the such of BFEP makes of them diffusing and learning nodes, reaching and motivating rapidly the ones that will become the future leaders of the community, thereby the significance of them carrying such new set of competences. Good examples of those activities at the cases reviewed where the Environmental Festivals, the Water Fairs, or the reforestation journeys, where students interactively learned about the protection of the environment or water consumption. Consequently, policy makers ought to promote schools as learning

centers and require their regular participation in any similar program than BFEP and SQSP. It is worth noting that, in addition of what regard to local schools, learning in general contributes in prompting community members to take over their own WSS system, and to build the capacity needed to run it once the presence of the external agents helping in the implementation of a new program such as BFEP decreases.

Third, WSS policy in regard to rural areas and following a bottom-up approach ought to make an effort in putting up programs aiming to the identification or the promotion of leadership. Once local WSS institutions are in place, leaders are needed for running them but also for convening and gathering the community in pursuing the common goal in question. The difference those leaders makes as long as they count with stable and long enough administration periods to carry out their working plan is substantial. However, before taking over, they must validate themselves before their community which expects only local residents to take over, and shows that their only driver is their yearning to contribute to local welfare. Once in office, those leaders are faced with regular situations that leadership comes across such as solving conflicts, team working, and engaging local residents. Therefore, any policy or public program launched to promote and increase WSS innovation in rural areas should consider a set of activities allowing those running the policy or program to identify future leaders able to take over once the design and implementation phases are left behind.

This dissertation explored the dynamics of innovation in the establishment of Water Supply and Sanitation Community-Based Systems of Innovation (WSS-CB-SI) by applying a qualitative methodology in three rural communities in Costa Rica. The

hypotheses tested the contribution of the participation and capacity of the community in local sustainability and learning by drawing a logic model based upon the conceptual frameworks of Systems of Innovation (SI) and Community-Based/Community-Management (CB/CM), and the Institutional Analysis Development (IAD) theory. Novelty comes with findings making emphasis on the effect of leadership and sense of ownership on both dependent variables, in addition of identifying participation and interaction at decision-making and social venues as innovation drivers.

APPENDIX 1 Case Study Protocol

1. Theoretical Frame

The model to be tested (see Figures 1 and 2) is based on the Systems of Innovation (SI), Community Based/Community Management (CB/CM) and the Institutional Analysis and Development (IAD) conceptual frameworks.

In terms of SI, there are three basic actors: firms, research organizations, and institutions/rules of the game. Interaction among them results in learning in the form of creating, testing, and adopting new products and processes. The pivotal actors of the network are firms whose performances are shaped by research organizations, e.g. universities or public laboratories, upon whose knowledge base firms may draw upon, and by institutions/rules of the game whose enactment may either facilitate or hinder firms' innovation (North 1990). I draw upon Global Systems of Innovation (GSI) framework proposed by Cozzens and Catalan (2008) which is socially-driven and renames SI actors by using the following definitions: Problem Solving Organizations (PSOs) including public utilities, private firms, health services, and Non-Governmental Organizations; Knowledge and Information Organizations (KIOs), covering universities, public laboratories, and R&D centers; and Governance referring not only to norms, rules, laws, but also to voluntary consensus formation among non-governmental groups.

IAD points to the analysis of decision-making situation over course of action involving interaction among bounded rational individuals whose behavior are determined by a certain context and a certain set of rules. IAD is multitier and multilevel conceptual map whose application focuses on a specific activity, the people who take part of such

activity, and the patterns of interaction between them (see Figure 15). It involves an *action arena*, IAD unit of analysis, which includes two entities: an *action situation* and *actors* involved in that situation. The action arena responds to three clusters of variables: a) *rules-in-use*, b) *physical/material conditions*, and c) *attributes of the community*.

CB/CM main goal is to achieve widespread, equitable, sustainable community management, where equitable means no section of the community is left with minimum needs unmet, and sustainable that once the service is provided there is no downgrade in terms of quantity or quality. CB/CM success is defined in terms of a set of intra and extra community factors, the former including *management capacities of the communities*, financing, appropriate service level and technology, and water resources availability, whereas the latter the efficiency/ capacity of intermediate level actors, and the existence of appropriate institutions.

2. Research Question

What are the dynamics of innovation in the establishment of rural Water Supply and Sanitation-Community Based (CB-WSS) systems?

3. Hypotheses

-Sustainability

H1.1 The greater the participation of the community, the greater the CB-WSS sustainability.

H1.2 The greater the capacities of the community, the greater the CB-WSS sustainability.

-Learning

H2.1 The greater the participation of the community, the greater the learning at community level.

H2.2 The greater the capacities of the community, the greater the learning at community level.

4. Unit of Analysis

Water Innovative Event (WIE) which I define as a systemic and collective choice process in which actors involved -Community, PSOs, KIOs, and Governance/Rules of the Games- interact, learn, and make the final innovative decision, with the goal of increasing the sustainability of their CB-WSS system. Two issues are considered once the WIE case selection occurs: a) focus on rural communities, and b) time frame of five years.

In regard to the present dissertation, WIE corresponds to “*Water and Sanitation Sustainable Certification*” referring to the implementation of two publicly-run bottom-up programs in rural communities: the Blue Flag Ecological Program (BFEP) and the Sanitarian Quality Seal Program (SQSP).

5. Variables and Dimensions

- *Sustainability*, the sustained operation of the CB-WSS system. As Schouten and Moriarty (2003) points out successful CB/CM is to provide a fully sustainable and equitable WSS system to a community, sustainable as community members are not

downgrade to lower level of water in terms of quantity and quality, and equitable as none of them is left with unmet needs.

Community, group of people living in a common geographical location, sharing a common development goal, ruled by a set of norms where solidarity is the guiding principle, and with a heterogeneous socio-economic structure.

- *Participation of the Community*, conceived of as combination of three variables administration, interaction and sense of ownership:

Administration, describes the participation of community members in the administration of the local WSS governing body, the Association of Rural Water and Sanitation System (ASADA), either as holders of administration positions or regular participants of the decision-making process;

Interaction, refers to the dynamics of the participation of community members at the WIE -that is the local implementation of the Blue Flag Ecological Program (BFEP) and the Sanitarian Quality Seal Program (SQSP)- in regard to activities not related with holding administration positions nor the decision-making process, that is ranging from interaction with solution providers to participation in social gatherings leading to WIE.

Sense of Ownership refers to whether community members perceive the WSS system as their own; willingness and ability to pay the service fee and the enforcement of collection rules are dynamics to consider.

Capacities of the Community as a combination of two variables:

Skills, refers to the capacities the community members have, in terms of education and training. To achieve sustainability the community should be provided with the right competences to be able to fulfill its role as the local decision-maker. Having illiterate

individuals working in the water committee may damage the odds of succeeding as well as local residents with basic Operation and Maintenance (O&M) knowledge may increase them;

Leadership, refers to the leadership exercised within the community which may have either positive or negative effects by efficiently managing local resources or leading community members to lingering conflicts and disputes, respectively;

6. Data Gathering Plan

The dissertation draws upon primary and secondary sources. In regard to primary sources, in-depth interviews to ASADA members, PSOs and KIOs will be conducted on the field.

Three case studies on rural communities in Costa Rica operating under the ASASA scheme and participating at BFEP and SQSP will be made. Two criteria will be taking into account for case selection: a) the sustainability of the ASADA's WSS system measured according to their total number of BFEP-CC and SQSP stars, and b) the learning capacity of ASADA members measured according to their secondary education level. The sample will present varying sustainability and learning capacity, with the two ASADAS having high sustainability carrying diverging learning capacity, and the two ASADAS having high learning capacity carrying diverging sustainability

To set the interviews I will contact interviewees either by email or by phone and drawing upon Water National Laboratory (WNL) professionals and Universidad Nacional de Costa Rica Interdisciplinary Water Research and Management Program (UNA-PRIGA) researchers.

Interviews will be recorded provided interviewees agreed upon and a digital copy was stored in a computer and notes will be made on the field and in the aftermath of each interview.

Secondary sources will also be drawn upon, particularly reports, documents, theses, brochures and newsletters from local and international organizations. In terms of learning capacity the National Institute of Statistics and Census of Costa Rica (INEC) was consulted to provide information on educational level at county level.

7. Interview Protocol

Questions included in the interview protocol are presented in Table 1 regarding each variable already mentioned. PSOs and KIOs professionals, public officials and community members would be interviewed, therefore the protocol structure will vary according to the interviewee.

8. Data Analysis and Reporting

The raw data consists of:

Interview notes taken during and after the interview, respectively.

Reports, documents, brochures, journal articles, and other types of publication provided by interviewees and personal searches.

The analysis will be done as follows:

Notes will be taken during each interview complemented with others taken afterwards over hearing each recording.

Final version of interview notes will be loaded into the Nvivo software.

Coding will be set according to the variables involved in the analysis that is nodes will be set as references to sustainability, learning, participation of the community - administration, interaction and sense of ownership-, and the capacity of the community – skills, leadership, sense of ownership-.

With coding behind, I will generate Nvivo query/matrices by crossing dependent and independent variables regarding each hypothesis.

Table 1 Variables of the Model

Variable	Definition	Categories/Dimensions	Question	Source
Sustainability	Sustainability of the CB-WSS system in terms of non-failure operation and coverage	-Number of BFEP and SQSP stars	-How many BFEP and SQSP stars the ASADA has been awarded?	Primary Sources -WNL officials -ASADA Board -Local residents Secondary Source -WNL records
Learning	New competences or new capacities	-Number of new competences -Number of new capacities -Number of new activities community members are involved.	-What new competences and capacities have you acquired along the way? -Do you participate in activities that you were not able before	Primary Sources -Local residents -Solution providers (PSOs, KIOs)
Administration	Participation of local residents in the administration of their WSS system	-Number of local residents holding administration positions at the ASADA and BFEP local committee. -Number of local residents attending the General Assembly	-How many local residents hold administration positions at ASADA and at the BFEP local committee? -How many local residents attend the General Assembly? -How do the ASADA and BFEP operate?	Primary Sources -ASADA Board -BFEP local committee -Local residents

			-How decisions are made at the ASADA and at BFEP?	
Interaction	Interaction dealing with participation of local residents at BFEP and SQSP initiatives.	-Number of BFEP and SQSP initiatives organized locally during the period under scrutiny. -Numbers of meeting between local residents and WNL official at the time BFEP and SQSP were implemented -Number of people attending both types of activities	-What BFEP and SQSP initiatives are organized locally? -How many people attend those initiatives? -Did WNL officials meet local residents during BFEP and SQSP implementation period? -What has been the role of the local school and other local organization at BFEP? -Have you or the ASADA interacted with other organizations?	Primary Sources -ASADA Board -WNL officials -Local residents -PSOs and KIOs professionals
Sense of Ownership	Sense of ownership among local residents over their WSS system	-Water Fee/household income -Number of community members paying WSS fee -Amount of WSS fee	-How many local residents pay their WSS fee? -How much do you pay for your WSS service? -What are the rules of the fee collection system? -Do you pay regularly your WSS bill?	Primary Sources -ASADA Board -Local residents

				-Are you satisfied with service? -How much of your monthly budget you spend on paying your WSS fee?	
Skills	Skills and educational background of local residents	-Local residents with primary/secondary/tertiary education -Number of local residents who have attended a training program	-How local residents have primary/secondary education? -How many local residents have attended a training program?	Primary Source -ASADA Board Secondary Source -INEC database	
Leadership	Type of leadership within the community	-Number of WSS conflicts within the community. -Number of years with non WSS conflicts. -Number of turnovers in the WSS management	-How do you evaluate the leadership of the head of the water committee or of the community leaders? -Have any conflict happened? -How long with non conflicts among local residents? -How many times the President of the ASADA Board has been removed?	Primary Source -ASADA Board -Local residents	

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