ABSTRACT

Title of Document: **MANAGING WATER: EFFICIENCY-EQUITY TRADEOFFS IN THE PARTICIPATORY APPROACH**

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This dissertation investigates the hypothesis that participation can overcome trade-offs in equity and efficiency. Literature within the field of economics and sociology has argued for tradeoffs in outcomes of allocative efficiency and equity and institutional efficiency and equity, respectively. Community-based participatory institutions are expected to overcome this tension by introducing institutional accountability and local-level decision making, which serve to enhance technical and allocative efficiency while retaining mechanisms for equitable allocation and empowerment. This research draws on fieldwork from a community-managed water supply program in rural Bahia, Brazil to examine whether outcomes of efficiency and equity are mutually compatible. Findings from the field research indicate that explicit and implicit subsidies to the water supply systems led to outcomes of allocative

equity in the sites visited, but that these generated tradeoffs with allocative efficiency. Findings from the research also indicated that the community organizations were relatively efficient in their administrative practices, but that this efficiency came at a cost to equality of membership and voice in the community organization. This suggests that participatory water supply programs generate certain and specific costs, although the findings also suggest additional positive externalities associated with participation.

MANAGING WATER: EFFICIENCY-EQUITY TRADEOFFS IN THE PARTICIPATORY APPROACH

By

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Chapter 1: Introduction

Recent perceptions of water as a scarce resource have brought a renewed focus on the dual goals of efficiency and equity and the need for appropriate institutions to achieve these goals (ODI 2002). The emphasis on outcomes of efficiency and equity as critical objectives culminated in widespread support for the internationally recognized Dublin Principles[1] of 1991 that not only highlighted the need to re-conceptualize water as an economic good to maximize efficiency, but recognized the need for equitable allocation and the stronger role of women in access and distribution (Global Water Partnership, 2003). Since then, the focus in water resources management has shifted attention to developing institutional configurations that could achieve outcomes of both economic efficiency and distributional equity.

The need for water management institutions to improve both efficiency and equity is particularly important for the lesser developed countries. Efficient[2] management of water resources limits water losses, which is especially important in areas of frequent drought or other types of water poverty and is critical to incomes and livelihoods of the global poor. However, the equitable[3] distribution of water resources, likewise, remains an important priority; access to clean drinking water prevents waterborne diseases, water is critical to food production, as well as numerous other industries and is essential for human and other life. In lesser

[1] The Dublin Principles are a set of four principles that relate to the definition and use of water as an economic good but also a critical right for humans. These four principles were adopted after the International Conference on Water and the Environment (ICWE) in Dublin, Ireland that took place between 26 and 31 January 1992.

[2] Defined as maximizing outputs with a given set of inputs, the typical usage with respect to water resources focuses on limiting water losses, and allocating water to the most productive uses.

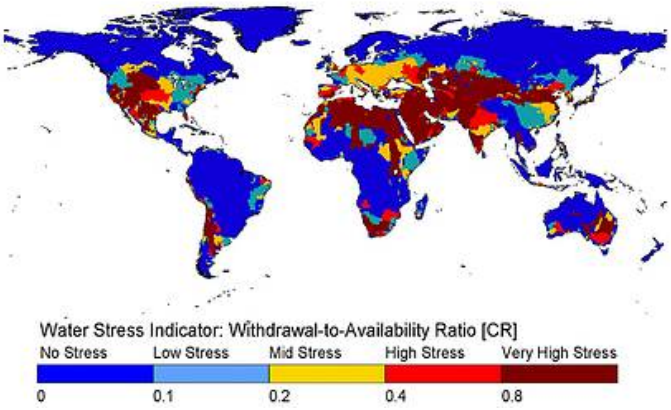
[3] Defined as the allocation of water resources that is considered to be fair by all users, this can include equal allocation of the water to all users, but also other allocative arrangements that users consider to be fair.

developed countries, the challenge to develop institutions for both efficient and equitable distribution of water resources remains a challenge.

This challenge is perhaps best seen in the following two figures that show the importance of institutions in managing water resources both efficiently and fairly. The first figure shows water scarcity, which is a purely physical measure that looks at the availability of water on a per capita basis. Differences in water scarcity here can be attributed to population density and availability of water resources; for example, China has less water than Canada and forty times as many inhabitants, and India sustains 20 percent of the earth's population on four percent of global water resources (Specter 2006). Thus, areas of high population density and low water stocks are at greatest risk of facing future shortages[4]. As seen by the highlighted areas in the figure below, many of the areas under water stress are located in middle or lower income countries (such as India, Iran, Jordan, Syria, Iraq, parts of China), but also in higher income countries of the United States and parts of Australia.

[4] While some debate continues over the role of technology in providing freshwater resources in the future, growing populations, especially in areas of relative water scarcity, indicate futures of rising water stress.

Figure 1: Water Stress Indicator[5]



Source: World Water Council

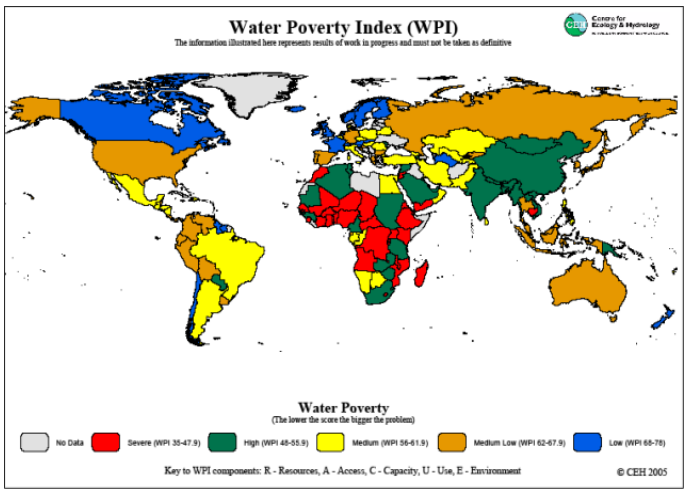
However, the figure below measures water poverty, that adds additional dimensions of water scarcity, including access and availabiltiy. Here, low-income countries feature heavily among nations considered to be water poor: of 147 countries included in the Water Poverty Index[6], most of the countries experiencing higher rates of water poverty are either developing or middle income countries[7] (Lawrence, Meigh, and Sullivan, 2002). Figure 2 shows national level representation of water poor countries:

[5] The Water Stress Indicator shows the balance between water use and water resources. As such, it "measures the proportion of water withdrawal with respect to total renewable resources. It is a criticality ratio, which implies that water stress depends on the variability of resources. Water stress causes deterioration of fresh water resources in terms of quantity (aquifer over-exploitation, dry rivers, etc.) and quality (eutrophication, organic matter pollution, saline intrusion, etc.)" (World Water Council)

[6] The Water Poverty Index is defined as "The idea… to combine measures of water availability and access with measures of people's capacity to access water. People can be 'water poor' in the sense of not having sufficient water for their basic needs because it is not available. They may have to walk a long way to get it or even if they have access to water nearby, supplies may be limited for various reasons. People can also be 'water poor' because they are 'income poor'; although water is available, they cannot afford to pay for it.

[7] For example, the top ten countries facing the least water poverty are (in descending order) Finland, Canada, Iceland, Norway, Guyana, Suriname, Austria, Ireland, Sweden, Switzerland, and the United Kingdom. The ten countries facing the highest water poverty are (in ascending order) Haiti, Niger, Ethiopia, Eritrea, Malawi, Djibouti, Chad, Benin, Rwanda, and Burundi (Lawrence et. al., 2004).

Figure 2: Water Poverty Index



Source: Oxford Centre for Water Research

These two figures highlight the importance of institutions in mediating access and distribution of water resources. Many countries, most notably in Africa, actually have abundant physical resources, but exhibit high water poverty because of how water is distributed. This observation was the focus on the UN's 2006 Human Development Report (HDR) that argued that water shortages were driven primarily by management of available resources. Addressing water management, then, was the key to improved provision of water supply services that were critical not only to human life, but also to reducing waterborne diseases and, in some areas, potential conflicts (HDR 2006).

Challenges to the state's monopoly over water management institutions has led to increased focus on the variation in nature and form that water management institutions could take to optimize the distribution of water resources. Historical precedents viewed water as a limitless resource, and the state played a strong role in

distribution largely where the resource best furthered state policy or objectives[8]. However, the state's track record, particularly in developing countries of inefficient and unequal distribution (De Ferranti, Perry, Ferreira and Walton 2004) created an opportunity for alternative institutional configurations to emerge. The Washington Consensus[9] first challenged this perception of resources as within the state's domain to distribute, arguing that market mechanisms and private enterprises are more efficient in their distribution. More recent popular opposition to privatization of water services has given rise to a "third way" in public service delivery broadly: the participatory approach.

The participatory approach is wide-ranging and takes many forms, but is fundamentally premised on the notion that local level management of resources can improve both efficiency and equity in service delivery. The approach has been used across a variety of public services, including budgeting, water supply, electricity provision, and housing, with varying degrees of success. But, where it has been effective, the particular institutional configuration, whereby users engage in local-level decision-making to allocate and distribute services, has delivered promising results, bypassing cumbersome bureaucratic management for more locally sensitive and accountable public service delivery.

[8] Even in societies of the ancient Mediterranean and Near and Far East, elaborate irrigation and water supply systems with dams and aqueducts, administration of water was highly centralized and water was the property of the state. The role of water in irrigation and industrial production was critical to state power, and this legacy continued into the medieval and industrial eras (Getzler 2004).

[9] The term Washington Consensus, first coined by John Williamson in 1990, is typically used to encompass a set of policies that promoted, amongst other things, fiscal discipline, trade liberalization, tax reform, privatization, and redirection of public expenditure priorities toward fields offering both high economic returns and the potential to improve income distribution, such as primary health care, primary education, and infrastructure. (Center for International Development, Harvard University, 2003 at http://www.cid.harvard.edu/cidtrade/issues/washington.html)

Decentralization and local level participation united anti-bureaucratic sentiment across the political spectrum and has been promoted enthusiastically for its ability to achieve outcomes of both efficiency and equity simultaneously. Support for the participatory approach to achieve outcomes of both efficiency and equity draws on two different sets of literature. First, the claim that increased participation leads to enhanced technical and allocative efficiency draws on studies developed within new institutional economics and game theory (Ostrom 1990, Seabright 1993, Bardhan and Ray 2008) that argue that where individuals can act as market regulators[10], the outcomes will be more efficient than under state management. Participation allows for preference revelation, and reduces informational asymmetries and corruption through greater accountability that lead to improved allocative and technical efficiencies (Osmani 2007) Greater efficiency in resource allocation will lead to less water wasted, enhanced productivity, increased incomes and consumption, and greater well-being.

Second, strategies of user participation appeal to a theoretical base that advocates for empowerment and enhanced equity, with little said about market efficiency. Participation creates opportunities for the poor and otherwise marginalized to be heard thereby creating opportunities for empowerment. In addition, when people are able to participate, then those who were previously marginalized will be able to exercise their voice in favor of more equitable allocation of the resources. This work draws on theories of empowerment of the poor and

[10] This is conceptualized as the rational economic individual that maximizes self-interest. Historically, state management of common pool resources was justified based on failures of collective action (Hardin 1968, Olson 1965). However, new institutional economics and game theory argue that individuals can enter into repeated interlocking games in collective institutions, since these provide a regulation mechanism to increase the cost of cheating.

marginalized as key to social change (Alinsky 1969, Freire 1973, Rappaport 1985). Inequities result from a set of power relations that continue to marginalize sections of the population, and a shift in these relations will increase equity by creating opportunities for voice and accountability. Thus, participation not only achieves greater equity by extending the vote (and hence voice) to all users, but in doing so, the outcomes achieved through consensus will likely be less discriminatory, or, more equitable.

Critiques of the participatory approach have typically been organized around two points. First, some critics point to the fundamental incompatibility of participation as a process of awakening, and participation within broader state structures. These authors have pointed to the 'radical' roots of participation (Mohan and Stokke 2000), arguing that development programs have co-opted and depoliticized the participatory process. The theoretical origins of participation advocate for transformative social change (Alinksy 1969; Rappaport 1985) that ultimately leads to a shift in power relations (Arnstein 1969; Freire 1970, 1973). Promoting active participation allows for the otherwise marginalized to voice their preferences leading to improved institutional accountability and greater equity in the allocation of resources (Osmani 2007). A second set of critiques has focused on how the participatory approach has been implemented, indicating that these implementations have largely ignored local cultural values and understandings. Scholars in this vein have criticized development programs for ignoring complex social realities (Mosse 2006; Scott 1998; Guijit & Shah, 1998; Meinzen-Dick & Zwarteveen, 1998), conceptualizing communities as harmonious (Lyons et al 2000;

Brent 2004) and static (Waddock 1991), discounting power relations within communities (Cleaver 1999; 2000) and overlooking the knowledge or training needed to participate (Depoe et. al. 2004).

However, few critiques have focused on the claim that participatory institutions can bridge these differences to achieve outcomes of both efficiency and equity. The compatibility between outcomes of efficiency and equity is often contested. Literature from the field of economics has argued that the market, as an allocating mechanism, is wholly efficient, but unequal. The state, on the other hand, can ensure equitable allocation, but this comes at a cost to efficiency. This relationship was most famously articulated by Arthur Okun (1967) who argued that state regulation of market allocation served to ensure equity, but that this came at a cost to efficiency analogous to a "leaky bucket". Thus, allocating goods and services equitably would create a tradeoff with efficient allocation.

Within the field of sociology, the administrative process within local level organizations also exhibit incompatibilities between efficiency and equity. Max Weber (1921/1978), for example, argues that local level institutions created expressly to preserve equity would tend to be undermined by the complexity of technical tasks, or adopt patterns of participation that favored elites. These institutions, he argued, were fundamentally unstable, and ultimately goals of efficiency would come at a cost to equity. Thus, the classical sociological literature also argues for the fundamental incompatibility between outcomes of efficiency and equity within organizations.

This research investigated the hypothesis that outcomes of efficiency and equity can be achieved within community-based participatory organizations to

manage water resources. To investigate this claim, this research drew on field work in Bahia, Brazil. Brazil provides a good backdrop to assess the compatibility of efficiency and equity for a few reasons. First, while the country has some of the largest freshwater reserves on the planet, they are unevenly distributed, and areas of the northeast—that already face high rates of poverty and economic stagnation—are also at risk for severe and frequent droughts. Second, Brazil's constitution of 1988 laid the groundwork for pro-equity policies and environmental rights that were pursued in subsequent administrations (De Ferranti, Perry, Ferreira and Walton 2004), and some of these sought to elicit greater participation of the historically marginalized populations. Indeed, as Jacobs (2002) notes, the environmental movements have played a key role in bringing about democratization in transitional economies, and the broader legislative framework for water resources places management at the lowest possible level, and advocates for strong participation on the part of water users. Finally, Bahia's semi-arid region, a long history of drought and outmigration, as well as the need to improve water supply to rural areas has meant that community-based water programs have been active in the region for quite some time. One such program, the Central program, is often cited as a best practice example (UN 2002), and with over ten years of experience in providing water supply services to over 45 local municipalities in Bahia's semi-arid region, the program provides a compelling case study wherein to investigate outcomes of both efficiency and equity within participatory organizations.[11]

[11] The communities supplied under the Central program are otherwise ineligible for state provision of water supply and sanitation; given their small size and relative remoteness, the state water company has deemed it to be ineffective cost-recovery wise.

Research was conducted in the form of individual and focus group interviews in six communities that are part of the Central program and that exhibited varying levels of participation (high, medium and low), as well as with key informants at the local, state, and national levels in Brazil. The goal of the research was to measure outcomes of both allocative efficiency and equity as well as organizational efficiency and equity within each of the community water management organizations. These outcomes were then compared to assess whether (i) efficiency and equity were compatible processes, or whether they generated tradeoffs; and (ii) what the role of participation was in overcoming tensions between efficiency and equity.

Findings from the field research indicated partial support for the hypothesis that efficiency and equity could coexist. Specifically, the research found that explicit and implicit subsidies to the water supply systems led to outcomes of allocative equity in the sites visited, but that these generated tradeoffs with allocative efficiency. However, the research also showed that community organizations exhibited signs of efficiency in their administrative practices, although this efficiency came at a cost to equality of membership and voice in the community organization. Thus, while both types of efficiency and equity generated tradeoffs, the end result was that the systems exhibited allocative equity that was compatible with organizational efficiency.

Findings from the research were less clear on the question of the role that participation played in overcoming incompatibilities between efficiency and equity. First, the research hoped to capture variations in efficiency and equity that was linked to patterns of participation on the community level. Unfortunately, only municipal level data were available on allocative efficiency and equity, making it difficult to li

nk any variation with differences in participation. And while community-level data were available for organizational efficiency and equity, there was no clear pattern linking variations in participation with outcomes of efficiency and equity. Second, the research attempted to link participation with evidence of intermediate mechanisms that led to outcomes of efficiency and equity, especially on accountability. Here there was also no clear pattern linking variations in levels of participation with consistent variations in accountability, or other intermediate mechanisms. Part of this is likely due to the small sample of communities visited; with only six communities it was difficult to ascertain patterns in participation that were not immediately attributed to local level characteristics or specific histories of the community for broader applicability. Thus, the hypothesis that mechanisms of accountability introduced through participation were critical to outcomes of both efficiency and equity was not found to be substantiated.

The implications of this research are threefold. First, this research indicated that for the communities investigated, outcomes of allocative efficiency and equity were not compatible, but rather favored outcomes of equality of access. While this is a critical priority, and one that is generally politically popular, the dependence of the Central program on state subsidies can also compromise the scope that participation is able to take within the program. Scholars critical of how participation has been co-opted within development argue that the dependence on state financing shapes the role of participants to be little more than the implementers of a state-driven program (Mohan and Stokke 2003) or the consumers of a state service (Darcy 1993). In addition, given the high level of dependence on state resources for survival, it is

unclear that the program can be expanded beyond its current stage to include more communities without access to water resources because of funding issues. This brings up broader issues of equity and sustainability beyond the current scope of the program. Second, the role of participation within the community organizations did not seem to have any effect in curbing elite capture. At times this could benefit the community, and at times it did not. Finally, the nature of participation varied in scope and importance from community to community, although on a broad level it was not critical to the survival of the community organization or to the continued delivery of water services. However, this research indicated preliminarily that the participatory community-based institution could provide some counterbalance to broader systems of the politicization of water resources.

This dissertation is organized in the following way. Chapter 2 discusses the origins of the participatory approach in water management. It first provides an historical overview of the evolution of water management policies, and then discusses the emergence of the participatory approach and community management as an alternative provider of water supply services. This section also highlights the changing emphasis in water management to include the primary objectives of both efficiency and equity as critical to resource sustainability. The chapter then turns to the three theoretical paradigms that allow me to address the debates on the compatibility of goals of efficiency and equity in participatory water management. Chapter 3 describes the emergence of participatory water management in Brazil's northeastern semi-arid region. The chapter begins with an overview of water

management policies in Brazil at large, and then a history of drought, water, and politics in the state of Bahia. It then turns to the emergence of alternative service provision of water supply services in the western semi-arid region of the state, and specifically the program that was investigated as a part of this dissertation. Finally, it provides a detailed overview of the Central program in the district of Seabra. Chapter 4 outlines the general methodology used in the study, and the data collection methods. It then goes on to describe the communities visited and provides some general information of the respondents, including socio-demographic data. It then provides a description of the research design, with the specific measurements used for participation, efficiency and equity, and describes how I went about collecting information on each of these concepts. Chapter 5 presents the findings of the research beginning with a presentation of concepts of allocative efficiency and equity, and followed by organizational efficiency and equity. The chapter then goes on to discuss the development model and presents findings from the research on the extent to which the development model was reflected on the ground. Finally, Chapter 6 presents the main conclusions and implications of the research.

Chapter 2: Literatures of Interest

The participatory approach to water management lies at the intersection of literature on the administration of natural resources and ideas of decentralization and community management. How society conceptualizes and relates to water has implications for the administrative structure over the environment; major shifts in how water is perceived, from embedded to separate from social life and from being an infinite to a finite resource, has driven decisions over allocation and distribution of water (Khanal 2003). During periods of modernization and industrialization, societies viewed the natural environment as an unlimited resource base to be exploited for maximum gain, and the administrative structure best suited to its efficient exploitation was a large public agency. More recent perceptions of water as a finite resource have shifted the emphasis in water management towards resource sustainability, efficient water use, and equitable access and distribution.

Participatory water management also draws on ideas of decentralization and local participation. Strong anti-bureaucratic sentiments from across the political spectrum have challenged large public agencies and state management of public resources, arguing that the top-down managerial approach resulted in practical inefficiencies and inequalities in service delivery, as well as degradation of the environmental commons and interference with rural livelihoods (Saito-Jensen unpublished). In addition, the practical recognition of the state's inability to extend and enforce regulations, and the frequent and serious conflicts over access to resources (Agrawal and Gibson, 1999; Arnold 2001) were critical to the emergence and broad based support of the participatory approach to water management.

Most importantly, the participatory approach promised to achieve outcomes of both efficiency and equity in water management. The growing concern over resource scarcity highlighted the need for both efficient water provision, on the one hand, as well as continued emphasis on equity in distribution. Where literature from the disciplines of economics and sociology has pointed to tensions between these outcomes, the introduction of participatory mechanisms seemed to be able to overcome these tradeoffs. This dissertation aims to critically assess this claim.

This chapter is divided into two sections. The first section presents the overlapping literatures in which the participatory approach to water management is grounded. A background of water management policies and administration types is followed by an overview of the broader trend of decentralization and participation in public service delivery. The second section of this chapter then outlines the theoretical frameworks used to examine the compatibility of outcomes of efficiency and equity in participatory institutions. The 'development model'[12] presents these outcomes as compatible, since mechanisms of accountability result in improved efficiency and equity. Insights from both Okun and Weber, on the other hand, argue for the fundamental incompatibility of these goals.

A. Background of Water Management Policies

Throughout history, water management institutions have taken on a variety of forms, from large-scale bureaucracies to local level councils that have defined rules over access, rights, and ownership (Getzler 2004). Much of the variation in how

[12] So called because of it's widespread use in development programs and institutions.

water was administered has been driven, in part, by the characteristics of the water resource- such as whether it was groundwater or surface water, the volume and flow of water, the frequency of droughts or other seasonal issues- as well as by what the water was used for and the cultural perceptions of water. Different periods saw greater intensity of use for navigation, irrigation, water supply, hydropower or industry, and each of these saw diverse ways that access and usage rights were defined and enforced (Teclaff 1972, Getzler 2004). The history of water resources management is extensive, and much of it lies outside the scope of this dissertation. Instead, this research argues that the starting point for discussions of participation in water management as it is conceptualized today begins with two marked shift in the perceptions of water: (i) the separation of the natural environment from humanity; and (ii) the recognition that resources are finite.

The following section presents these two critical shifts within water management that occurred to shape the debate on participatory water resources management today. The first section looks at how modernity introduced a conceptualization of water as separate from the human condition (Kapoor 2001). As such, the efficient extraction and exploitation of water became a critical priority, and large public bureaucracies decided questions of allocation and distribution. The section then presents the second major shift in water management where evidence of resource depletion introduced notions of water stocks as finite (ibid). Limited resources and issues of scarcity necessitate decisions of allocation and distribution to introduce the dimension of equity, in addition to efficiency. This opened an

opportunity for alternative provision and management of water resources, most notably through participatory locally based institutions.

Water Management in the Modern Era: efficiency and bureaucratization

The role of water in social life is complex and variant. Large public bureaucracies directed water use as early as Antiquity and society viewed water as an input to production that benefited the state, such as through large irrigation schemes (see, for example, Getzler 2004). But the cultural significance and meaning of water goes far beyond production inputs or unit of consumption, and many people understood water to be mystical and holy source or a gift from god, among others[13]. In addition, the intricate water is often part of complex cleansing rituals and viewed as sacred to human life.

Modernity marked a decisive shift in the perceptions of and relationships to water where it was no longer viewed as embedded within cultural practices, but viewed, rather, as a resource that was separate from the human condition. This allowed for a broad conceptualization of water as a pure input towards achieving higher levels of socio-economic growth and development (Kapoor 2001). This shift was grounded in the ideology of the Enlightenment and the Age of Reason that ushered in beliefs of scientific progress and technological capabilities to achieve higher standards of living. Mystical understandings of water were decried as

[13] For example, several scholars have pointed to how cultural understandings of water in the Muslim world draw on key texts in the *Qu'ran* that emphasize the social nature of water, and emphasize issues of equity in distribution (Faruqi 2001). In addition, water plays a critical role in faith, in practices of abolution and cleansing (De Chatel 2002). This creates a fundamental divide between a prevalent view in the Western world (and, by extension, underpinning many international development institutions) that water can be privately owned and managed, because of the critical role it plays in social life (Faruqi 2001).

backwards, and future progress could be improved with the raw potential of water as an input to hydropower, and mechanized agriculture, among others.

The implications of this on water management are threefold. First, modernity served to separate humans from their natural environments and re-conceptualized nature as a resource to be exploited without limit for human gain (Kapoor 2001; Scott 1998). Second, the exploitation of these resources was presumed to be best done through state management, given the cost-intensive infrastructure that technologically driven solutions to water management necessitated (Meinzen-Dick 1997). And finally, the administrative structure best suited to exploit water resources with the greatest efficiency[14] for the state was a bureaucracy.

(a) Rationalization of nature

The growing prominence of science and reason, coupled with a permeation of means-end rationality in all spheres of social life resulted in attempts to discern and understand the social world, including nature, according to scientific and rational orderings. This drew on tenets from the Enlightenment and the Age of Reason that emphasized scientific objectivity and reason above mystical beliefs, and was accompanied by the specific historical religious traditions of the Protestant sects in Western Europe that saw the advancement of means-end rationality (*zweckrational*) above other forms[15] (Weber 1921/1978). While rationalization of social life had

[14] Here the efficiency refers to the ability of the administrative structure to complete tasks efficiently, making bureaucracies the preferred administrative structure used to manage public resources

[15] The other types of rationality include value-oriented rationality, where actions are rooted in a value or ethical system but means to achieving them are rational, affective rationality, where actions are driven by emotions, and traditional rationality, where actions are rooted in customs or traditions. Modernity, Weber argued, places increasing emphasis on means-end rationality, where both the goal and the means to achieve the goal are driven by concerns of efficiency maximization.

generated scientific and technical progress that had the possibility to achieve expanded production and the growing satisfaction of human needs, it also resulted in attempts to master nature (including human nature) and to "design …social order commensurate with the scientific understanding of natural laws" (Scott 1998: 4).

Rationalization of social life changed the way that nature was viewed, administered and even organized as modern nation states attempted to order the natural world to better oversee its exploitation. Scott (1998) argues that with modernity, nature as a habitat disappeared to be replaced by the view that nature offered a resource to maximize state taxes, revenues and profits. This shift is perhaps best revealed through a change from the "term 'nature' [to]... the term 'natural resources,' [which focuses]… on those aspects of nature that can be appropriated for human use" (Scott 1998: 13). This served to permanently separate nature from the human experience to be viewed as a limitless resource and to be exploited without consequence for socio-economic growth (Kapoor 2001).

(b) State Management of Water Resources

The emphasis on science, reason and technology to propel societies into a modern, and hence better, era, necessitated the strong lead of states for investment and oversight. Water resources were conceptualized as an input to industrial growth and expansion of services that were believed to signify progress (Scott 1998). States were responsible for decisions over allocation and distribution. This was justified based on (i) the historical precedents in Europe that viewed water as a common good; (ii) the scale of capital and resources needed for investments in large-scale

infrastructures; and (iii) the need for state management of common pool resources to counter failures of collective action.

The early modern nation state in Europe based its administrative rights over surface water on historical precedents such as the Roman Code and the Code Napoleon that defined water as a public resource with specific usage rights (Teclaff 1972).[16] This precedent carried into the modern era, although modern nation states tended to favor usage rights that involved state-led industrialization projects. These programs attempted to engineer social progress (Scott 1998) through investments in large-scale infrastructure such as the construction of dams, diversion technology and large canal systems, as well as comprehensive urban water supply schemes. Not only was this infrastructure often too large and costly to be maintained by small collectives (Johnson III, Svendson and Gonzalez 2004), but state control of natural resources was justified on the following grounds: (i) water management often has been viewed as a public trust, where the state is responsible for a common resource; (ii) infrastructure facilities necessitate initial investment costs that are believed to create a natural monopoly; (iii) the water supply has a strategic importance for food security (Meizen-Dick 1997).

State management of water resources was further justified on the inability of individuals to act collectively. Interdependent societies were associated with the feudal era and with greater inequality, poverty, backwardness and communal

[16] Under the Roman Code, water was defined as a public resource, and rights to usage had to be authorized. Under the Code Napoleon, water was also considered to be a public resource, although ownership of waters on private land were granted rights of use, provided they did not interfere with water flows, such as through large-scale diversion.

obligation[17]. Modern nation states, on the other hand, were associated with progress and scientific objectivity and could usher in a new era of well being. The individual in modernity was seen as inherently free, and whose association with others in society was rational, specific, limited and voluntary[18], and free from communal responsibility. This logic was the foundation for later works to show that without individual incentives collective action would fail (Olson 1965), and that the scope for collective action in communal resources, without oversight or incentives, would lead to their degradation (Hardin 1968)[19]. This dichotomy also meant that objections or resistance to modernity and subsequent modernization projects was seen as impeding progress. Where water sources had been managed communally, modernist ideology argued that state intervention was justified both because the natural law of man negated the possibility for communal relationships to survive in the modern era, and because the state would be instrumental in attaining greater efficiency in resource extraction through large-scale investments in dams, canals, and water supply systems (Meinzen-Dick 1997).

(c) Maximizing Efficiency in Administration: the Bureaucracy

Greater focus on nature as an input to higher growth levels necessitated an administrative structure that allowed for an efficient ordering of the natural world. As

[17] Rousseau, for example argued "From the moment one man began to stand in need of the help of another; from the moment it appeared advantageous to any one man to have enough provisions for two, equality disappeared, property was introduced, work became indispensable, and…slavery and misery were soon seen to germinate and grow…" (Rousseau, 1913: 214).

[18] As Nisbet (1966:49) notes, the Enlightenment philosophers promoted a new social order that "must rest on man not as guildsman, churchman, or peasant, but as *natural* man, and it must be conceived as a tissue of specific and *willed* relationships which men freely and rationally enter into with one another".

[19] Hardin (1968) advocated for greater privatization of communal resources to avoid a tragedy of the commons scenario, although his argument was also used as further justification for state regulation of certain public goods where privatization was not considered.

means-end rationality permeated authority structures, Western European states saw a shift away from traditional and charismatic authority types to an impersonal form of authority that Weber called 'rational-legal'[20] (Weber 1978). The hallmark of this new authority, the bureaucracy, represented the most efficient means of administration; the bureaucracy is the typical expression of *rationally regulated* association within a structure of domination, that

> is capable of attaining the highest degree of efficiency, and is in this sense formally the most rational known means of exercising authority over human beings. It is superior to any other form in precision, in stability, in the stringency of its discipline, and in its reliability. It thus makes possible a particularly high degree of calculability of results for the heads of the organization and for those acting in relation to it. It is finally superior both in intensive efficiency and in the scope of its operations and is formally capable of application to all kinds of administrative tasks (1978: 223).

Bureaucracies were particularly well-suited to the efficient administration of water, since this was a resource considered to be publicly owned, and thus in the state's administrative domain.

The technical superiority of the bureaucratic structure allowed for optimum levels of "precision, speed, unambiguity… reductions of friction and of material and personal costs" (Weber 1978: 973) making it particularly well suited to the early modern nation state's desire to maximize revenue through enhanced legibility and extraction (Scott 1998). While bureaucracies as an administrative structure have always existed,[21] their growing predominance in all aspects of social life reflected,

[20] The others: *traditionally* prescribed social action is typically represented by *patriarchalism*; *charismatic* structure of domination rests upon individual authority which is based neither upon rational rules nor upon tradition (Weber, 1978: 954)

[21] Weber points to a number of historical examples of bureaucratic administrations, most notably in the Roman Empire and Egypt. In fact, the latter, Weber notes that in Egypt, the "oldest country of

Weber argued, the increasing ubiquity of means-end rationality that was particularly prominent in scientific reasoning. The permeation of means-end rationality above other forms would, however, eventually have detrimental effects for individual freedom; means-end rationality focuses on achieving goals (whatever those goals might be) in the most efficient manner possible, as opposed to other forms of rationality where value-based judgments of the goals were still present.

This had several effects on social life. First, the bureaucracy did not take values into account when weighing goals, instead focused on the most efficient means of achieving those goals, whatever those goals might be.[22] This had a particular "dehumanizing" effect, where the more perfectly a bureaucracy executes its efficient attainment of goals, the "more completely it succeeds in eliminating from official business love, hatred, and all purely personal, irrational and emotional elements which escape calculation" (Weber 1978: 975). Second, bureaucracies would come into inevitable tension with democracy over time; as power and authority becomes concentrated within the bureaucracy. This undermines democracy[23] and the goals of equality associated with it[24], the bureaucracy eventually comes to undermine the same

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bureaucratic state administration, it was the technical necessity of a public regulation of the water economy for the whole country and from the top which created the apparatus of scribes and officials…." (Weber 1921: 971-972). Other examples of bureaucracies appeared in Germany's Hansa League, and the Holy Roman Empire

[22] One notable example of this is in Bauman's *Modernity and the Holocaust*, where Bauman argues that the bureaucratic structure was harnessed to seek the most efficient methods to annihilating populations since that was the stated goal of Germany's National Socialist regime.

[23] Defined by Weber as a political concept "deduced from the 'equal rights' of the governed, [and] includes … (1) prevention of the development of a closed status group of officials in the interest of a universal accessibility of office, and (2) minimization of the authority of officialdom in the interest of expanding the sphere of influence of 'public opinion; as far as practicable" (Weber 1978: 985)

[24] The bureaucracy and the rational-legal authorities were in opposition of the inequalities found in charismatic or traditional authority types that used a rule by notables based on personal relationships (Weber 1978: 984). Rational-legal authorities in general, and bureaucracies in particular, initially created opportunity for "social leveling", "equality before the law", and the impersonal application of

democracy that developed alongside it. Thus, "democracy inevitably comes into conflict with bureaucratic tendencies… in so far as [democratization].. is understood to mean the minimization of the civil servants' power in favor of the greatest possible 'direct' rule of the *demos*…" (Weber 1978: 985). The concentration of power and awarding status and privilege to positions were inimical to the principles of equality enshrined with democracy.

The process of bureaucratization had two consequences for water management. First, the designation of oversight and management to public agencies focused the administration of water on goals of maximizing efficiency in extraction to achieve economic growth and progress. This created greater oversight and efficiency over water resources, as well as the financial ability to invest in large-scale infrastructure projects. However, this meant that goals of efficiency, particularly technical efficiency, were pursued, arguable at a cost to other goals (Kapoor 2001).

In addition, the construction of water scarcity was seen to be an entirely a-political process, based on scientific evidence rather than a product of political negotiations. The bureaucracy, as an impersonal structure was assumed to reside outside of political negotiation, and so best able to make decisions over allocation and distribution based on scientific rationality rather than personal preferences. However, even in conceptualizing scarcity and administration from a technical perspective, the access to and rights over water sources were narrowly defined by the state (Tavolaro 2008).

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the law to all, but this tendency was later undermined with the concentration of power, and the emphasis on technical knowledge (Ibid: 987)

(d) Modernization Projects: Engineering Modernity

By the twentieth century, the rapid progress achieved in the West served as a model for emerging industrial states in the world that were looking for development examples to promote their economy and to achieve political independence through emulation of Western nation-states in industrialization and modernization (Peet 1999). Modernization theory argued that investments in large-scale infrastructure would help the process of a nation-state's development from a relatively simple traditional or agrarian society towards a modern and industrialized economy (So 1990). Throughout the developing world large public agencies were created to operate and maintain water resources infrastructure that promised to bring higher levels of efficiency and growth and to propel the world's poor into higher standards of living[25]. The dominant view of water was that it remained a public trust, best managed and distributed by the government, and large subsidies to public agencies were justified on the basis of achieving modernity. The strong role of the state in managing large-scale water infrastructure virtually eliminated users from management (Johnson et. al. 2004)

In Latin America, modernization projects served as a model to expand infrastructure, and other, services that would serve as a catalyst for development. The discussion on development was framed in the context of a modern that was defined much in opposition to but also drawing on notions of the traditional (Canclini 1995). In Brazil, this debate linked notions of modernity with Westernization and attempted

[25] Throughout much of the 1950s and 1960s, modernization projects were typified by a "'blue-print' approach…, characterized by external technologies and national level policies" (Ellis and Biggs 2001: 443), that attempted to bring 'lazy peasants' out of 'backward' agricultural practices into the modern era (Ibid: 439).

to implement a top-down modernization program to propel Brazil into the "creative centers of the West" (Tavolaro 2008). This program was driven by political elites whose dominance over public administration structures gave them the opportunity to expand services and to engineer social progress. But the specific historical development of capitalism in Brazil created institutions that lacked the impartiality of Western bureaucracies and "rather than playing the role of modernizers, local power holders (the "caudilhos") tended to reproduce that centralizing and suffocating form of sociability within their zones of influence, thus obstructing even further the development of the nation" (Tavolaro 2008: 115).

In addition, the inevitable tension between democracy and bureaucratization emerged in Brazil through the institutionalization of patterns of inequality. The end of Brazil's military rule culminated in a transition to democratic rule and a new constitution in 1988 that conferred greater social and environmental rights to its citizens. However, this transition did little to remove the political institutions established during military rule that had consolidated power within the hands of a few. Given Brazil's history of inequality, political institutions and their associated administrative structures served to institutionalize inequality within administrative structures, since bureaucrats were mostly drawn from social and political elites (Tavolaro 2008), thereby further concentrating power among elites.

This was particularly true for the Northeast region of Brazil, where the legacy of landownership, slavery and agricultural production concentrated political power within the hands of a few elite families. Power is closely related to land ownership, and water resources, particularly groundwater resources, are then often within the

usage rights of land holders. This legacy continues into the twentieth century, where a small number of elites and their families remain the dominant political force in the state of Bahia, and government seats and privileges are allegedly distributed according to political loyalties (Arons 2002). This legacy has resulted in some of the highest rates of poverty and inequality in Brazil. The poverty rates in Bahia are also closely linked to access to water resources, both for irrigation purposes, and water supply. Lack of reliable irrigation water means that many subsistence farmers face risks of drought and crop losses, which severely impacts their livelihood strategies. In addition, lack of water supply is linked with higher incidence of waterborne diseases, and poverty (World Bank, 2005).

(e) Challenges to Modernization

By the late 1980s, three challenges to this modernist picture emerged. First, growing concerns over climate change and population growth contested the notion of the environment as a limitless resource. As states worked to devise efficient technologies to attain higher levels of growth, a "bias towards capital-intensive, and hence energy and resource-intensive, industrialization" emerged (Kapoor 2000: 270). It was becoming more apparent that this strategy had obvious and irreversible effects on the environment, and water stocks were rapidly depleting.[26] Large-scale modernization projects were increasingly linked to growing impoverishment of the rural poor in developing countries, whose socio-economic activities depend on access to land, water and forests (Kapoor 2001). These environments were now at risk; the

[26] Most notable among the global examples of this is the rapid degradation of the Aral Sea through expanded cotton production. The Aral Sea shrunk by half between 1960 and 1980, and is, today, considered one of the worst man-made environmental disasters. (Bissell 2003).

large-scale investments in modern infrastructure, such as dams and roads, had, at times, degraded the natural surroundings that were not only important for socio-economic survival, but also integral to cultural and religious worldviews (ibid). This contested the view that nature was separate from the human environment.

Second, state management of water resources was called into question since, particularly in Latin America, it was characterized by inefficient and unequal provision of services that was of poor quality (De Ferranti et. al. 2004). This was fueled by systems of political patronage, where politicians retained control over the public sector through political bargaining, that provided public agencies with subsidies, kept tariffs low, and ensured supporters would occupy managerial positions (ibid). For many Latin American countries, concerns over the environment coincided with the debt crisis that brought periods of fiscal uncertainty and high inflation. In Brazil, inflation rates were particularly severe, 2,398% in 1990 (Little, Cooper, Corden and Rajapatirana 1993). The crises over balance of payments and increased awareness of environmental problems highlighted the need for greater sustainability in resource development as well as the pressing need to revaluate the financial viability of public agencies (ibid).

Finally, bureaucratic public agencies were criticized for cumbersome top-down management styles that reflected little of local needs. Scott (1998) argues that top-down implementation of dams, canals and other diversion technologies attempted to create rationalized units of analysis, such as square plots and straight canal systems that made it easier for the state to account water volume, measure distribution, and ultimately gather tariffs. However, these systems rarely matched local realities, where

informal rules and institutions had adapted to the realities of their particular environments (Mosse 2003; Scott 1998). In Latin America, public agencies were long sites of clientalistic behavior that operated in a wider political atmosphere of patronage (De Ferranti et. al. 2004). The debt crisis of the 1980s called into question public enterprises that were "characterized by low productivity, bloated payrolls, and the rising drain on government budgets" De Ferranti et al. 2004: 206).

(f) Alternatives to State Management: Privatization

Brazil's government responded to the fiscal crisis of the 1980s with widespread reforms to the institutional administration of public services. Most notably, water provision was decentralized to the state and municipal levels, attempts were made to "corporatize" national utilities in the public sector, and to privatize other national utilities. While the underlying goals of expanding service provision lingered from modernization projects, it was becoming clear that state management alone would likely not achieve this result, particularly with limited budgets. Thus, calls to engage the private sector in the water management (primarily water supply and sanitation) intended to correct for inefficiencies, inequalities in access and provision, and for poor quality. However, while private provision of public infrastructure did increase, this expansion did not compensate for the overall declines in public provision that occurred during the financial crises (De Ferranti et. al. 2004)

Privatization was often accompanied with tariff hikes, a move that was particularly contested among the poor[27] and remained a politically unpopular alternative to state management. Public opinion surveys, such as the *Latinobarometro,* have shown consistent negative opinions of privatization that have grown throughout the 1990s as perceived negative effects from privatization continued to occur (De Ferranti et. al. 2004). Much of the discourse around the perceived negative effects resulted over issues of equity; where subsidies were eliminated and tariff hikes ensued, the poor faced difficulties in making payments, and risked being cut off from water provision. This issue of access and equity was reflected in much of the emerging livelihoods and sustainability literature that argued for water as a basic right, rather than as a commodity (Filmer-Wilson 2005; ODI 2004).[28]

(g) Alternatives to State Management: the 'Third Way'

The shift in focus away from the state as leading development opened the door for the locus of change to shift to other realms of social life, including the market and the local level. Ellis and Biggs (2001) argue that grassroots initiatives would not have gained the significant momentum that they enjoyed without structural adjustment and other market liberalization policies that effectively removed the state from its role as service provider. This shifted the focus away from top-down, blueprint approaches to development (or "supply-driven" approaches) to bottom-up grass-roots initiatives

[27] Bolivia's experience with water privatization highlights some of these issues. In 2001, Bolivian citizens took to the streets in protest over rate increases of up to 200 percent. Similar privatization programs elicited largely negative responses from citizens.

[28] The Rights Based Approach (RBA) "presents a framework for the pursuit of human development with human rights standards and principles guiding that process, and international human rights obligations providing the objectives of development" (Filmer-Wilson 2005: 213)

("demand-driven" approaches). Several trends, most notable in rural development, reflect this shift. These included: (i) growing acknowledgement of indigenous technologies; (ii) the advent of 'actor-oriented' approaches that emphasized the role of the poor in determining development outcomes; (iii) disenchantment with government provision of services; and (iv) the rejection of over-arching theories and truths, which drew, in part, on post-modern challenges to meta-narratives (Ellis and Biggs 2001: 443).

Parallel discussions among environmentalists challenged both the state and the market as allocators of natural resources. The legacy of state-led modernization had seen the overuse and depletion of water stocks, and environmentalists grew concerned over questions of overuse and expansion. Concerns over water stocks and future shortages were backed up by alarming statistics. The UN estimates that by 2025, 25 percent of the world's population will begin to feel the results of water shortages. In addition, the world's current freshwater resources are unevenly located across the globe[29], and many arid and semi-arid regions facing water shortages today are located in the global south. This places a disproportionate and immediate pressure on governments of the south to put into place allocative mechanisms to preserve the long-term sustainability of their water resources. Many of these governments, however, face limited capacity to operate and maintain critical water delivery infrastructure. This creates a vicious circle, whereby water delivery is unreliable and wasteful, and users are less likely to pay for services, further decreasing the revenue base needed for costly maintenance. Continued mismanagement of these resources

[29] If water was evenly distributed everywhere, or distributed according to population density, then it could suffice for all. For example, China has less water than Canada and forty times as many inhabitants, and India sustains 20 percent of the earth's population on four percent of global water resources (Specter 2006).

could lead to rapid depletion resulting in increased conflict, migration, health problems and climate change.[30]

The Participatory Approach to Water Management

The participatory approach grew out of backlash towards both state provision of public services as well as the debates over private provision. This, combined with growing concerns over resource sustainability paved the way for a "third way" to management of public resources: community management. Community management made use of participatory ideals, whereby users with a stake in a common resource would decide jointly over allocation and distribution. The precise form and content of this participation varied greatly by location and task at hand, but essentially constituted a range of activities that more actively engaged citizens in the decision-making process. This could include setting policy goals, making collective decisions over allocation of public resources, sharing information, generating systems of accountability, among others. Within water management institutions, greater input and decision-making on the part of users typically ranged from partial to full decision-making over the allocation of water, input to full decision-making on pricing systems, budgeting for operation and maintenance activities, etc. The act of participating was expected to elicit both improved efficiency of service, as well as improved equity in allocation.

The participatory approach draws on two distinct bodies of literature that link to outcomes of efficiency on the one hand, and outcomes of equity on the other. As

[30] For example, cotton production in the then Soviet Republic of Uzbekistan used significant amounts of water at subsidized rates from the Aral Sea, which shrank by more than two-thirds during the 1980s and 1990s. This had devastating effects the climate and on the fishing industry around the lake, affecting livelihoods and health.

such, it bridges anti-bureaucratic sentiments in both the neo-liberal and the soft left communitarian literature (Darcy 1993) that advocate for local management of public services to improve quality and performance.

(a) Participation and the rise of community management

By the 1970s, a new policy paradigm was emerging in the provision of social services, most notably in public housing projects in Britain (Darcy 1999). This policy approach called for the direct involvement of users within a "community" to manage the allocation and distribution of services, thereby ensuring greater flexibility and responsiveness to needs on the local level. This approach brought together several strands of anti-bureaucratic sentiments, from both the rising wave of neo-liberalism on the right, and from "soft left communitarians" (Darcy 1993). These seeming opposed camps were united in their distaste for cumbersome top-down management and argued for improved efficiency of services, on the one hand, and greater equity in distribution, on the other.

Participation was perceived as critical to this policy for two reasons. For neo-liberals, individuals were rational actors within the broader market place, and their participation in decisions of allocation and distribution would better signal consumer preferences. This would better allow the market forces to distribute and allocate goods and services, thereby maximizing efficiency. For the "soft left communitarians", participation harkened back to the radical roots of social activism, whereby individuals awakened to their positions of injustice and would become conscious of their positions as actors of social change.

(b) Participation and the market: improving efficiency

The discussion of improved efficiency in water management is couched in the broader context of the market and market interactions that was solidified with the end of the Cold War, eliminating ideological alternatives to liberal capitalism (Thomas 2000). The emergent liberalism, or neo-liberalism, is complex and variant, but in general, tends to see market expansion and the logic of the market as the root of all human interaction. As such, it goes beyond a set of economic policies, and "involves *extending and disseminating market values to all institutions and social action*, even as the market itself remains a distinctive player" (italics original, Brown 2003:3). Neo-liberalism draws on theories from classical economics that argues for limited state intervention for the rational allocation of goods through self-regulating markets, and essentially aims to replace more revisionist forms of liberalism (specifically Keynsian notions of 'embedded liberalism' that advocated for state intervention and regulation to allocate more equitably) to return to classical liberal roots of market efficiency. Neo-liberalism proposes that "human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets and free trade" (Harvey 2005:2). As such, the role of the state should be to enforce the proper functioning of markets where they exist, and to create markets where they do not exist[31] (in areas such as land, water, education, health care, social security, or environmental pollution) (ibid).

[31] Classical liberalism was primarily concerned with the protection of political liberty, but this liberty provided the foundation for the economist's focus on market transactions. However, under classical liberalism, three important spaces remained outside of this: armed forces, non-excludable goods and

Yet there is some recognition even among the neo-liberal programs that pure market self-regulation for water management will not always be possible, at least immediately. In these cases, there could be a role for user involvement, particularly in areas where commercial and competitive behavior is constrained. The area of water management provides precisely such an arena; despite neo-liberal beliefs about the universal applicability of commercial and market principles, there is some recognition that water does not operate as a pure commodity. Thus, it does not signal price changes in the market as efficiently as market commodities, and costs of production are not reflected in the costs of consumption (Pindyck and Rubinfeld 1997). Given this, the participation of users is theorized to more closely align with market interests than state regulation would; state intervention impedes market efficiency through distortions, subsidies and allocative inefficiencies where smaller user groups would better maximize these shortfalls. User participation, then, is seen as the initial step in freeing water management from state intervention, even while water markets remain in their nascent stages.

As this market develops in areas where they have historically been undermined through state intervention, the institutional frameworks that promote user participation is the most appropriate to promote market interests. State intervention "must be kept to a bare minimum because, according to the theory, the state cannot possibly possess enough information to second-guess market signals (prices) and because powerful interest groups will inevitably distort and bias state interventions (particularly in democracies) for their own benefit" (Harvey 2005:2). Ultimately, the

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law enforcement (Thorson and Lie 2006). Water, as a non-excludable good, had tended to be defined as a public good, with state ownership over resources to exploit for the common good.

emergence of market-driven water management institutions serves to best advance human well-being.

Neo-liberalism was a strong undercurrent to structural adjustment programs in development throughout the 1980s and 1990s. While concerns over the environment remained a small part of the broader goals to improve terms of trade, fiscal prudence and create economic stabilization packages, it affected large public agencies, including those that oversaw water management. The strategy most often promoted was to privatize these agencies not only to improve government balance sheets, but also to bring the management of scarce resources more in line with market principles. Disseminating these principles to the government of water was the optimal solution for enhancing well being through both improving service and reliability but also in better pricing the value of water in line with its true cost. While the debate over pricing and pricing mechanisms remains outside the scope of this research, suffice it to say that greater user involvement in the decisions over allocation and distribution of water was theorized to bring about greater efficiency because individuals were seen as rational actors that promoted self-interest. This, in turn, was seen to minimize system losses and allocative distortions associated with government management.

(c) The 'radical' origins of Participation: improving equity

The concept of "participation" also draws on tenets of social activism that sought to introduce mechanisms whereby individuals would awaken to broader structures of inequality and oppression to advocate for social change. The theoretical origins of public participation are rooted in the pioneering work of Arnstein (1969), who developed a typology of citizen participation. Arnstein's 'ladder of participation'

equated real citizen involvement in decision-making with a redistribution of power, which allows certain 'have-not' citizens to join in the decision-making process. Implicit in Arnstein's work is the notion that "effective" participation entails a shift in power relations "from hierarchical to vertical" (Chambers 1988).

This overlaps with literature on the process of empowerment. The main intellectual and practical foundation for the development of the concept of empowerment is through the works of Alinsky (1971) and Freire (1970, 1973). The thread that ties their views together is the emphasis on a process of personal development that includes increased involvement in decision-making and enhanced consciousness as well as social action. The goal of Alinsky's (1971) approach was to facilitate a process whereby people unite around a shared interest or concern to collectively identify targets, gather resources, mobilize, and ultimately act to realign power within the community.

In his theory of critical consciousness, Paulo Freire (1970), working from a Brazilian context, described man as an incomplete being whose vocation is to become fully human, by (a) critically reflecting on an objective reality, and (b) taking action based on that reflection in order to transform this reality. He drew a fundamental distinction between those who were 'oppressed' and those who were the 'oppressors' in society. The dialogical method upon which *conscientization*, or education of critical consciousness is based, involves oppressed groups of individuals in a process of (i) reflecting upon their reality; (ii) looking at the root causes of the problem; (iii) examining the implications and consequences of these problems; (iv) developing a plan of action to deal with the problem.

(d) The state's 'anti-state' solution

What is, perhaps, most ironic, is that by the 1970s, the participatory approach began to make inroads within public policy as an option for the state to deliver public services. Despite its strong anti-state rhetoric, community management of services promised to address issues of inequality and inefficiency in service provision. This was driven, in part, by three discussions in public policy: (i) 'democratization', as defined by the reversal of inequalities and asymmetries in rights; (ii) 'commodification', as defined by the principles of economic production and consumption permeating all social realms; and (iii) 'technolization', or the growing role that technology plays in addressing specific discourses (Fairclough, 1992: 201-216 as quoted in Darcy 1993). These first two discussions, in particular, advocated for improving the equality and efficiency of public services, and the participatory approach provided a unique avenue that promised to deliver both of these goals.

The adoption of participation into mainstream public policy discourses in the 1970s elicited enthusiasm from the left because it provided an avenue for dealing with different needs of heterogeneous users. Many of those who were traditionally disadvantaged within the larger and more impersonal bureaucracy could once again find their voice and advocate for greater equality. Some even went so far as to say that participation and greater local control over public resources acted as a countering effect to "the alienating forces of global capitalism, and ideological site, and a discursive community where alternative value positions could be articulated" (Darcy 1993: 34).

What is noticeably absent from the discourse of participation in the public policy realm is the discussion of power relations that formed the foundation for much of the discussions with equity. This has led to critiques the adoption of participation within public policy discourse served to remove it from it's more radical origins since the state could not support a process that would lead to the dismantling of itself (Hickey and Mohan 2003). Despite these critiques, the enthusiasm for the participatory approach was gaining significant traction as a public policy option also for the developing world.

(e) Participatory Water Management as a development strategy

By the mid-1990s, international development organizations, most notably the World Bank, adopted the "participatory approach" as strategies in development programs. The discovery and adoption of the approach promised to bypass inefficient and unequal state structures to deliver more accountability and sensitivity to local conditions. Within water supply programs, the ideals of community managed programs in both urban and rural areas emerged as an alternative to state management. This was a particularly appealing approach in areas of the world where state provision fell short, and where privatization of services was politically unpopular.

Water resources management projects in developing countries drew on successful cases of decentralization in budgeting (for example, in Porto Alegre, Brazil) or public services (for example in Andra Pradesh, India) to show that opportunities for participation generated citizen engagement and improved the sustainability and effectiveness of projects. Water projects (both irrigation and water supply) suffered

from problems of sustainability, brought about primarily by negligence in operation and maintenance of critical infrastructure. Large scale investments in water infrastructure in, for example, Indonesia, the Philippines, India, and elsewhere weren't adequately maintained by state governments and water agencies, leading to disrepair and renewed problems in water delivery. The decentralization of operation and maintenance responsibilities to the lowest possible level and the participation of users in deceisions over allocation and distribution were expected to improve both the efficiency and equity of service, and, by extension, lead to improved investment sustainability.

The popularity of the participatory approach in water management also drew on debates within natural and common pool resource scholars of collective action and resource sustainability. Renewed scholarship of the commons emerged around the seminal work of Ostrom (1990) who drew on economic principles within game theory to show that collective action on the local level could emerge under specific preconditions[32] and through a series of consecutive interlocking interactions. Her work provided a theoretical alternative to collective action literature that had been characterized by a dominant view of individuals acting according to pure self-interest that precluded the provision of public and common goods (Olson 1965; Hardin

[32] Ostrom's (1990) seminal piece showed, for example, that local level institutions could persist, given the following eight institutional principles: (1) clearly defined boundaries; (2) congruence between appropriation and provision rules and local conditions; (3) collective choice arrangements allowing for the participation of the appropriators in the decision-making process; (4) effective monitoring by monitors who are part of or accountable to the appropriators; (5) graduated sanctions for appropriators who do not respect community rules; (6) conflict-resolution mechanisms which are cheap and of easy access; (7) minimal recognition of rights to organize (e.g. by the government); (8) in the case of larger common pool resources, organizations in the form of multiple layers of nested enterprises, with small, local CPRs at their bases.

1968)[33]. Ostrom (1990) showed that self-regulating institutions could be crafted and maintained under specific circumstances to collectively manage common pool resources effectively.

The revival of liberalism had advocated for the application and extension of market logics to water management, but initial programs to privatize public services were met with widespread resistance, especially in the developing world[34]. The participatory approach offered neo-liberals a management that mirrored decentralization and removed inefficient bureaucracies. On the other hand, local participation offered the left assurances that resources critical to human life, such as water, would not be allocated solely on the basis of profits and bottom lines.

The participatory approach was solidified into the water resources management strategy in the form of the Integrated Water Resources Management approach (IWRM). This approach sought to address how best to create decision-making mechanisms that would help in the allocation of water amongst competing uses (such as food production, human consumption, industry, etc.). The approach draws on the Dublin Principles of 1991 that (i) defines water as a finite resource; (ii) argues that water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels; (iii) recognized that women play a central role in the provision, management, and safeguarding of water; and (iv) defines water as having economic value in all its competing uses, and should be

[33] Public goods are defined as being non-rivalrous (consumption of the good does not take away from others), and non-excludable (it is not possible to exclude others from using the good). Production of public goods is assumed to lead to market failures. Commons are a subset of public goods and are defined as any set of resources that is accessible to all members of a community, such as cultural or natural resources.

[34] Most notable among these were the widespread protests in Cochamba, Bolivia, where thousands of protesters marched on government buildings to contest the privatization of water supply services in a sale to Bechtel. The decision was eventually reversed.

recognized as an economic good (Global Water Partnership, 2003). The IWRM approach, then, is defined as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (Global Water Partnership, 2003: 22). The widespread adoption of the IWRM approach meant that the participatory approach emerged as the new dominant paradigm for water management.

(f) Critiques of the Participatory Approach

The growing preeminence of the participatory approach in international development, broadly, and water management, specifically, has created a critical following of scholars who argue that participation has become a "tyranny" (Cooke and Kathari 2001), paying little attention the role of participation in reversing unequal power relations. Instead, these critics argue that participatory approaches too often focus on users as implementors to programs, rather than as participants in transformative social change. A second set of criticisms focus on the oversimplification of the word "community" and the virtual ignoring of existing power dynamics and social relationships on the ground.

As the participatory approach gained momentum within development programs, critiques emerged that it ignored important power dynamics in local settings that were replicated within participatory institutions (Cooke and Kathari 2002). These critiques pointed to idealizing local knowledge as paramount to development agendas as an inherently flawed process. This local knowledge is often gleaned through collaborating non-governmental organizations, as the 'voice of the

people'. These organizations are, however, often subject to elite capture, leading to a problem of agency for the most vulnerable and undermining the precise goals of participation to begin with. This form of participation, critics argued, had been rearticulated from its radical roots (Mohan and Stokke 2000) and depoliticized (White 1991). In its original conceptualization, participation was closely linked to notions of empowerment and political resistance that had all but been forgotten within development programs.

The "depoliticization" of participation means that the term is used in a variety of development contexts. Khanal (2003), for example, outlines different roles of participation in various development 'contexts' to be (i) economic development and modernization; (ii) joint planning and problem solving; (iii) inclusion, equity and reduced vulnerability. Participatory forms of organization can further each of these agendas, but in a different way. Under the first agenda, participation is a means to economic development and modernization. Devolvement of management directly to the users creates the proper incentives for farmers to use these resources more efficiently. In this model of economic development, the state is viewed as interfering with the market and perverting incentives through subsidies and inefficient management.

In the second development context, participation is a tool for joint planning and problem solving. Participants engage in a process by which they jointly induce change through a combined effort. Under this model, knowledge is key to change; the focus is on access to knowledge that would help all participants in self-determination (Khanal, 2003). In this context, participation is *representative* (White, 1996). It is

limited to serving donors' interests of sustainability in the long-run, by including the voices of a variety of different stakeholders. Sometimes participants in the organizations are able to voice real concerns about the goals and implementation of the program or project, but their impact on major decisions is usually rather weak.

In the final context of development, participation is seen as a vehicle for social inclusion, improved equity, and reduced vulnerability (Khanal, 2003). Reducing barriers to participation ensures the inclusion of the poor, who are generally excluded and vulnerable. In this way, participation results in improved equity; actors in the process become empowered, and are then able to execute beneficial change. The focus in this model is on transferring capacity to participants so that they are able to contribute effectively; and this transfer leads, or should lead to, their empowerment. This model is *transformative* in nature (White, 1996) and aims at the empowerment of the poor and excluded, but this is seen as benefiting the entire society. In this way, participation is a means of empowerment and an *end in itself* (ibid). It is a continuous and dynamic process.

Unfortunately, as Khanal (2003) notes, transformative participation has all but taken a back seat to goals of efficiency and economic development. Instead, participation replicated top-down development programs[35], and participation was analogous to little more than the perception of participants as implementers of pre-determined goals and programs, rather than leading to truly transformative change.

[35] Early examples of systematic approaches to community development came out of British and American urban reform movements and rural organizations of the late nineteenth century (Mayo 1975, Petersen 1994), and the term 'community development' was adopted by British, French and Belgian colonial administrations in Africa and Asia, especially after World War II, as a social and political as much as an economic strategy for rural areas. Hence community development remained essentially an aspect of top-down government policies, and limited involvement from community-based organizations (see, for example, Chambers, 1995; Bond, 2002)

Where the participatory rhetoric advocated for community development programs with "bottom-up" change, the goal of these programs was to create a competent community to manage pre-determined goals. Bracht and Tsouros (1990), for example, define the community organization as "a planned process to activate a community to use its own social structures and any available resources (internal or external) to accomplish community goals, decided primarily by community representatives and consistent with local values" (Bracht and Tsouros 1990). Purposive social change interventions, they argue, are organized from within the community by individuals, groups or organizations with the primary aim of attaining and then sustaining changes within the community. However, critics have argued that the goals cannot deviate far from state policies to receive state funding, and thereby lose some of the scope for action.

A second set of criticisms focus on the oversimplification of notions of community and community action. This view of participation does not see community institutions as self-regulating, but rather argues that individuals are embedded within broader social structures that shape notions of reciprocation and obligation (Polanyi 1954; Scott 1998; Mosse 2003), as well as power and authority (Cleaver, 1999, 2000, 2003; Gujit and Shah 1998; Bardhan and Ray 2008). Participation must be understood in the specific contexts within which people operate, which is complex and variant. Thus, social partnerships must, first and foremost, be understood to be shaped by their environments, including norms, class, politics (Waddock 1991), the scope of the problem being addressed (Lyons et al. 2000) as well as conceptualized as a process that will reflect both the multiple and overlapping

social networks and "communities" that people actually belong to (Guijit & Shah, 1998). Cleaver (1999) argues that ignoring this has created what she terms, 'myths of community', where the community is "often conceptualized as some kind of natural, desirable social entity, imbued with all sorts of desirable values and the simple manifestation of this in organization form" (Cleaver, 1999: 603). Finally, Meinzen-Dick and Zwarteveen (1998) point out that needs and priorities with regards to resource use differs according to gender, thereby critiquing the view that all community members necessarily are the same in their interests and motivations.

One underlying tension in the literature can be found in the conceptualizations of collective action. Where goals of efficiency draw on principles of market liberalization, the assumption tends to be that the basis for collective action on the local level lies in the inherent rational nature of the actor. Thus, collective action, as portrayed by Ostrom (1990) and others, was viewed as a rational decision that looked to the costs and benefits to participation for the individual, rather than through systems of obligation (see also Seabright 1993; and, for a critique, Cleaver 2003). However, many of the critiques above point to the inherent embededness of social actions that place collective action decisions in systems of obligations or social responses to others (Mosse 2003; Bardhan and Ray 2008; Cleaver 2001, 2003, 2005).[36]

[36] This tension harks back to the Enlightenment's view of a new social order that emphasized the individual as naturally free who rationally enters into specific and limited associations on a voluntary (Nisbit, 1966). Classical sociologists, notably Durkheim, Weber, Comte and Marx, took issue with this view, arguing that individuals were socially embedded, as evidenced by the despair and alienation that individuals suffered when separated from communal relationships (for example, Durkheim's *Suicide*, Comte's *Systeme de politique positive,* and Tönnies' *Community and Society* all point to the embedded nature of human beings as a natural state).

This section has summarized the emergence of efficiency and equity as twin goals within water management and presented the emergence of the participatory approach in water management as way to achieve these two goals simultaneously. This assumption refutes literature in the field of economics and sociology that argue for a fundamental incompatibility between outcomes of efficiency and equity. In the following section, I will lay out the theoretical framework used to examine the role of efficiency and equity within participatory institutions. Specifically, I will examine the model used within development programs that promote efficiency and equity as compatible processes within participatory water management institutions. I will then turn to two separate models that argue that efficiency and equity come as tradeoffs to each other.

B. Theoretical Framework

Much of the debate surrounding the participatory approach focuses on the effectiveness of participation, or argues for outcomes of efficiency, on the one hand, or equity on the other. The claim that locally based, participatory institutions can achieve outcomes of efficiency and equity simultaneously refutes much of the literature on the subject that points to numerous tradeoffs between different types of efficiency and equity. Specifically, participation in water management is expected to result in outcomes of greater allocative, technical and administrative efficiency, with little or no loss to allocative and administrative equities (Global Water Partnership 2003; Osmani 2007).

The claim that participation is expected to eliminate tradeoffs in efficiency and equity refutes much of the literature arguing for a tension between the two. Within the field of economics, for example, Okun (1975) argued for a tradeoff between allocative efficiency and equity, since any move to redistribute in the interest of fairness would generate losses in efficiency. Within the field of sociology, Weber (1978) argued for a fundamental incompatibility between equality and efficiency within locally based organizations, since broader trends in and concerns over efficient administration would come at a cost to equality of membership.

This section is divided into four subsections. The first subsection presents definitions of the concepts of participation, efficiency and equity. The second subsection presents the framework that describes the relationship between participation and outcomes of efficiency and equity as compatible. The two theories

of efficiency-equity tradeoffs (allocative and organizational) are presented in the last two subsections.

Defining Participation, Efficiency, and Equity

As the previous section has shown, the meanings and use of the terms participation, efficiency and equity are widespread and varied. For the purposes of this dissertation, each of these concepts will be defined based on their usage and understanding within the broader frameworks of public service delivery and community management, since these are the usages and meanings that are most directly relevant to the questions of participation in water supply systems. The following section outlines the definitions for the concepts of participation, efficiency and equity.

(a) Participation

Participation within the context of community managed services is defined as the contributions in time, energy, and experience that consumers and interested local people provide to organizations in which they have a direct stake (Darcy 1993). This definition is similar to the World Bank's definition of participation as a "process through which stakeholders influence and share control over development initiatives, decisions and resources which affect them" (World Bank 1996). It is seen as a primary input to making administrative structures and the process of governing local resources more efficient and democratic. This definition does not preclude processes of empowerment and redistribution visible in the theoretical origins of its usage amongst community activists (see, for example, Arnstein 1969), but within

community management and with the adoption of participation in public policy, the more 'radical' origins of participation that advocated for shifting power relations has been lost. Instead, the measures of successful participation often have little to do with individual awakenings or power redistribution, and more with the successful management of local level services. Within this framing, local groups enter into specific arrangements to manage and oversee water supply services, sometimes on concession arrangements from the state, and the measures of success focus on service targets, accountability arrangements, outcome and performance.

Individual participation in this vein draws on Hirschman's *Exit, Voice, and Loyalty* (1970), whereby individuals express their preferences either in one of three ways. First, in discovering that goods or services have declined, consumers can "exit", or move elsewhere to purchase or consume that good. This option is particularly relevant for the economic sphere, where a number of firms offer similar goods or services. In the political sphere, however, lack of options may make the option of "voice" more relevant. In this, consumers voice their discontent with the failing quality of goods or services through protest or other means of communicating discontent.[37] One final strategy for consumers exists in the form of loyalty, where the declining level of services is accepted (i.e. brand-loyalty for consumers in the marketplace, or patriotism in the political sphere).[38] Community-based organizations offer options of exit and loyalty viewed from the perspective of improvement of

[37] Consumers can also voice discontent over the falling quality of goods in the marketplace through contacting firms and voicing their discontent. In addition, citizens can also use exit in the political realm, through emigration. However, both of these options are considered more costly and to take more time, and Hirschman argued that the exit strategy prevailed in the marketplace whereas voice prevailed in the political sphere.

[38] As a caveat, Hirschman noted that strategies of mental "exiting" could be mistaken for loyalty. In countries where dissent is not tolerated and there are no formal exit strategies (through limits on emigration, for example), citizens may mentally exit through not engaging.

services. Community organizations offer competition in facilitating the "exit" option for consumers unhappy with the level of services (either back to state provision, or other options, if available). Second, community provision of water supply services provides consumers with an avenue for "voice" where dissatisfaction on the part of the consumer is close to decision-making and water management, creating an avenue for more effective and quality service.

Local level participatory management is expected to lead to improved outcomes of both efficiency and equity vis-à-vis state management. In fact, as Darcy (1993) notes "community is posed as a counterpoint to the bureaucratic organizing principles of specialization and impersonality" (Darcy 1993: 36). Devolving decision-making to the local level is also supposed to reduce administrative costs, and improve flexibility and response to consumer demands. Equity is expected to result from improved inclusion of disadvantaged groups that may have been overlooked by bureaucratic management.

(b) Efficiency

Efficiency is broadly defined as maximizing outputs with a given set of inputs. The issue of efficiency in the provision of water services is generally measured along dimensions of technical and allocative efficiencies, where technical efficiency refers to the "efficiency with which resources are used for a given end" (Osmani 2007) and allocative efficiency refers to the best allocation of resources according to consumer preferences (ibid), including quantity and price. These two dimensions are not necessarily compatible processes; a system that is highly technologically efficient may be so at a cost to allocative efficiency, since the

technology used to achieve technical efficiency may require high levels of initial capital investments that are difficult to recoup through pricing mechanisms in line with consumer preferences. However, the two may not necessitate a tradeoff, and optimal levels of technical efficiency could be achieved where allocative efficiency is maximized.

A water system that is technically efficient is one where water losses are kept to a minimum. This is dependent on both the quality of construction, and the continued operation and maintenance of the system that, if done well, will continue to keep water losses relatively low. A water system that is allocatively efficient is one where each user is charged for the costs they generate. In an ideal situation, information about the costs that users generate is available, although in practice, this is relatively difficult to ascertain. Thus, typically a water system that is allocatively efficient is one where each unit of water is priced at the long term marginal cost of production.

(c) Equity

Equity[39] tends to be a subjective measure of how goods should be distributed within a particular society. On a theoretical level, there are four general views of equity: (i) egalitarian, where all members of society are allocated equal amounts of a good; (ii) Rawlsian, where the utility of the person least well off is maximized; (iii) utilitarian, where the total utility of all members in society is maximized; and (iv)

[39] Equity is a distinctly different term from equality, where the former entails a subjective measure of what is equitable in society. Thus, what can appear to be unequal in one society, could be viewed as equitable in another.

market-oriented, where the market allocates the most equitably (Pindyck and Rubinfeld 1997).

On a practical level, however, the market is rarely viewed as equitable. This is especially true for public goods, such as water, where market allocation would effectively exclude those unable to pay for services, thereby cutting off a resource vital to human existence[40] While many societies are able to endure some level of inequality (and still consider this arrangement to be fair), it is rarely the case that this perception of equity includes market mechanisms for allocation (Pindyck and Rubinfeld 1997). Water systems that are considered equitable may ensure equal access for all users (where users could opt out of services, if they choose). Notions of fairness may even include cutting off water services for several months of non-payment. All of these arrangements may not be perfectly equal, but they are considered fair in the context of resource constraints.

Achieving Equity and Efficiency through Participation: the "Development Model"

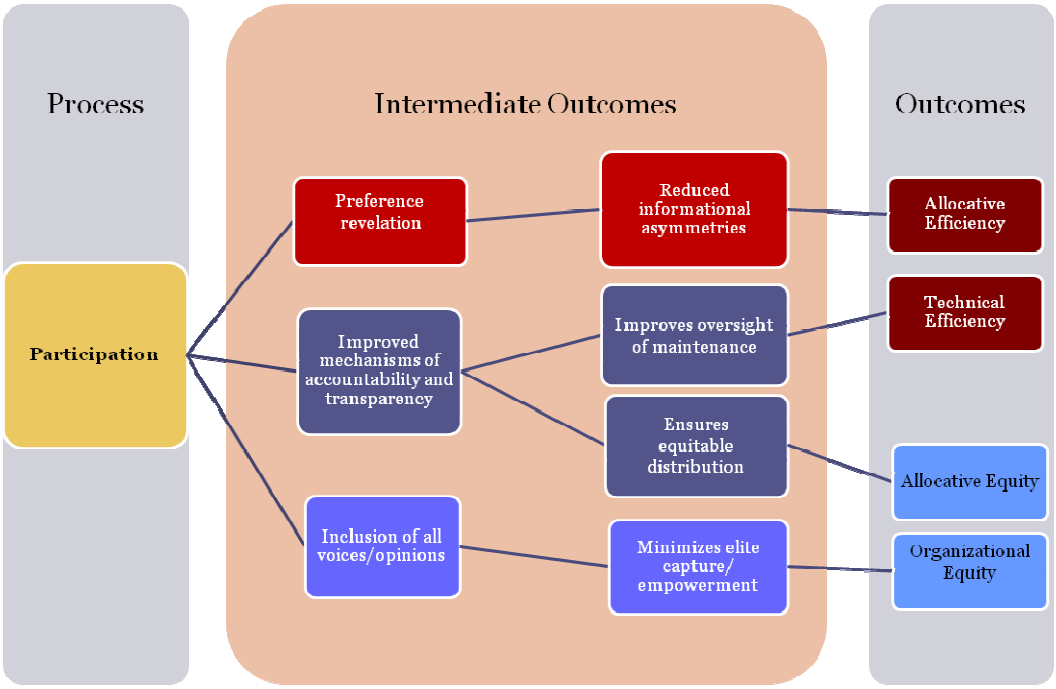
Within the development literature, scholars argue that the decentralization of water management to the local level, and the introduction of participatory mechanisms serve to enhance both technical and allocative efficiency (Osmani 2007). When water users participate, their preferences are revealed thereby reducing informational asymmetries and enhancing accountability for greater technical efficiency. In addition, participatory mechanisms mean that resources are allocated

[40] This strain of thinking is perhaps most visible in the rights based approach that argues for water and other critical resources to be defined as basic human rights. Thus, allocation should focus on goals of equity, since these resources are considered basic life necessities

according to user preferences, thereby eliminating waste and enhancing allocative efficiency.

Participatory mechanisms also serve to enhance equity through by including the poor and marginalized in the decision-making process and through achieving a solution that is perceived to be equitable by the users. In emphasizing participation, the voices of the poor and otherwise marginalized users are included which serves to enhance institutional accountability. The ability to hold local level institutions accountable will limit discriminatory practices and policies. Thus, participation not only achieves greater equity by extending the vote (and hence voice) to all users, but in doing so, the outcomes achieved through consensus will likely be less discriminatory, or, more equitable. Figure 3 outlines this relationship.

Figure 3: The "development model"[41]



Source: Author's illustration, based on Osmani (2007)

As is seen in Figure 3 above, the same mechanism of accountability is expected to lead to improved outcomes of efficiency and equity. In this way, the "development model" promotes the compatibility of both of these goals, arguing that efficiency and equity can be achieved simultaneously. This discovery runs counter to literature in the field of economics and sociology that have long argued for a tradeoff between the two.

[41] This model is termed the "development model" because of it's widespread use within the development literature and practice. The illustration linking the process of participation to outcomes of efficiency and equity was done by the author but based on Osmani's (2007) framework that outlined the relationship between participation, efficiency and equity within development practice.

Equity and Efficiency as a tradeoffs

Much literature has been devoted to the inherent tensions between notions of efficiency and equity. The most relevant to this research focus on the tradeoffs in efficient and equitable resource allocation, and the inherent tensions in equality and efficiency within administrative organizations. On the allocative side, much of the tensions between the distribution and allocation of resources are visible in debates over prices and cost recovery that are particularly relevant to the independence and sustainability of non-state water suppliers in developing countries. On the organizational side, Weber has noted that equity within an organization is achieved primarily at the cost to certain types of administrative efficiency. The following section outlines these two tradeoffs.

(a) The Allocative Tradeoff

The allocative tradeoff was first articulated by Arthur Okun in his 1975 book entitled *Equality and Efficiency: The Big Tradeoff*. In this, Okun argues that efficiency and equality are mutually exclusive, where improved efficiency comes at a cost to equality and vice versa. Okun's work is perhaps best known for the argument that, within the marketplace, redistribution has negative overall effects. He uses the parable of a "leaky bucket" to point out that redistributive policies result in wasted income, similar to transferring water in a leaky bucket; each dollar transferred from the rich result in a less than one dollar increase in income for the poor. This decrease results from certain costs associated with transfers (administrative or tax collection costs) and reduced incentives to work and save (Okun 1975).

What is, perhaps, less often discussed is Okun's earlier chapters of his book, where he discusses different "spheres" of life, including social life, political life, and the market. In capitalist democracies, the first two give priority to equality over efficiency, whereas in the market place, efficiency is prioritized and inequality is accepted, creating a double standard in American society. The market, Okun argues, has an extraordinary ability to allocate goods efficiently. Certain social goods, however, should remain outside of the market ("extra-market goods")[42], such as freedom of speech, police protection, or public goods (such as education, etc.).[43] Okun's major contribution was on sketching the virtual incompatibility of equality and efficiency[44] and the double standard present within capitalist democracies.

Many of the debates surrounding efficiency and equity for water supply mirror some of the themes present in Okun's work. Where expanded public provision of water was considered a certain measure of progress in the 1950s and 1960s, neo-liberal thought of the 1980s and 1990s began to highlight the high levels of inefficiency that public utilities exhibited in the name of broad coverage. Thus, where historically public utilities and water supply and sanitation services were considered "extra-market" goods, the last twenty years has seen these services relegated to market mechanisms for distribution and allocation. This has not come without significant debate over the feasibility and viability for public services to be

[42] Extra-market goods are defined by Okun as those which (i) are acquired and exercised without monetary charge; (ii) have no comparative advantage and specialization; (iii) are not distributed as incentives, rewards and penalties; and (iv) give priority to equality over equity and freedom.
[43] The justification for this draws on humanist writings of moral obligations and fundamental rights, as well as on libertarian writings that argue for limited intervention of the government in the markets (only where necessary).
[44] Okun's third chapter of his book does look at cases where equality and efficiency could be compatible. For instance, Okun argues that if equality were defined by opportunity, rather than income, then equality and efficiency could be mutually compatible processes.

provided for by the market, given the inherent inequality that ensues from goals of efficient service provision (Khanal 2003).

The definition of water as an economic good[45] subjects it to debates over the role of pricing in allocating and distributing water. The assumption is that, if water acts as an economic good, then the demand for water is a function of its price and other economic have noted, water is not only a commodity, but it is also a natural resource, and is perceived to be a human right (ibid)[46]. This realization has not undermined the economic value of water, and most pricing debates focus on how to assign tariffs that would include alternate meanings of water, while still using market mechanisms to allocate efficiently.

Historically, tariffs were set to provide broad coverage, and did so by ensuring affordability for consumers through subsidized prices. Thus, the primary goals for water supply were technical efficiency and affordability that was made possible by government subsidies to fill financing gaps; affordable tariffs inevitably led to revenue shortfalls that, if left unfilled, would compromise the quality of service provision. Here, efficiency and equity were compatible only through dependence on subsidies and external financing.

With neo-liberal development policies came a renewed focus on the market as the most efficient allocator of goods and services, and public utility companies that

[45] The Dublin Statement of 1990 argued that, among other guiding principles, "water has an economic value in all its competing uses, and should be recognized as an economic good". The statement then goes on to say that "within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources" (GDRC at http://www.gdrc.org/uem/water/dublin-statement.html).

[46] Some scholars would argue that according water an economic characteristic robs it of its other meanings in human life, including social (STEP 2004).

could not demonstrate financial sustainability came under increasing attack, especially in developing countries, like Brazil, where budget shortfalls were blamed for financial crises and high inflation. Since then, the tension between universal coverage (equity) and financial sustainability (efficiency) has resulted in attempts to develop tariff systems that provide both equitable and efficient services. Those who argue for goals of efficient allocation argue that subsidized water service does not allocate charges to those who generate the highest cost. However, those who argue in the interest of equity argue that raising tariffs (in addition to often being politically unpopular) would price the poorest and most vulnerable out of water supply services.

While the discussion of the appropriateness of different tariff structures are beyond the scope of this research, suffice it to say that the debate brings up an interesting conundrum for water supply companies that must attempt to achieve seemingly incompatible goals. Each of these goals are, in their own right, critical to the continued sustainability of quality water services. Overuse of resources, or poor operation and maintenance because of budget shortfalls could threaten the future provision of quality water services. However, perhaps more importantly, underlying this debate is Okun's age-old dilemma of the efficiency losses that ensue from emphasizing equality. In a fully efficient system, water would be priced at the full cost of production[47]. In a fully equitable system, water would be affordable for all users. The pricing debate attempts to address both of these issues by creating

[47] There is considerable debate as to what constitutes the full cost of water. At the very least, the costs typically associated with water supply are (i) operation and maintenance costs; (ii) capital costs; and (iii) the cost of servicing debt (OECD 2010). However, the full economic costs of water also include opportunity costs of water and economic externalities. Other authors argue that the full costs of water should also reflect the administrative and governance costs to sustain services (Cardone and Fonseca 2003) as well as the environmental and water resources costs (Rees, Winpenny, and Hall 2008). For the purposes of this dissertation, I will be examining the argument of pricing water at its full cost, which includes only the first three costs mentioned.

differential pricing structures for users, or different fees for periods of use that reflect attempts to maintain a certain level of equality (as understood by affordability, and, hence, access) while balancing issues of efficiency (both technical and allocative efficiency). As Okun (1975) noted, however, balancing these objectives could come at an overall negative cost to society; administrative costs in, for example, targeting the poorest users, or the costs of installing hydrometers to measure use could outweigh the financial gains made from targeting non-poor users or flat block tariffs.

The tension between affordability and financial sustainability of utility companies has typically been addressed through government subsidy programs. One study indicated that 65% of water supply companies worldwide continue to receive financial support (either implicit or explicit) from governments[48]. Where this arrangement may work well in developed countries, the introduction of community-based management arrangements in developing countries were often seen as a "third way", offering a non-state and non-private solution to water provision: "in the new discourse, community-based organizations (CBOs) or water user associations (WUAs) are understood to replace state agencies in governing their own resources" (Mehta et al., 2007: 25). Thus, the issues of financial sustainability, fairness and equity of access (including affordability), efficient service provision, and resource sustainability must all be balanced in developing country contexts where the ability to pay is often very low. Without sustainable revenue streams, however, these community based solutions stand to be short-lived solutions to water service provision.

[48] While this is assumed to lower efficiency in the interest of equity, one study showed that privately run utility companies in Tanzania were no more efficient than publicly funded ones (Swai, Unpublished)

(b) The Organizational Tradeoff

While Max Weber's writings on power, authority and domination (*Herrschaft*) are well known, much less attention has been paid to his, albeit brief, writings on direct democracy. These are particularly pertinent to the discussions of participatory water management, since it is here that Weber outlines a type of administration that calls for the direct and immediate involvement of all members that would focus on equality rather than efficiency. For Weber, widespread rationalization in Europe had resulted in the emergence of large bureaucracies that employed means-end rationality and emphasized efficient administration. This efficiency came at a cost to other social goals, most notably equality. In his work *Economy and Society,* Weber briefly noted one type of administration that was effectively able to counter broader trends of rationalization: the direct involvement and emphasis on equality that Weber found in Swiss cantons and North American townships made these places true "direct democracy" ("*unmittelbar demokratischer Verwaltung"*).[49]

"Direct democracy" is defined by Weber as a certain type of organization that "may attempt to reduce … [imperative powers] as far as possible. This means that persons in authority are held obligated to act solely in accordance with the will of the members and in their service by virtue of the authority given by them" (Weber 1978: 289). Weber's concept of direct democracy lies at the intersection of ideas of equality and minimization. Thus, it is based on the notion that "all are equally qualified to occupy any position of civic responsibility" and that "'minimization' both

[49] Weber noted that the direct democracy was inherently rational in its form of administration, making it inherently different from more "primitive" patriarchal forms of administration that based its rationality on value-systems or on charismatic leaders.

entails that the *powers* of the incumbent of any office will be strictly limited… and that the *numbers* of offices will be strictly curtailed" (Thomas 1984: 225). In addition, Thomas (1984) notes that Weber conceived of direct democracy as a rational form of government that embodied a certain sophistication and complexity to execute: the "rationality of direct democracy lies in its precise articulation of a set of political and administrative norms and in its awareness of (undesirable) alternative dominatory modes of administration" (Thomas 1984:226).

Weber's examples of direct democracy, Thomas (1984) points out (e.g. the Swiss cantons or the North American townships), have explicitly noted their attempts to limit power and domination through precise and regulated administrative measures that responded to broader historical trends of rationalization (ibid). These cases indicate common set of pre-conditions that, Weber argues, are necessary for a direct democracy to exist:

> (a) Short terms of office, if possible only running between two general meetings of the members; (b) Liability recall at any time; (c) The principle of rotation or of selection by lot in filling offices so that every member takes a turn at some time. This makes it possible to avoid the position of power of technically trained persons or of those with long experience and command of official secrets; (d) A strictly defined mandate for the conduct of office laid down by the assembly of members. The sphere of competence is thus concretely defined and not of a general character; (e) A strict obligation to render and accounting to the general assembly; (f) The obligation to subject every unusual question which as not been foreseen to the assembly of members or to a committee representing them; (g) The distribution of powers between a large number of offices each with its own particular function; (h) The treatment of office as an avocation and not a full time occupation (Weber 1978: 289)

These conditions of a direct democracy are necessary, but not sufficient, conditions for the continued equality of members. Indeed, Weber (1978) argues that this form of administration is easily undermined in one of two ways. (i) the equality of members is undermined with forms of elite capture; and (ii) the technical tasks at hand require specific knowledge that creates an imbalance in how voices are weighted.

Since a direct democracy requires of its members to devote time to community service, it creates a propensity for the wealthy and those with more time available to dominate administrative positions. Second, the call to service is particularly unsuited to industrial societies, where it is less possible to abandon work. This critical question of the availability of time that will tend to favor the wealthy or others with prestige will result in the degeneration of direct democracy into a "rule by 'honoratores' (notables)". These are defined by Weber as persons

> (1) whose economic position permits them to hold continuous policy-making and administrative positions in an organization without (more than nominal) remuneration; (2) who enjoy social prestige of whatever derivation is such a manner that they are likely to hold office by virtue of the member's confidence, which at first is freely given and then traditionally accorded (Weber 1978: 290).

As Weber (1978: 291) notes, "every type of immediate democracy has a tendency to shift to a form of government by notables" in part because this administration is cost-effective, and because "*honoratores*" may be particularly qualified.

A second mechanism that undermines direct democracy is the nature of the task to be administered that could give rise to technical expertise.[50] The emphasis on technical qualifications will exclude others because of their lack of technical knowledge, thereby creating a hierarchical form of administration. Thus, as Weber remarks,

> Both immediate democracy and government by notables are technically inadequate, on the one hand in organizations beyond a certain limit of size constituting more than a few thousand full-fledged members, or on the other hand, where functions are involved which require technical training or continuity of policy. If, in such a case, permanent technical officials are appointed alongside of shifting heads, actual power will normally tend to fall into the hands of the former, who do the real work, while the latter remain essentially dilettantes (Weber 1978: 291)

The extent to which technical knowledge will come to dominate administrative functions will depend on the demands of the tasks that require administration. However, as Thomas (1984) notes, as the demands for technical skills to administer complex tasks grows, so too does the threat to direct democracy. The attempt to incorporate technical advisers alongside democratic representatives does little more than to shift the power in the direction of technical experts and technical knowledge. The ultimate demise of direct democracy comes, according to Weber (1978: 292) with the emergence of parties, since these put into place a structure of domination that undermines the very egalitarian nature of democracy.

Three features Weber's discussion of direct democracy are relevant to the question of participatory water management. First, is in the type of organization and

[50] According to Thomas (1984), the stress that Weber places on this aspect mirrors the stress that he "placed on the way in which legal forms of domination are grounded in *technical expertise* and *functional specialization* (Thomas 1984: 228, italics original)

the broader relationship to forms of "domination". Where in the English versions of his text in *Economy and Society* the term "direct democracy" is used, the German version of his work calls this form of governance the "*minimisierung der Herrschaft*" or, minimizing domination or authority (Weber 1922)[51]. This touches on widely noted issues of translating the meaning of "*Herrschaft*", but also indicates that Weber's text called for a form of governance where *Herrschaft* was minimized (not eradicated). Here it is useful to summarize briefly the history of the word *Herrschaft* and to review Weber's use of the word in *Economy and Society* (1922) to better understand what Weber meant by how this relationship could be "minimized".

The most comprehensive text on the history of the word *Herrschaft* is given by the *Geschichtliche Grundbegriffe* (1972), which provides an overview of the history of the term, followed by a discussion of Weber's usage and how the term has been applied and used conceptually within disciplines in the social sciences. While *Herrschaft* has come to be treated as the equivalent of Latin terms such as *imperium*, *domunium*, and *auctoritas*, and English terms of "authority", and "domination", the term historically referred to a specific and willed unequal relationship. The root of the German word, *Herr-*, is the same as the word for God, or Lord, and referred to types of relationships where there was a willing subjugation to one with higher power. In exchange, the *Herr*, carried the specific responsibility to care for subjects (Geschichtliche Grundbegriffe 1972; Richter 1995). This described specific types of

[51] The text calls the broader form of administration *minisierung der Herrschaft*, but later argues that, this is the form of administration that most closely resembles a "*unmittelbare Demokratie*" (direct democracy). Of issue here is not the translation of the text used, but rather the subtle differences that exist between the usage of the terms *Herrschaft* and *Demokratie*

relationships prevalent in the feudal era, between lords and serfs, between masters and servants, and between mortals and God.

With the Enlightenment, the emphasis shifted to freeing people from oppressive relationships, especially those that enshrined personal domination on the basis of property rights (Richter 1995). The goal of history was now emancipation, and the term *Herrschaft*, and any form of "domination" over others was viewed as something predominantly negative. Those ruled were no longer considered subjects (or, in a position of *Knechtschaft*) but rather as citizens ruling themselves, as emancipated individuals. What the authors of *Geschichtliche Grundbegriffe* note is that the term *Herrschaft* was redefined during this time period, where "the notion of ruling became transferred to abstract entities, and away from previous usages associated with the rights of individual lords over servants. The 'reign of reason' (*vernünftige Herrschaft*) was one example of such new usage" (Richter, 1995: 65, italics original).

What remained within the term "*Herrschaft*" was the underlying notion of a relationship between those ruling and those ruled. Where it had moved away from specific relationships between people or positions within society, the relationship of "domination" was replicated within state structures and its citizens. This relationship was seen as free of the *Herrschaft* of man over man, and replaced by a more objective and virtuous relationship that was part of the natural order. By the nineteenth century, fear of anarchy and revolution led to the assumption in much of German-speaking Europe that "order is so much a prerequisite of the public good that any resistance to the state indefensible in principle" (Richter 1995: 67). This "command-

obedience" relationship, the authors of *Geschichtliche Grundbegriffe* argue, is the centerpiece of Weber's political sociology (ibid).

While Weber's use of the word *Herrschaft* reflected the concept of a willed relationship, albeit between citizens and the state, his usage of the word reflects an attempt to further neutralize the word that stemmed, in part, from the legal positivism dominant at the time (Richter 1995). However, the relational aspect of the term remains, even in Weber's definition: Weber defined *Herrschaft* "in terms of power to exact and receive power as the distinguishing aspect of politics… [and] he saw the struggle for power as one of the few redeeming possibilities for action in a routinized and bureaucratic society" (Richter, 1995: 69)[52].

While the authors of *Geschichtliche Grundbegriffe* do not address Weber's ideas on "direct democracy" directly, the origin of the word and the analysis of Weber's usage of the term provide an illuminating overview of the social relationships that existed within German-speaking Europe.[53] This is particularly important, given that the German term that Weber used for "direct democracy" was not *demokratie* (democracy) but rather *Minimisierung der Herrschaft* (minimizing *Herrschaft*). In addition, Weber does not term this form of administration "*Herrschaft*-free" (*Herrschaftsfrei*). Thus it seems that Weber always assumed that this broader relationship between the state and its citizens to be inevitable, but that

[52] Richter (1995) notes that it is interesting that, for Weber, resistance occurred within relationships of *Herrschaft*: "It is striking that he [Weber] does not seem to have considered the possibility of combating the routinization of society by resistance to the state. He had defined legitimate *Herrschaft* in such a way that resistance to constituted authority was neither a moral nor a political option" (Richter, 1995 69).

[53] Indeed, the authors' treatment of *Herrschaft* and equality draws largely on Rousseau's ideas of moral equality between people that would manifest in political life through "democracy". For German-speaking Europe, however, fears of anarchy and chaos meant that the term *Herrschaft* (albeit changed in usage) was considered to be an acceptable facet of political life, since it would ensure a reciprocal relationship that would ensure order (Richter 1995)

within these structures, smaller pockets of areas where the negative aspects of the *Herrschaft* relationship that emerge as a part of broader patterns of rationalization could be minimized.

Weber's interest in *minimisierung der Herrschaft* ("direct democracy") was not in it, as such, but rather as an comparison to legitimate and illegitimate forms of *Herrschaft* ("domination")[54]: "It is … an investigation which points up, as it were from beneath, the central features of Weber's argument about domination: its universality, its stability, its profound significance for the establishment of an ordered condition" (Thomas 1984: 225). In other words, Weber's interest in exploring "direct democracy" stemmed from his desire to contrast forms of administration where *Herrschaft* is minimized with an administration where it is not.

Second, the careful balance of equality and efficiency through discussions of elite capture (either by people or by knowledge) lend important insight into the sustainability debates of participatory organizations. Weber is quick to note that direct democracies tend to be short-lived; the processes that emerge to produce democracy tend to quickly produce a plebiscitary leadership that is equivalent to modern party leadership. The basis for legitimacy then moves to a rational-legal authority structure. Weber's view that direct democracy is a fundamentally unstable highlights a fundamental problem discussed in the literature on participatory water management: the disintegration of the associations once project funding is withdrawn (Samad and Vermillion 1999). While this is a clear and obvious link to the failure of direct democracy to survive, Weber's insights could expand the notion of "failed

[54] *Herrschaft* has numerous English translations, depending on the author's interpretation. Where English texts were used in this section, the English word chosen by the author was referenced.

democracies" to include the routinization of democracy and the emergence of authority structures. Thus, while some associations founded with participatory principles in mind could continue to exist as assembly points, the emergence of an authority structure would also be, according to Weber, categorized as the disintegration of a direct democracy. This is linked to Weber's defining characteristics of a direct democracy of the freedom of rule by man, as well as of equality. The violation of these principles has undermined the direct democracy, and, while the group may continue to meet, their democratic nature is farcical, at best. This discussion addresses debates within participatory water management of the true need for a democratic administrative structure in water management, or whether other types of authority structures might be just as suited (and perhaps more stable and predictable) for service delivery.

Finally, Weber's framing of forms of administration that call for direct involvement as anti-bureaucratic, rather than anti-state closely mirror the discussions in the previous section of the growing anti-bureaucratic sentiment prevalent in water management. The particular anti-bureaucratic nature found in Weber's definition of direct democracy emerges in much of the discussion of participatory water management. The particular configuration of water management that emphasizes the active participation of all users in the diurnal management of water is framed in an anti-bureaucratic discourse. Indeed, it is precisely this point that has tended to unite the right and the left in the joint promotion of decentralization and participation. Curtailing the role of bureaucracies is viewed, from the right, as bypassing impediments to efficient market allocation of resources that would reduce waste and

address issues of scarcity. On the left, the direct involvement of water users in the active decision-making over allocation and use corrects for state-generated inequities and marginalization of some groups at the expense of others.

This section has summarized the key theoretical relationships between participation, equity and efficiency. While key literature in the field of both economics and sociology has traditionally argued that efficiency and equity generate tradeoffs, the introduction of participation is theorized to overcome these tensions. In the next section, I will examine this claim empirically. I will examine the case of community-based water supply systems in rural Brazil that have introduced participatory community management strategies. The development model would argue that the active participation of users leads to greater efficiency and equity. On the other hand, Weber would argue that these processes are mutually incompatible. The case of Bahia will illuminate whether these two processes have been able to occur in a mutually compatible way.

Chapter 3: Decentralization and Participation in Water Management: The Case of Brazil

The promises of the participatory approach elicit much enthusiasm over the prospect that goals of equity and efficiency are mutually compatible. This research aims to assess these claims. Brazil is a good case study for this analysis, since it has been at the forefront of water reforms amongst middle and lower income countries, adopting international practices in water resources management (such as IWRM, and the Dublin Principles) as early as 1997. In addition, the transition from a military rule to a democracy ushered in social and environmental rights enshrined in the 1988 Constitution, and a series of reforms to better align institutions with these new rights. These reforms have taken place in a broader context of inequality, where the most water poor areas (e.g. Bahia's semi-arid region) also suffer from some of the country's highest levels of poverty. The combination of resource scarcity and poverty necessitate both efficient and equitable water provision that the participatory approach promises to deliver.

In Bahia, one example of participatory water management dates back to 1996 with the Central program. This program, funded by the German Development Bank (KfW), installed simplified water supply systems to small communities in rural Bahia's semi-arid region. Once installed, the water supply systems were turned over to community organizations to operate and maintain. The program presents a case where local user groups have successfully operated and maintained their systems for over ten years. In addition to an impressive record of sustainability, the program

boasts relatively high cost recovery, low system losses, and an inclusive decision-making process.

This chapter is divided into three sections. The first section sketches the emergence of participation as a key strategy in water resources management policies in Brazil. This development occurred, however, within a broader context of how water was perceived, defined, and used over time. The second section then juxtaposes these broader laws of water administration with the politics of water in Bahia, especially in the semi-arid region. The final section describes the emergence of alternative service providers in Bahia, specifically the participatory water supply program Central.

A. History of Water Administration in Brazil

The administration of water in Brazil reflects broader global trends in natural resources management that moved from an ideology of modernization to one that promotes resource sustainability. Brazil is home to the largest reserve of freshwater resources on the planet, with about eight percent of the world's existing total. Much of this water flows in several large river basins—such as the Amazon—although the country contains an abundance of groundwater resources as well (roughly 112,000 k^3) (Benjamin, Marques, and Tinker 2005). However, much of these freshwater resources are unevenly distributed within the country; the north and central-west of the country, for example, have the highest mean water discharge rate and the lowest population density (Benjamin et. al. 2005), whereas much of the northeast is dominated by a semi-arid climate that faces the problem of droughts and water storage.

Water Use in Brazil

The administration of water is closely linked to how water is perceived, and three broad time period broadly define Brazil's attitude to water use (Heller 2006).[55]. The first, which Benjamin et. al. (2005) dub the "navigability phase", base water use on the Portuguese traditions laid down in the Ordinances of the Kingdom (*Ordenações do Reino)* that emphasized navigational use for rivers. Brazil's Civil Code of 1916 defined water as a public good (*bens públicos de uso comum do povo*- public property for the shared use of the people), but public use could not interfere with the broader goals of navigation (Benjamin et. al. 2005: 2190). This precedent gave way to what Benjamin et. al. (2005) term the "hydroelectricity phase" with the fall of the First Republic in 1930. The Water Code introduced by Vargas in 1934 broke the historical emphasis on agriculture and navigation, and adopted a distinctly industrial vision of water that emphasized hydroelectric production (ibid). Under the 1934 Water Code, water resources were a distinctly public good; following the Roman Code, water found on private property was classified as private, although its use was not to interfere with flows of public waters. Groundwater, too, was addressed in the Water Code of 1934, and it's use was allowed for on private property provided it did not interfere with flows of common or public waters (ibid). The use of water resources during this era have adopted a distinctly modernist approach; as Benjamin et. al. (2005) note, "the 1934 Water Code did not embrace an ecological

[55] These three periods describe Brazil's water administration after independence in 1822. Prior to that, there was no specific legal code that addressed water management in Brazil, since, as a Portuguese colony; Brazil's resources were viewed as property of the Portuguese crown. As Heller (2006) notes, "The colonial structure was shaped to serve … [economic policy based on foreign trade]; there were therefore no explicit policies aimed at improving living conditions in Brazil" (Heller, 2006: 3).

perspective…. Water was not seen as one of the natural resources that deserved conservation or sustainable use regulation" (Benjamin et. al. 2005: 2193).

This changed, however, in the more recent "environmental phase" which was marked with the National Environmental Policy Act of 1981 that, for the first time, recognized water's environmental value (Benjamin et. al. 2005). A series of laws, such as the National Water Act (*Lei da Política Nacional dos Recursos Hídricos)* in 1997 and the creation of the National Water Agency (*Agência Nacional de Águas*) signalled a "departure from the 1934 Code's vision of water as an inexhaustible, power-generating resource" Benjamin et. al. 2005: 2193). Brazil's National Water Act (Lei 9.433/97) drew on recommendations of major international charters, such as the Dublin Statement of 1991, that defined a series of priorities, such as sectoral integration, decentralization of water management to the river basin level, the participation of stakeholders, and the concept of water as an economic good while guaranteeing priority for human consumption. Its three main objectives are (i) to preserve water quantity and quality for present and future generations, (ii) to assure the sustainability of water uses; and (iii) to protect human beings and the environment against critical hydrological events (Benjamin et. al. 2005), thereby firmly placing water resources management in Brazil within the sustainability paradigm.

Administration of Water

Within the sustainability paradigm, Brazil's administration of water was largely based on the French experience, and included: (a) the creation of river basins as the primary unit of planning and management, and (b) stakeholder committees (river basin committees) to manage the distribution and planning of resources within

a river basin in a participatory and deliberative fashion. The laws also foresaw financial autonomy for these new basin institutions through the creation of water management instruments, such as bulk water charges (Brannstromm 2004). This approach effectively served to decentralize water management to the lowest possible unit, the river basin, with the concession and control of water user rights remaining largely within the state domain[56] (Johnsson and Kemper, 2005:1).

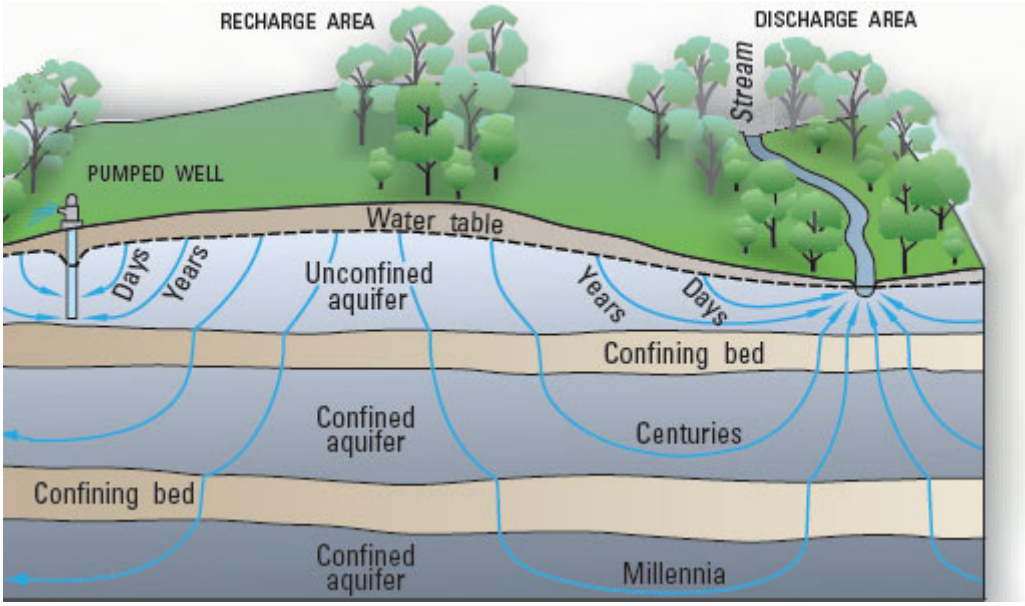
The establishment of river basins and stakeholder committees served to root water management in Brazil firmly within a participatory approach, effectively reversing decades of top-down and centralized decision-making (Brannstrom, 2004). Instead, participatory management brings together all relevant users of a particular hydrological area to decide jointly on the planning, management, and distribution of water resources. River Basin Committees, established to create a forum for water management, limit the role of the government to 33 percent, and include members of the private sector, civil society, and other relevant water users (Garrido 2007). These stakeholders must work collectively to manage water resources for sustainable and equitable use. This reshapes the role of state-led water management, to, at least in its ideal form, a deliberative and inclusive process.

The National Water Act gave only brief guidance on the legislation of groundwater resources[57], and, as such, the legal status of these resources remains

[56] Under the Brazilian Constitution of 1988, waters that cross state or international boundaries are in federal jurisdiction, while those located entirely within the territory of a single state as well groundwater resources are in state domain. One major exception is also established in the 1988 Constitution: state waters collected in or regulated by federal structures are under federal jurisdiction. This norm is especially relevant in the semi-arid Northeast, where the majority of reservoirs were built by federal agencies in charge of drought prevention policies and programs (Johnsson and Kemper, 2005).

[57] While scholars continue to debate the ownership of groundwater, this debate is concerned primarily with whether the states or the federal government has ownership over these resources; groundwater is

unclear, at best. The role of groundwater in Brazil is significant, not only for its supply of drinking water[58], but also because of the critical link between groundwater and surface waters[59]. The following figure outlines this relationship:



Source: US Geological society: http://ga.water.usgs.gov/edu/watercyclegwdischarge.html

The predominant perception of groundwater in Brazil is that it is an unregulated resource that provides opportunities for expanding water provision[60]. The lack of federal regulation on groundwater resources mean that, at present, private wells can be dug with little attention paid to larger issues of how these water sources are hydrologically linked to others. As the figure above shows, groundwater

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generally understood to be a public good, with permissions for use granted through a permit system (*otourgas*).

[58] For example, it is estimated that 5.5 million people in São Paulo receive their drinking water totally or partially from groundwater sources (Benjamin et. al. 2005: 2206)

[59] Benjamin et. al. (2005) note that around 90% of the rivers, lakes and lagoons in Brazil are supplied by underground waters, and that the intensity of use of these resources increases especially in periods of drought.

[60] As such, the perception of groundwater resources seems to lag behind surface water regulation in the sustainability paradigm, and resources are seen as relatively more infinite (driven, in part, by their untapped potential, but also, arguably, because they are perceived as quasi-private).

resources are located underneath the ground in soil pore spaces, and are recharged from surface water as it runs off into aquifers (USGS 2007). The deeper the soil pore space, the longer it takes for these sources to be recharged from water runoff. While single wells are not anticipated to significantly deplete these water sources, the widespread or intensive use of wells to supply drinking water could alter the delicate hydrological cycle between surface and groundwater.

B. Water Resources in the State of Bahia: Climate and Poverty

Bahia is the fifth largest state in Brazil, with a total area of 567,295 km^2, corresponding to 6.6 percent of the total area of Brazil, and 36.3 percent of the total area of the Northeast. The state has three geographic "zones": the *litoral*, or coastal, zone, the *zona da mata*, which is hot and humid, and home to the region's vast sugar plantations, and the *zona do sertão*, or the drought-prone "interior". This latter area covers around two-thirds (336,000 km^2) of the state, and experiences droughts in roughly three year intervals, with serious droughts occurring every twelve years or so (Arons 2004). On top of the geography of the state is a political economy of patronage and clientalism rooted in the history of large plantations, concentrated land ownership and limited access to water (Arons 2004; Kenny 2002). Drought mitigation policies long favored investments in water storage facilities that required heavy upfront investments and typically favored larger landholders, leaving much of the rural population in the *sertão* to suffer starvation and illness during droughts. Recent investments in community-managed water supply systems draw on the region's groundwater supplies to deliver water to rural households in an attempt to mitigate the impact of drought and to stave of migration in the region.

The map below shows the drought polygon in the northeast (highlighted area) that covers nine states in the region. Bahia, the largest state in the semi-arid region, sees a median annual precipitation is between 250 and 500 mm (Cirilo 2008) (as compared with an average 1,010 mm (40 inches) and 2,030 mm (80 inches) for the rest of Brazil).

Figure 4: The semi-arid polygon in Brazil's Northeast Region, 2008[61]

[61] The semi-arid region is defined receiving between 250 and 500 millimetres of rain per annum, and where the vegetation is primarily bushes that lose their leaves in the driest months (Cirilo 2008). The actual area of the semi-arid region is redefined on an annual basis, depending on patterns of rainfall.

(a) Water, Drought, and Politics

Bahia's semi-arid region has long suffered from severe droughts; as recently as 1999, the northeastern drought polygon was affected by a severe drought that impacted around 10 million residents (Kenny 2002). The persistent problem of drought has plagued the region for as long as there are historical records, with droughts appearing in accounts of the region as early as 1522 although it was the drought of 1877 "which caused the deaths of nearly one million people [that] alerted the political bosses in Brazil to the obvious fact that people lived beyond the coastal cities and sugar plantations" (Arons 2004: 17).

Nineteenth century Bahia was the political, economic, cultural and religious capital of Brazil. Powerful landowners oversaw great sugar plantations that were run on slave labor imported primarily from the West African coast. Most of this production was located in the humid regions of the *zona da mata* that extends behind the coastal region in the eastern part of the state. By the late nineteenth century, however, much of the political and economic power was shifting to the industrial south (most notably around Rio de Janeiro). During the U.S. Civil War, the South stopped producing cotton, and foreign importers turned to Brazil, leading to a cotton boom in the northeastern region of the country (Arons 2004). Cotton barons moved into the *sertão*, taking slaves, indentured servants, and sharecroppers to work the land (ibid).

The drought of 1877 destroyed agriculture in the interior, slaves were shipped south, and of those that weren't, many were freed because landowners couldn't afford to feed them (Arons 2004). Slavery was officially abolished in 1888, but the legacy

of agricultural production and the precarious and drought-prone climate continues to impact inequality and asymmetric power relations in Bahia's *sertão*. Limited state services, and unreliable access to water meant that, although freed, many former slaves and sharecroppers continued to rely on systems of "unequal reciprocity" (Neves 1998) for survival. As anthropologist Nancy Scheper-Hughes (1993) notes:

> The history of the sugar plantations, slavery, peonage, paternalism and *coronelismo* can weigh heavily on the demeanor and behaviour of the rural workers, who throughout their lives put up with humiliating gestures and postures and with unequal exchanges that obligate them to people who would only take further advantage of them... A good boss is a rescuer and a saviour, one who will swoop down at a precarious moment and snatch a dependent worker and his or her family from the clutches of disease, penury, death, or other forms of destruction. For people who live their lives so close to the margins of survival the idea of a benefactor is soothing. To admit the opposite, to entertain the idea that patronage is itself exploitative, is to admit that there is not structured safety net at all and that the poor are adrift within an amoral social and economic system that is utterly indifferent to their well being and survival (108).

Prior to 1877, large landholders had a virtual monopoly on water supply, using them for irrigating cotton fields, and, in periods of drought, rural workers could move to a patron's more fertile land (Kenny 2002). Kenney (2002) goes on to note that "with the distribution of land titles, expansion of agricultural trade, and the penetration of capitalism, much of the land that rural workers could use or occupy during times of scarcity became unavailable" (Kenny 2002:126) creating a culture of constant migration in and out of the region. The outmigration of 100,000 people fleeing the drought of 1877 created widespread fear of the migrants, and raised public awareness in Brazil to demand state intervention. This led to what Kenny (2002)

argues is the official invention of drought and drought mitigation policy, where "drought mitigation [was linked] with state obligation, rather than a *natural* disaster excised from public responsibility" (126). In other words, where droughts were historically viewed as disasters that were outside of the realm of control or responsibility of the state, the drought of 1877 brought, for the first time, the impacts of drought into the public consciousness necessitating state response. This was the first time that the state intervened to stave off the impacts of the drought and to mitigate future droughts, through, for example, improved water storage facilities. However, over the next century, policies of drought mitigation were typically large public works projects that favored the large landowners, not subsistence farmers, further consolidating the political power of the elites.

(b) Drought Mitigation in the Modern Era

By the 1930s, drought mitigation programs were firmly located in the state's domain. The revolution of 1930 had "supposedly supplanted the clientalism that dominated the fiefdoms of the rural interior (Albuquerque 1995 p. 113) with modern, civil, democratic systems that would eliminate social, political and economic relations that imprisons men through ties of personal dependency, obedience and submission (Neves 2000)" (as quoted in Kenny 2002: 126). Large public works programs, fixed prices on staples, housing cooperatives and camps for drought migrants, and labor programs were all meant to address the issues of drought and migration. Large public agencies were created to combat drought: in 1934, the *Inspetoria de Obras contra as Seccas* became the National Department of Works against the Droughts

(*Departamento Nacional de Obras contra as Secas*, or DNOCS,) with the specific aim of dealing with the problem of droughts.

The continued frequency and severity of droughts in the region undermined the existing policies of addressing migration and turned to water supply, especially for irrigation purposes. The purpose of irrigation programs "was quite progressive: to settle agricultural populations, avoid migration, and correct the social imbalance in favor of small landholders and sharecroppers" (Arons 2004). These programs were the brain child of Celso Furtado[62], a noted Brazilian economist, whose efforts to develop the northeast regions culminated in the establishment of development banks to specifically target the underdevelopment of the region, specifically the Superintendency for the Development of the Northeast (*Superintendência do Desenvolvimento do Nordeste* SUDENE). The establishment of the *Banco Nordeste do Brazil* and SUDENE in the 1950s laid the foundations "for new industrial investments and modernisation [sic]... including transport systems and telecommunications, as well as drinking water and sewerage systems" (Hita and Hill 2009: 8) Furtado argued that the northeast region's underdevelopment could not be alleviated by market forces, but, rather, necessitated state intervention to propel it into higher development. Thus, he advocated a strong role for the state in the development of irrigation programs to change the economy of the *sertão.*

[62] As Thorburn (1999) notes, "along with Raúl Prebisch, Celso Furtado is seen as one of the creators of the highly influential structuralist school of economic development thought, which articulated the initial blueprint of the industrialization by invitation development strategy followed by many if not all Latin American states in the 1940s and 1950s. Joseph Love's … attributes Furtado with being the first to 'specifically assert that development and underdevelopment were part of the same process of the expansion of the international capitalist economy' (1996, 153)."

The results of this are two-fold. First, the types of projects that were favored under Furtado's legacy were large dams with extensive canal systems to deliver water to irrigation projects. These projects tended to favor the larger landholders, where economies of scale prevailed and larger production could be pursued in the name of development. However, the invention of drought and the subsequent efforts to address it created an opportunity for some to benefit. In some cases, this meant the direct access to controlling water supply, and "politicians and top-down NGOs have replaced the rural colonel as the new super-patrons and are expected to supply services, protection and work in exchange for labor, votes, and loyalty" (Kenny 2002: 128). Thus, water became a commodity that was carefully controlled by politicians and others who stood to benefit from it.

Second, building dams and other water storage facilities created a cadre of experts (*tecnicos*) who favored scientific approaches and megaprojects (Kenny 2002). Their approach to drought as a purely scientific phenomenon was at odds with the local culture of the *sertanejos* (residents of the *sertão*), whose "'fatalistic supernatural ideology' (Gomes 1998, pp. 209, 210) and submissiveness in the face of problems and social change" (Kenny 2002: 125) characterized their attitude to drought. Rain was a gift of the heavens, and lack of rain was beyond individual control (ibid). As Magalhães (1993) notes

> Dependence on nature, especially on climate variations; a close relationship with the surrounding environment; a strong religious sentiment that makes him accept as given his destiny and the difficulties of life (and, in a way, the belief that he is not able to change things); a lack of preoccupation about the future making him worry only about his present-day subsistence; the courage to face his day-to-day difficulties, of which the fight against droughts is the most important; and the disposition to work and never give up- all of these are traces of the culture of the Sertanejo and components of his character (186)

The figure below is an example of a dam in Bahia (the Pindobaçu dam) that was considered the primary strategy to combat drought in the earlier half of the nineteenth century. Large dams like this increased the state's ability to store water. However, this did little for residents of the rural areas, who were not connected to the water supply, because extending pipes was often far too costly for the remote areas. Aside from not extending water to rural areas, dams also fell out of favor because of high levels of evapotranspiration in the region (Garrido 2007).

Figure 5: Pindobacu Dam in Bahia, Brazil

Source: Author

The influx of engineers and other scientific experts to combat drought with large water projects shaped a suspicious ambivalence towards remote authority figures with utopian projects (Kenny 2002). In turn, the culture of the *sertão* exasperated the technical elites, who blame the "backwardness" of the people for persistent problems of drought in the region (Arons 2004; Magalhães 1993). However, the simple reliance on technology-driven solutions ignore the broader

socio-political context of poverty and inequality. As Mehta, et. al. (2007) note, "simplistic notions of scarcity often lead to simplistic solutions which can intensify problems of access and exclusion" (22).

By the early 1990s, it was clear that drought management policies that consisted primarily of building dams for water storage were not sufficient to mitigate the effects of droughts on dispersed rural populations; and many water reservoirs lacked canal systems to deliver the water to rural communities (Garrido 2007). As a result, many dispersed rural villages lack consistent water supply both for irrigation purposes and supply and sanitation purposes, and their livelihoods continue to be affected by droughts.

(c) Water and Poverty in Bahia's *sertão* today

Lack of access to water supply in Bahia continues to be closely linked to poverty in the state. Bahia's poverty is disproportionately located in the *sertão*[63], where the majority of residents are dependent on rain-fed agriculture and government transfers for subsistence. Historically, poverty in Bahia has been closely associated with agriculture. In 2001, 52 percent of the extreme poor household heads cited agriculture as their primary form of employment (Verner 2001). Most of these households are located in the rural areas, with limited access to basic infrastructure and services. In many areas, males migrate to urban areas in search of work, which, in the absence of reliable remittances, could leave the household more vulnerable to droughts and other water stresses. Many of the villages are small and remote, with limited access to basic infrastructure. The photos below were taken during field

[63] Bahia's overall poverty rate is 39 percent, rising to 47 percent in rural areas (World Bank, 2005).

research in the area, and show the typical red sand ("poeira") that dominates the landscape of the *sertão:*

Figures 6 and 7: : Villages of the *sertão*[64]

Source: Author

The rural poor are primarily smallholders, sharecroppers, and informal wageworkers that depend on a diverse strategy of income-generating activities in which the subsistence production of corn, beans, manioc, rice, and small livestock predominates (Verner 2004). In the semi-arid and transition zones, rainfall is scarce and highly irregular, yielding crops of low quality and low income generating capacity. These small farmers lack modern production technology, basic infrastructure to store harvests to take advantage of cyclical price fluctuations, technical assistance to improve productivity, and organized marketing facilities. Family income is, therefore, highly variable and there is little opportunity for saving. They have very few assets, including education, and are very vulnerable (Verner 2004). The photos below show the impact of low rainfall on crops and livestock in the *sertão*:

[64] These are photos taken of villages during the initial stages of field research and were not selected for further investigation. Photos of the sites chosen were not selected to ensure

Figures 8 and 9: Low rainfall and crops, livestock

Source: Author

Many of these rural poor rely on transfer programs such as *Bolsa Familía* and other federal and state programs for basic foodstuffs. In 2005, Bahia was the largest beneficiary of the *Bolsa Familía* program in Brazil, with nearly 13 percent of the recipient families servicing all 417 of Bahia's municipalities. Many of these families are located in the rural regions and the *sertão*, where income opportunities are limited, droughts are frequent, and social protection programs are few (Verner 2004). While many of the rural poor have chosen to migrate from the poorer interior zones, nearly 2.8 million rural citizens continue to live in poverty in Bahia. More than 60 percent of these household heads had incomes of less than one minimum wage (*salario minimo)*[65] in the poor regions, compared to the regional average of 55 percent, or the capital zone's 34 percent (Verner 2004).

While drought or limited rainfall is certainly linked to the precarious situation of rural residents of Bahia's *sertão*, access to water is also mediated through political patronage structures (Zimmerman 2009). Political campaigns in these areas often

[65] The minimum wage in Brazil is R$465 per month (2009 value) (Ministério do Trabalho e Emprego, http://www.mte.gov.br/sal_min/ accessed 7/19/2009.

promise free water in exchange for votes, and either fail to make good on their promises, or the water system collapses soon after the election for lack of basic maintenance (Arons 2004; Selka 2009). In addition, water and land ownership are closely linked in the state, and large-scale agricultural producers have a virtual monopoly over the water that flows under their lands. Without the capital to invest in pumping systems, or rain storage facilities, many rural residents continue to use open sources of water for consumption and small agricultural plots. The table below shows the percentage of Bahian households with access to basic services.

Table 1: Access to Basic Services (% of households with service), 2003

		Piped Water	*Sanitation Services*	*Electricity*
BAHIA	Rural Households	32%	57%	64%
	Urban Households	88%	95%	99%
BRAZIL	Rural Households	58%	72%	82%

Source: World Bank (2005)

Both the state and the national government have implemented a number of programs in recent years aimed at bringing water supply, sanitation, and electricity services to the semi-arid region. This is, in part, because of growing concern over migration of the rural poor to urban areas (particularly São Paulo city and state) because of drought and poor living conditions. In addition, the provision of clean water and sanitation services is closely linked to improved health indicators, through the reduction of diseases associated with contaminated water sources and dehydration. The largest such program in the water supply sector is falls under the 2007 law on water supply and sanitation (Lei 11.445/07 *para o saneamento básico*)

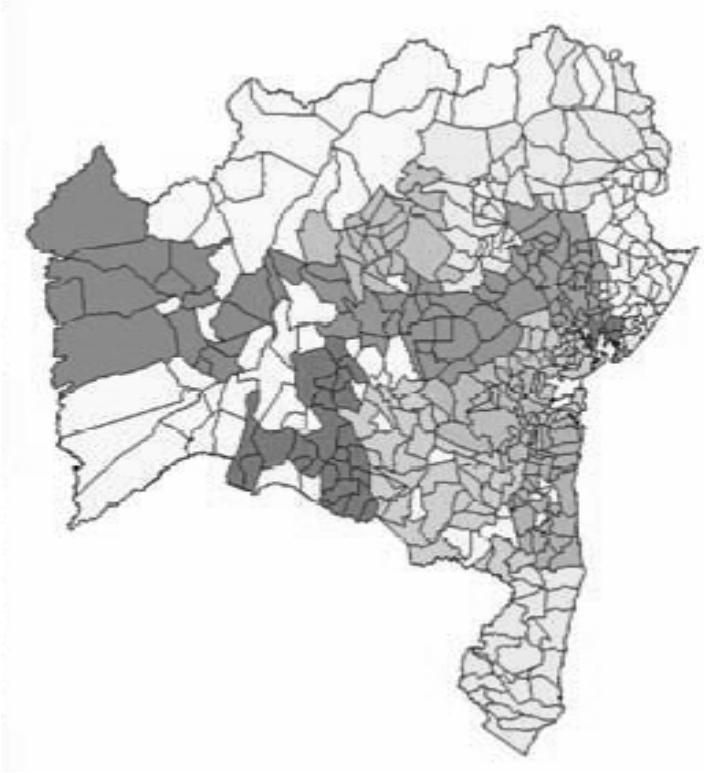
that sets out to increase investments to expand access to water supply and sanitation, while also taking into account local contexts.[66]

Today, the State of Bahia is supplied by the private enterprise, Embasa (*Empresa Baiana de Àguas e Saneamento*), although the majority stake (98%) is held by the state government. With an annual revenue (liquid operational) of R$370 million, EMBASA services around 7.2 million people in 344 municipalities (of 417) in the state of Bahia. Today it is the largest sanitation company in the northeast, the twenty-seventh state company in the country, and is forty-second on the list of the 100 largest companies in the North-Northeast region (Revista Exame, 2001 as quoted in ANA 2006). Embasa provides services to towns and communities in the state of Bahia with more than 5,000 inhabitants. This means that even where Embasa provides water to the district, communities with less than 5,000 inhabitants are not eligible for water provision through the state company. Districts in Bahia not serviced by Embasa are supplied water through one of six of the other water supply companies in the state[67]. The figure below shows the districts in Bahia that Embasa services:

[66] This law updated the national plan to expand water supply and sanitation services, PLANASA, that had operated between 1968 and 1986. Critics of this program argued that the centralized approach to service expansion did not take local realities, including appropriate technologies and the ability to pay, into account. The abolishment of PLANASA opened the playing field to private companies and alternative service providers. The new law places renewed emphasis on universal access to services.

[67] There are a total of six water supply companies active in the state: 1. SAAE - SERVIÇO AUTÔNOMO DE ÀGUA E ESGOTO; 2. EMBASA -Empresa Baiana de Águas e Saneamento; 3. PM - Prefeitura municipal de Santa Maria da Vitória; 4. EMSAE - Empresa Municipal de Serviços de Água e Esgoto; 5. EMASA - Empresa Municipal de Agua e Saneamento Ambiental S/A; and 6. PMBE - Prefeitura Municipal de Barra da Estiva (SNIS 2008). EMBASA is the primary supplier of water, although they offer concessionary arrangements for water supply to companies in other districts. Each of these companies has their own policies for distributing water supply services. The CENTRAL program is not counted as a concessionary water supply company.

Figure 10: Districts in the State of Bahia where Embasa supplies water[68]



Source: Embasa 2008

Small rural communities with less than 5,000 inhabitants that are not eligible for Embasa services tend to use open water sources (mostly rivers) when available, leading to greater risk of exposure to waterborne diseases. In order to address this gap, the Government of Bahia has recently drawn on international experiences in participatory water management institutions to invest in simplified water and sanitation systems and then turn over the operation and management to the local community. Recently, the relative success of these collective management institutions has provided a useful starting point for examining the relationship between equity and efficiency in these experiences.

[68] This map shows the different districts and regions in the state supplied by Embasa. The shadings represent different regions within the state. What is of interest for this analysis is the fact that several districts are not supplied water under Embasa.

Figures 11 and 12: Residents of a village carrying water from open rivers

Source: Author

While irrigation remains an important priority for the state of Bahia, this research will focus on the self-managed systems for water supply and sanitation. The reasons for this are two-fold. First, the success of irrigation and agricultural crops is influenced by myriad other factors, such as access to markets, world commodity prices, pests and other crop diseases, etc. In this scenario, water resources are an additional input to crop outputs, and the reliable delivery of water resources is not the ultimate cause for improved crop outputs. Thus, since this research is interested in the participatory administration of water resources, it will focus attention where the administration style can more clearly be connected to outputs of reliable water services.

Second, the provision of water supply and sanitation services has typically been promoted as a hallmark of modernity, with responsibility for management historically resting with the state. Beginning in the 1990s, however, the Brazilian government, at the urging of the IMF expanded provision of water supply and

sanitation services to the private sector (Heller 2006). State companies were now less concerned with expanding water supply services, since this would undermine profitability (Heller 2006). EMBASA's decision not to supply water to communities with less than 5,000 residents has left the water supply sector open to addressing the lack of water supply in a variety of other ways, including community management.

C. Community Level Participation in Water Management: the CENTRAL program

During the 1990s, the introduction of municipal cooperatives been recognized as a successful strategy for water supply and sanitation services. This approach is premised on the notion that smaller municipalities face challenges to ensuring adequate service delivery that can be overcome with a grouping of municipalities and the creation of a supra-municipal authority with the appropriate level of administrative and technical capacity. It is primarily a self-organization of services, with little state and federal government participation (Heller 2006). One of the first such experiments was implemented in the state of Bahia together with the German bank Kreditanstalt für Wiederaufbau (KfW). The objective of this program was to "supply the population in the north-west of the Brazilian state of Bahia with improved basic sanitation as a contribution to improving their health situation" (KfW 2000). The program targeted 45 municipalities with 34,000 inhabitants to receive simplified water supply, and, in some cases, waste water disposal systems. This program was implemented under the Secretariat for Urban Development (SEDUR- *Secretaria de Desenvolvimento Urbano da Bahia*, with the construction of the systems done by CERB- Bahia State Rural Engineering Company (*Companhia Estadual de Engenharia Rural da Bahia*).

The program financed the installation of simplified water systems and trained community members in the operation and simple maintenance procedures of the water supply system. The system consisted of an electric pump that pumped groundwater to a water storage unit where hydrochloride and sodium were added to purify the water. The water is then pumped to each of the houses. The program also financed the installation of meters at each of the entry points to the houses to measure consumption. Annex 1 provides photos and descriptions of the water supply systems.

Originally, the program envisioned handing the operation and maintenance of these systems over to the local communities. But by 1999, with concerns over the ability of the communities to effectively and sustainably maintain these systems (given the necessity for technological and administrative capacities), two supra-municipal associations were founded. These associations, called CENTRAL (*Central de Associações Comunitárias para a Manutenção de Sistemas de Abastecimento de Água*- Community Association Forum for Water Supply Systems Maintenance), are non-profit associations open to all community associations and are responsible for the maintenance of the water supply systems (basic operation rests with the community themselves). The objectives of CENTRAL are: (i) to ensure financial viability of systems through collection of tariffs; (ii) to promote improvements in community management of water supply systems; and (iii) to represent the community associations and advocate for their interests (Heller 2006). Initially, Central provided preventative maintenance and repair services and billing, although their activities have expanded to include trainings in hygiene behavior, technical assistance in system operation, and assistance in registration and other legal issues.

The program selected municipalities to take part in the program based on (i) the community's demonstrated willingness to take on a project in water supply; (ii) the commitment of the municipal government to support the project; and (iii) the majority vote of a community association to take part in the project. Of the roughly 115 communities who applied, about 40 percent were selected into the program. The community associations all elected a president, a treasurer and a secretary for two year terms, and the associations meet on a monthly basis. Each user pays a flat fee for the first 10 cubic meters (m^3) that they consume, and according to consumption after that. Some communities covered the cost of water and electricity, whereas in other communities, the municipal governments agreed to cover the cost of electricity. Two supra-municipal associations were established in the municipalities of Seabra and Jacobina. These two CENTRALs are administered by the following authorities: a general meeting, an executive board, a managing committee and a finance committee. The executive board meets quarterly, and has four representatives from community associations, two representatives from the mayor's office, one representative from CERB, and one representative from SEDUR.

Ten years on, the Central program continues to supply water with relatively high cost recovery and user satisfaction. The United Nations highlighted the program as a "best practice" award in 2006 for its quality of service, and for filling a key gap in the state's service provision. The table below presents some key statistics on the Central program. From this table, it is clear that water losses are relatively low, listed at 13 percent in 2008 (as compared to an average of 50 percent among water supply companies in Brazil as a whole). In addition, the program succeeds in covering a

high proportion of the population in the communities and municipalities it services. Finally, the program is expanding to include more communities, bringing critical infrastructure to small rural communities.

Table 2: Indicators of the Central program, Seabra system

Year/Indicator:	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Number of Associations affiliated	36	37	50	53		57
Communities covered	52	54	75	78		88
Number of water supply systems	35	36	40	42		44
Number of sewerage systems	-	-	-	-		-
Number of water supply connections	3362	3616	5,562	6,156		7,271
Number of sewerage connections	-	-	-	-		-
Population served	16,200	18,080	27,810	30,780		36,355
Consumption (# of liters per person per day)	60	63	55			96[69]
Losses	27%	21%	29.2%			13.1%[70]
Staff	8	8	7	7		8
Municipalities served	17	17	17	19		19
Illnesses attributed to water quality	0	0	0			
Percent of population covered (water)	95%	95%	95%	95%		98%
Percent of population covered (sewerage)	-	-	-	-		-
Number of disconnections	63	68	56	163		
Number of visits to systems (technical)	391	340	353	396		
Number of visits to systems (social)	238	221	217	228		
Range of piping (kilometers)	75,054	70,477	76,642	68,460		
Number of pumps replaced	17	19	16	10		
Rate of non-payment	8.50%	9,55%	10,64%			1,2%
Number of pumps replaced (new)	6	6	8	1		

Source: Central 2008

[69] This figure is based on the average liters consumed per household of the six communities surveyed, and is not representative of the whole system.

[70] This figure is taken from a sample of one community that Central tested in 2008 and does not represent a system-wide average.

The CENTRAL program provides a compelling case study of the ability to achieve outcomes of both efficiency and equity within participatory organizations. Given the importance of reliable service delivery, the issue of technical and allocative efficiency remains of fundamental importance to these water supply schemes. However, the emphasis on participation and the prominent role of community associations also provides a forum to address issues of equity. An ex-post evaluation initiated by KfW indicated that gender equity had improved as a result of the program, although the primary success indicators focused on the technical and allocative efficiency of the water supply systems.[71] Cost recovery for the CENTRAL systems is estimated at 95 percent for Seabra and 90 percent for Jacobina, a key factor in the program's success rating, and a prime driver in discussions to expand the program to other municipalities. If we are to believe the development model's predictions, the efficiency achievements should be accompanied by greater perceived equity within the community realized through high rates of participation. On the other hand, if we are to believe Weber's predictions, than the efficient delivery of water services has been accomplished at the cost of equity within each of the communities, and a relative redundancy in participation. In the next section, I outline a proposed research design that attempts to investigate the relationship between levels of participation and outcomes of efficiency and equity.

[71] These included indicators of mean water consumption, water losses, water quality, system malfunctions, etc. I was not able to obtain a copy of the ex-post evaluation, so I was not able to understand how the program led to improved gender equity, or how this was measured.

Chapter 4: Research Design and Methodology

A. General Methodology

This research drew on participatory rural appraisal (PRA) techniques to examine the compatibility of outcomes of efficiency and equity within participatory water management institutions. The methods used included open-ended interviews, semi-structured interviews, key informant interviews, focus group interviews, community mapping exercises, and participant observation. In addition, financial data was collected for the supra-municipal water supply organization, Central.

The PRA technique was initially developed as "an approach and range of techniques that enable stakeholders to analyze their problems and then plan, implement and evaluate agreed-upon solutions" (GTZ 2006). The methodology introduced abbreviated versions of in-depth qualitative methods that would allow assessors to better understand the dynamics and relationships within communities, and to work together with communities to identify development solutions. It was developed in response to top-down state-driven development solutions to develop a more demand-driven, or user-driven solution.

The decision to use PRA techniques was based on two motivations. First, the techniques are particularly useful to examine relationships at and institutions on the village level in rural areas of less developed countries. PRA makes use of abbreviated qualitative methodologies that better allow for examining dynamics and relationships, and is particularly focused on examining social differences, which remains important when researching access to water supply services. Second, the techniques allowed for an input on what the key variables of efficiency and equity

and participation meant in the local context, and made room to explore emerging themes and issues within the community.

PRA makes use of a variety of methods, depending on the information to be gathered. Since this dissertation did not address the problem-solving aspect of the PRA methodology, the methods used were geared towards gathering information on descriptions of and relationships within the community at large, and also specific to the community organization and water supply company. Thus, the methods that were used included semi-structured interviews with a random sample of community members, focus group interviews to observe how joint opinions were formed, and community mapping exercises which showed to what extent the community organizations replicated existing inequalities within the community. In addition, participant observation of the communities was used to identify community conditions and relationships, as well as to map the water system.

Finally, PRA emphasizes triangulation of data sources by relying on different techniques to compare answers and decipher patterns on the ground. Perceptions within the community were triangulated with key informant interviews with local government officials, and members of the supra-municipal water supply company, Central, as well as with the president and operator within each community. The triangulation of data allowed for an understanding of where community members lacked relevant information, and also provided a way to cross-check information sources

The specific methods used are presented below[72]:

METHOD	DESCRIPTION	APPLICATION OF METHODS
1. Review of existing data	Participatory methods demand an initial understanding of the likely issues to be addressed through the research. This information could come from documents, or from local folklore. Special attention must be paid to not over-emphasizing previous analyses too much.	Research was done through official and unofficial studies and reports on the socio-cultural, political, ecological, and hydrological conditions. Specific information on the Central program was gathered, as well as socio-demographic statistics.
2. Direct observation	This helps identify the local conditions, can provide topics or areas for discussion, and help assess the differences between reported and real conditions. These are assumed to be a starting point	Direct observation of the communities to be studied provided an understanding of how remote the communities were, the ecological climate (semi-arid), and an initial understanding of the local resources (i.e. school, clinic, etc.)
3. Transect walks and guided field walks	The researcher and key informants conduct a walking tour through areas of interest	Guided walks provided an overview of the location and relative condition of the pump, as well as the knowledge of the operator in the location of hydrometers and relevant local issues
4. Informal interviews	Perhaps the most widespread method of PRA, requiring a balance between open-endedness and directed enquiry	Informal interviews were used in the initial stages of the research to feel out whether an enquiry into efficiency and equity would be relevant for the local context. Results from the informal interviews revealed this to be a relevant testing ground for more structured questions
5. Group meetings	Group meetings provide an insight into community dynamics, specifically in how communities share	Community association meetings were attended to observe community dynamics and participation,

[72] Adapted from GTZ 2006. The methods and descriptions were presented in GTZ 2006. The application describes how these research methods were used during the research time period for this dissertation. This is not an exhaustive list of PRA methods, but rather a list adapted to present the methods used in this dissertation.

	information, discuss issues of relevance, and gain consensus on issues.	and to understand which issues were of local importance
6. Focus group interviews	Established groups or people using the same resource are interviewed together	Focus group interviews were conducted with community members who were part of the water supply system to observe how communities discussed and reconciled differences of opinions, and which themes emerged from group discussion
7. Semi-structured interviews	Predetermined questions and topics are used, but the method allows for new topics to be pursued as the interview develops. The interviews are informal and conversational but carefully controlled.	Semi-structured interviews were conducted on the themes of efficiency, equity and participation. The focus of the interview questions allowed for a greater number of respondents to be interviewed.
8. Key probes	A question addressing a key issue is asked of different informants and answers are compared	Key questions on efficiency, equity, and participation were asked of all respondents to compare differences and emergent themes in the answers
9. Community mapping	Respondents provide their input (either alone or in a group) as to the relationships between decision-makers in the community, the community organization, and water resources.	Community mapping provided a clear picture of which groups of people were more or less active in the community organization and allowed for mapping of groups along a continuum of participation
10. Field Report writing	Key findings are recorded before leaving the village. Brief summaries are made of diagrams, as well as the processes	Field notes were kept for all the communities visited to record the days events

B. Research procedures and data

The starting criterion for this research was to do an in-depth study of a water supply program that relied on participation of users to ensure sustainability. Generally speaking, much of the literature on participatory institutions indicated that

they reflected the compatibility of outcomes of efficiency and equity. Brazil was chosen as a research site because of widespread legislative support for participatory initiatives, including one of the most widely cited cases of successful participation, the case of participatory budgeting in Porto Alegre.

The state of Bahia was determined because it provided an interesting case within Brazil. The northeast is poorer than the south, with more limited resources and a relatively weaker civil society. On the other hand, the large semi-arid triangle, located in the northeast, has received political attention because of outmigration and relatively low living standards. Thus, water provision to these areas has been a political priority for a while, both on the national and the state level, because of expanding water services and improving development, but also to stem wider social issues of poverty and migration. Given the relatively weak civil society and the history of patronage in Bahia, the semi-arid region seemed to pose an interesting challenge for bringing in autonomous water supply programs through development financing.

Initial conversations with development specialists revealed that the Central program, located across two districts in Bahia, provided a good case study of successful autonomous water supply and sanitation provision that relied on participatory user organizations for sustainability. These simplified systems were operated at the community level, and had been highlighted by the United Nations as a best practice in the provision of community-based water supply systems.

Water supply systems were chosen over irrigation systems for two reasons. First, the research examined the relationship between participation and outcomes of

efficiency and equity. As such, water supply institutions provided a clearer indication of the relationship between each of these, since the delivery of water (and the extent to which this is efficient and/or equitable) is the end goal of the institution. Water management institutions for irrigation intend to use the allocation of water as an input to maximize crop yields, or otherwise produce foodstuffs, meaning that the relationship between participation and water delivery is affected by many other factors. Second, the expansion of water supply and sanitation is an important political priority for Brazil in general, and Bahia in particular.

Once the program to be researched had been established, the next step was to determine the appropriate communities that would provide some variability on participation. Initially, participation was determined simply by the percentage of the community that belonged to the community organization[73] and how often the community organization met. This indicator is problematic to assess the more nuanced issue of quality of participation, but it provided a sample list of 23 communities that presented some variability. These 23 communities were provided by Central and based on the criterion of percentage of people who belonged to the community organization.

This full list of communities was then presented to state level officials at CERB, and to staff at Central to determine a more refined list of communities that would fulfill the objectives of variability in participation, but would also be feasible to study over a three week period. The list was refined first based on feasibility and

[73] This indicator is problematic in this context because affiliation with a community organization is a pre-requisite to qualify for government benefits. Thus, the indicator of membership was refined to get a sense of how many people really "actively" participated and how often the community association met. While this relies on impressions of Central staff, the total list of communities provided gave a wide enough variation in levels of participation so as to further narrow down the research sites.

access. Next, a number of communities were visited together with Central staff as they made rounds. This provided an overview not only of the work of the maintenance organization, but also of the distance and types of communities that were part of Central (in terms of size and resources). Informal interviews were conducted with residents of the communities to explore the relevance of themes of efficiency and equity as outcomes and their relationship to participation. Questions asked in the informal interviews were designed to test the semi-structured interviews and to make modifications. Around 25 informal interviews were conducted, lasting between 60-120 minutes, with an average of about 70 minutes each. The results from these interviews formed the basis for the more semi-structured interviews.

Sampling

Once the questions were piloted, the list of sites to be visited was finalized. Discussions with Central staff indicated that there might be several factors affecting active participation within communities. These included:

1. *Local Government Support*: The support of the local government in sustaining, and not undermining, the Central program was determined as being important to the survival of the community organization. Some municipal governments hoped to undermine Central by offering free water, or by diverting the water fees to their administrations. This typically occurred during elections, and soon after elections, water was no longer provided.

2. *The cost of electricity*: The costs of electricity could, depending on the location of the pump, double the cost of water to the average household. Some municipal governments offered to pay for the cost of electricity,

resulting in lower average bills for the community members that those who had to pay for the cost of electricity themselves.

3. *Integrated Systems:* Even for those communities who had to pay the cost of electricity, the actual cost assessed per household depended on the rate, and also the location of the pump and the communities involved. One major problem cited with the program in Jacobina was that the systems were "integrated", meaning that one, or even several, pumps covered several communities over long distances, thus, effectively, raising the price of electricity.

4. *Funding Source*: The supra-municipal organization was initially set up with financing provided by the German Development Bank (KfW), to provide maintenance services to communities that had received water supply infrastructure funded under their program. Other funding sources have also financed water supply infrastructure, including the World Bank (under the federal program PROAGUA/SEMI-ARIDO), and municipal financing (through state grants). Any community can apply to be a part of Central, irrespective of the origin of the funding for the infrastructure, and the Central program ensures that water supply is metered and that similar operating procedures are in place. However, communities were selected with a variety of funding sources to control for any potential sampling biases between the communities.

5. *Size of the community*: The size of a community has been cited as potentially having an impact on the participation of a community organization (Ostrom

1990), specifically, as the community grows in size, the ability to provide peer monitoring is limited. Thus, sites were selected that were different sizes, both in the number of households and population, as well as of the breadth of coverage of the water supply system.

6. *Community Association*: Part of the requirement to join the Central program is to have a community association that will be responsible for the administration of the water system on the community level. Some communities had associations that pre-existed the program, whereas others were founded as part of the requirement to affiliate with Central. A variation was sought here, both in the length of time that the organization had been in existence, as well as how long before, if at all, the community organization pre-existed the Central program.

The research sites were sampled to provide some variation in some of the factors that could be associated with differences in participation. However, several key similarities remained that could be used as points of comparison. First, the communities were all affiliated with the Central program, and were between 30 households and 5,000 inhabitants. This meant that all communities had simplified water supply systems installed, hired an operator from the community trained in the daily maintenance of the system, all consumption was metered by hydrometers, and rates for the water were set by the supra-municipal maintenance organization, Central. Second, the communities were similar in climate and location; the communities are predominantly rural, rely on subsistence agriculture for survival,

have few local resources, and are dependent on state subsidies for income.[74] Finally, all communities were similar in the administration of water supply. All communities had a community association with two year term limits for the positions of president, vice-president, treasurer and secretary. The associations typically met monthly, and association dues were decided by the community through a majority vote.

While the research sites selected do not necessarily provide a point to generalize for all of the participating communities, they provide important insights into how participation is linked to outcomes of efficiency and equity within these communities, and can provide some insights into patterns across communities. More research would have to be done on a wider set of communities to investigate whether the relationships found between participation, efficiency and equity would hold on a broader level.

The list of research sites was finalized to provide, first and foremost, variation in the levels of participation, but also to provide some variation in the factors listed above. The following table provides an overview of each of the sites visited:

[74] The majority (97%) of respondents reported receiving different forms of government assistance, which was predominantly from *Bolsa Familia*. This program provides food aid (formerly under the program *Fome Zero*) and cash subsidies to families with children. The amount of the subsidy varies. For families that report monthly incomes of less than R$70 per month, families receive R$68, plus R$22 for each child up to 15 years of age, and R$33 for each child between 16 and 17 who is enrolled in school. For families that report monthly incomes of between R$70 and R$140 per month, each family receives R$22 per child up to 15 years of age, and R$33 for each child over 15 who is enrolled in school (but no standard minimum benefit). Agricultural workers who reach retirement age receive the monthly minimum wage of R$450 per month.

Table 3: Research Sites

Water Supply System/ Level of Participation	*Municipality*	*Communities covered under water system*	*Pop (est)*	*No of households (est)*	*No of WS connections.*	*Source of Investment financing for hardware*	*Year Joined Central*	*Year Community Association Founded*	*Who pays for Electricity*
High									
Beco e Saquinho	Seabra	Beco/Sauquinho/Fazenda Malhada/ Barreirinho	700	114	114	Proagua/Semi Arido	2006	1997	Community
Conceição	Boninal	Conceição/ Bateia	1,200	200	195	Central I	1996	1985	Community
Lagoa Dionizio	Ibitiara	Lagoa Dionizio, Vereda, Gameleirinha and Capoeira	2,200	445	445	Municipal	2007	1992	*Prefeitura*
Medium									
Pau D'Alho	Iraquara	Pau D'Alho	1,400	200	158	Central I	1996	1985	Community
Lagoa Seca	Seabra	Lagoa Seca	1,100	220	190	Proagua/Semi Arido	2005	1985	Community
Low									
Bebedouro	Seabra	Bebedouro	475	119	119	Municipal	2007	2007	*Prefeitura*

Data Problems

Since this research relied on gathering local understandings and perceptions of efficiency, equity and participation, the majority of the methods used were qualitative in nature. In particular, interviews were conducted to reveal local level understandings of equity, but also concepts of efficiency, and participation. Data based on interviews typically presents problems in that it is difficult to ascertain whether respondents are answering truthfully. This is especially true given that I was an outsider to the community, as well as foreign and white. In the initial stages of research, I was traveling with Central to potential sites to get an idea of the area. At this point, many respondents thought that I was associated with Central, which created a potential bias to the question of whether respondents were happy with the water supply system.

This obvious affiliation was eliminated for research in the selected sites, since I hired a car to travel to the sites independently. However, as an outsider, respondents were still suspicious of my motivations, despite the fact that I explained to them about the nature of the research project, and assured them of their anonymity. It was only when I stopped recording conversations, and proceeded to use codes for respondents rather than names that the respondents seemed less hesitant to respond.

Methodological triangulation was used to address issues of perception-based data by balancing responses with data sources available. Sources for this included financial data of the associations, as well as from the supra-municipal level, coverage rates, access and connection information, non-payment rates, and historical information (2003-2006) on consumption patterns, and payment issues.

A second problem with the data was that I did not end up with a balanced number of sites for each of the rankings of participation. In initial conversations with Central, I indicated I was looking for two communities in each category of participation. However, in my notes I mis-labled one of the communities as low participation, and proceeded to select the community as a good example. It was only during the course of the research that it became clear that the community association was clearly very active, and, in asking about the community again, it became clear that it was, indeed, a high participation community. Thus, in the final site selection, I have three high participation communities, two medium participation communities, and one low participation community.

Description of Data

(a) General description of the communities researched

The communities selected were relatively typical of communities in the region and part of the Central program. All of the communities selected were rural, and had less than 5000 inhabitants[75]. The average population of the communities was 1,179. Within each community, snowball sampling was done to conduct semi-structured interviews. An initial walk-through of the community was done, and then the president and operator were contacted for interviews. After the interview with the operator, the operator provided an overview of the water system, such as the location of the pump, the description of daily operation and maintenance, the location of the

[75] The Central program is active in communities with between 30 and 5,000 inhabitants. The minimum is required for installation of a simplified water supply scheme, since the cost of the pump and other hardware makes financial sense only with a minimum number of consumers. The state water company, EMBASA, does not supply water to communities with less than 5,000 inhabitants.

hydrometers of some of the houses. During this walk through of the community, I would meet several residents, and ask them for some of their time to talk to them in greater detail about the water system. Once these interviews were set up, I would conduct the interview in a private room in the person's house. Names were not recorded to ensure the anonymity of the respondents.

In each community, one group interview was also conducted to better observe the interaction of the community members in how they discussed the questions and issues pertaining to the water supply systems. The following table provides an overview of the interviews conducted in each community:

Table 4: Interviews conducted during field research

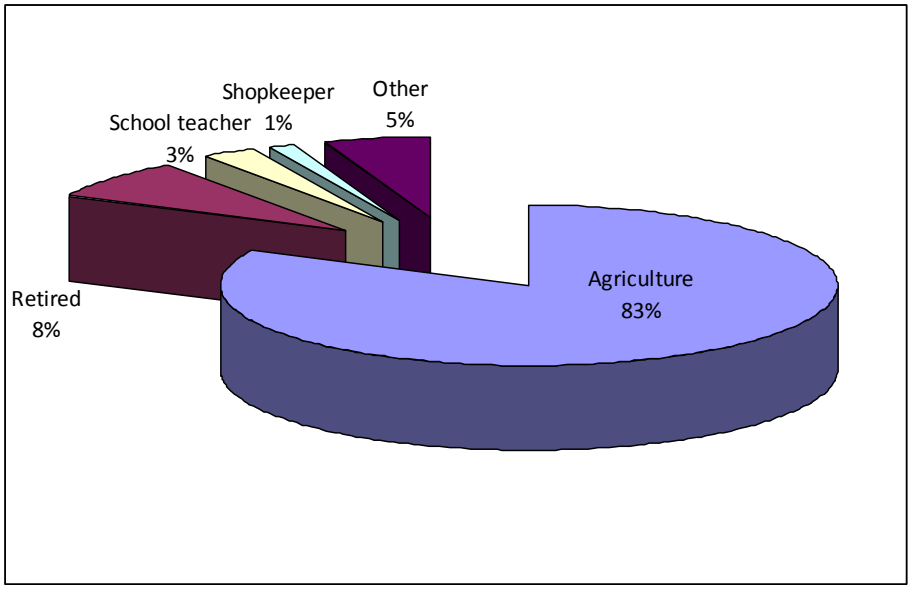
	Beco e Sauquinho	*Conceição*	*Lagoa Dionizio*	*Pau D'Alho*	*Lagoa Seca*	*Bebedouro*	**Total**
Population (est.)	700	1,200	2,200	1,400	1,100	475	**7,075**
# of focus group discussions	1	1	1	1	1	1	**6**
# of key informant interviews	3	3	1	3	2	4	**16**
# of individual interviews	12	13	14	18	15	12	**84**
Total	16	17	16	22	18	17	**106**

(b) Socio-demographic characteristics of the respondents

The majority of the respondents were active in subsistence agriculture (83%). The other economic activities included retired (where the respondents did not specify their occupation), school teacher, shopkeeper and other. Shopkeepers included any type of shop, and including a computer shop in one community. In one community, significant outmigration meant that several respondents (or their husbands) were

involved in construction work elsewhere, such as in Salvador. The table below shows the economic activity of respondents (n=84).

Figure 13: Economic Activity of Respondents



(c) Literacy

Illiteracy rates in Bahia in general and in Seabra in particular have been on a downward trend. However, illiteracy rates remain higher in the semi-arid region than elsewhere in Bahia, which still has some of the higher illiteracy rates in Brazil.

Table 5: Illiteracy rates

Illiteracy rate (%)	*1970*	*1980*	*1990*	*2000*
Seabra	63.9	45.8	35.1	21.0
Bahia				19.3[76]
Brazil	33.6	25.5	20.1	13.6

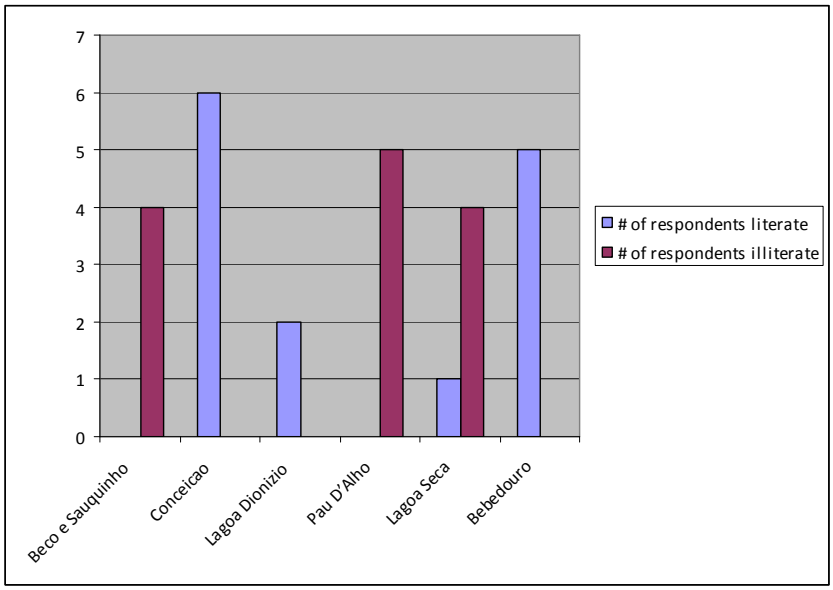
Source: IGBE

Literacy rates in the communities studied varied quite a bit. While no precise literacy rates were available in each of the research sites, literacy rates seemed to be high in Bebedouro (low participation community) Conceição, and Lagoa Dionizio (high participation communities), and very low in Beco e Sauquinho (high

[76] Figure from 2001 (PNAD 2001)

participation community), Pau D'Alho and Lagoa Seca (medium participation communities). The chart below presents the number of people who responded to the question of whether or not they were literate by community:

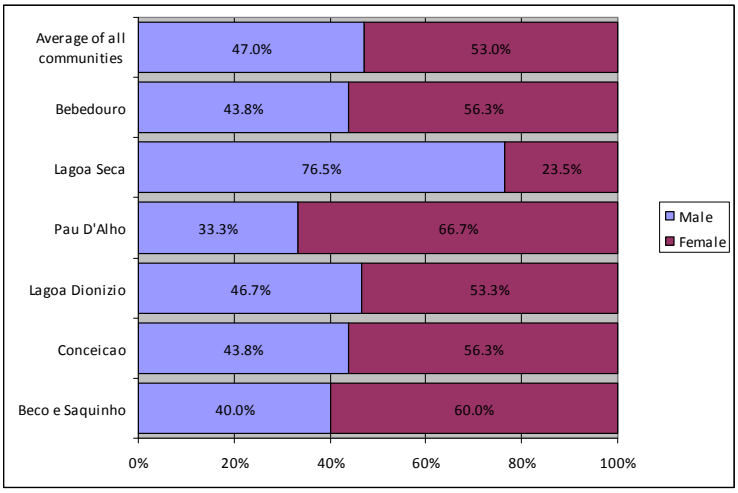
Figure 14: Number of literate and illiterate respondents by community (n=27)



(d) Gender

The gender of respondents was fairly well distributed: 47 percent of the respondents were male and 53 were female. This pattern is close to the gender ratio at large, where the district of Seabra reports a male to female ratio of 49.77 to 50.22 percent (IGBE 2000). The gender distribution of respondents was not always equal, as the following figure shows:

Figure 15: Gender breakdown of respondents by community



The primary reason for this was that since many questions asked respondents about their community association, the knowledge and ability to answer questions in the interview depended on the role of the community association in the community. In Pau D'Alho, for example, women tended to dominate the community association, since it dealt primarily with issues pertaining to local schools and state cash transfer programs. In Lagoa Seca, on the other hand, men were more active in the community association, since the association dealt with issues related to agriculture (i.e. seed provision, tractor rental, etc.).

(e) Age

The age range of respondents ranged from 16 to 68, with an average age of 43.1, and a median age of 42. The median age of respondents is higher than the average age that was given for most communities (closer to 34[77]). However, young people were typically not involved in the community association or with water issues. Attempts to interview young people (between 18 and 25) typically revealed that they

[77] This figure is not precise. Key informants (such as the association president, school teachers, and other community leaders) were asked their estimates of the average age in the community.

had very low knowledge of the community association, and were not interested in participating.

C. Variables:

Many of the debates over the participatory approach make use of a wide variety of definitions of participation, efficiency and equity. Many scholars agree that participation can occur on a continuum, and there is much discussion over when participation is meaningful. Outcomes of efficiency are also more complicated than would seem at first. Many different types of efficiency exist, even within debates over outcomes of water management. For example, outcomes of technical, allocative and administrative efficiency are all, for different reasons, considered to be important priorities in water management. Similarly, a variety of types of equity exist, including allocation and voice. In addition, equity, as different from outcomes of equality, in a contextually driven outcome, where what is considered to be "fair" varies based on the context and culture. The following section lays out the definitions for each of the terms used in this dissertation.

(d) Participation

As noted in Chapter 2, participation within the context of community managed services is defined as the contributions in time, energy, and experience that consumers and interested local people provide to organizations in which they have a direct stake (Darcy 1993). In order to measure these contributions, levels of participation were defined based on (i) the percentage of the community that was a member in the organization; (ii) the percentage of members that attended meetings

with some regularity; (iii) the perceptions of community members as to how many members actively participated; and (iv) the perceptions of the community members as to how open the participatory process was. This definition encompassed both quantitative and qualitative measures, and was cross-referenced with perceptions by program staff of Central, as well as state government officials. In many ways, the definition used relates also to Hirschman's *Exit, Voice, and Loyalty* (1970), where community members could exercise voice (considered "active" participation through voicing opinions but also through contributing time, goods, or other services), or remain loyal (conceptualized for the purposes of this dissertation as attending meetings even if nothing was said).

(e) Efficiency

Efficiency is broadly defined as maximizing outputs with a given set of inputs. As noted in Chapter 2, efficiency within the provision of water services is generally measured along dimensions of technical and allocative efficiencies, where technical efficiency refers to the "efficiency with which resources are used for a given end" (Osmani 2007) and allocative efficiency refers to the best allocation of resources according to consumer preferences (ibid), including quantity and price.

A water system that is technically efficient is one where water losses are kept to a minimum. This is dependent on both the quality of construction, and the continued operation and maintenance of the system that, if done well, will continue to keep water losses relatively low. A water system that is allocatively efficient is one where each user is charged for the costs they generate. In an ideal situation, information about the costs that users generate is available, although in practice, this

is relatively difficult to ascertain. Thus, typically a water system that is allocatively efficient is one where each unit of water is priced at the long term marginal cost of production.

For the purposes of this dissertation, a further measure of efficiency was introduced to measure the relative administrative efficiency of the community organization. This measure was introduced based on the definition put forth by Weber (1921) on administrative efficiency within direct democracies. A tendency towards efficiency was found when technical experts or other community elites exercised a disproportionate level of authority within the community organization that may serve to increase the level of efficiency with which administrative tasks are performed, but would come at a cost to equity.

(f) Equity

Equity[78] tends to be a subjective measure of how goods should be distributed within a particular society. As noted in Chapter 2, equitable outcomes can range from absolute equality in the provision of goods or services, to outcomes that are not equal in allocation but are considered to be fair. To arrive at a working definition of equity, then, field research was conducted to arrive at a better understanding of what community members considered to be fair. In this regard, the definition was left open to be defined locally, where responses within the communities would identify the precise levels of equity that were considered to be fair. For the most part, the field

[78] Equity is a distinctly different term from equality, where the former entails a subjective measure of what is equitable in society. Thus, what can appear to be unequal in one society, could be viewed as equitable in another.

research revealed that the working definition of equity was that all community members had equal access to water supply services.

D. Methods

In order to measure the compatibility of efficiency and equity within participatory water management organizations, the research used different techniques to measure outcomes of efficiency and equity. It then sought to compare these outcomes in participatory organizations that presented variations in levels of participation. Specifically, the research measured technical, allocative, and organizational efficiency, as well as allocative and organizational equity, since these measures are commonly used when evaluating the efficiency and equity of water supply systems (Global Water Partnership 2003). These measures are presented below.

(a) The Allocative Tradeoff

The allocative tradeoff argues that outcomes of efficiency and equity are incompatible processes, and will inevitably come at a tradeoff to each other. Thus, this part of the research sought to establish outcomes of allocative efficiency, on the one hand, and allocative equity, on the other. Once established, the levels of efficiency and equity could be compared to determine if both were high (indicating compatibility) or whether one was high and the other was low (indicating a tradeoff). The measures of allocative efficiency are given below:

Measure	Description	Method Used	Type of Efficiency
Price of water, marginal cost of water	Comparing the tariff system to the cost of producing one cubic meter of water will indicate whether the	Calculations made from financial	Allocative Efficiency

	two are equal. When price is equal to the marginal cost of water, then allocative efficiency is achieved	data	
Customer satisfaction surveys	Consumer's satisfaction with the price and quantity of water received provides an indication of product-choice efficiency	Questions on satisfaction with quantity and price	Allocative Efficiency
Cost recovery	Cost recovery indicates appropriate pricing of water to create optimal allocation of resources	Calculations from financial data and water bills	Allocative Efficiency
Subsidies	Subsidies to the water system indicate pricing of water is not adequate to ensure continued operation and maintenance of system and price does not equal marginal cost	Questions to key informants; water bills	Allocative Efficiency

Because measurements of allocative efficiency rely primarily on pricing data, the level that most of this data was collected was at the supra-municipal level. This meant that a community-by-community breakdown of allocative efficiency was not possible beyond the perceptions of consumers.

The measures of allocative equity are given in the table below:

Measure	**Description**	**Method Used**	**Type of Equity**
Equity of coverage	The percentage of the population that is covered by water supply services provides an indication of how accessible the service is	Calculations made from water bills	Allocative Equity
Perception of fairness	Consumer perception of the fairness of the system provides an indication of how equitably water is allocated	Interview questions on perception of fairness	Allocative Equity

Because equity is a subjective measure of fairness, the measurements of allocative equity were primarily gleaned using qualitative techniques.

(b) The Organizational Tradeoff

The organizational tradeoff argues that administrative processes that will tend to favor efficiency will, over time, undermine equality within a democratic organization. One area of contribution of this research to debates on efficiency and equity of water supply systems is the application of the institutional literature to address issues of administration and organization. These variables were considered to be outcomes of participation, and evidence to this end was gathered based on the following:

Measure	Description	Method Used	Type of Efficiency
Outcome of efficiency	Outcomes of community meetings and the decisions made provide insight as to whether the organization operates efficiently	Participant observation of community meetings	Organizational Efficiency
Perceptions of technical expertise	Concentration of technical expertise will make decision-making more efficient	Individual and group interviews with community members	Organizational Efficiency
Perceptions of leadership in community organization	Concentration of leaders in administrative positions of community organization makes decision-making more efficient	Individual and group interviews with community members; records of leadership positions	Organizational Efficiency

Concerns over efficient administration within the community organization are expected to lead to diminished equality of participants. If the opinions of one group is seen as more relevant (in the case of technical expertise) or more knowledgeable

(as in the case of elites), then the opinions of others in the group will hold less validity and equality is compromised. Because this is mostly a process-based approach and dependent on perceptions, the measures of organizational equity were largely qualitative in nature. The following table outlines these measures:

Measure	Description	Method Used	Type of Equity
Voice weighting	How equally voices and opinions are weighed in the community organization gives an indication of how fair the community organization is in its administration of water	Interview questions on perception of how voices are weighted; Participant observation of community meetings	Organizational Equity
Equity in membership	Determine the procedures and rules in place to ensure equal opportunity of voice in community meetings	Questions to respondents; Minutes of community meetings; Organization by-laws	Organizational equity
Equality within the community/community organization?	Respondents provide perceptions of the community organization based on levels of participation that are broken down by age, gender, and wealth to determine patterns of voice	Community Mapping	Organizational Equity

(c) The Development Model

The development model argues that participation leads to improved outcomes of efficiency and equity vis-à-vis bureaucratic management. The research did not have access to timeline data, and so could not address this claim. Instead, what the research did was to establish the links between participation and the outcomes of equity and efficiency gathered above to determine the extent to which participation resulted in

accountability, peer monitoring, and preference revelation that, in turn, are linked to outcomes of efficiency and equity.

The participatory structure is said to result in greater efficiency through improved accountability. Levels of efficiency can also be increased through reducing 'hidden action'[79] through mechanisms of "peer monitoring" or increased sense of "ownership" over the system. The following table provides an overview of the measures used:

Measure	**Description**	**Method Used**
Peer Monitoring	Participation is expected to act as a peer monitoring mechanism that will result in reduced negligence and improve transparency, leading to improved efficiency of the system.	Questions to respondents of how they monitor the financial flow of their association, and the president
Hidden Action	Hidden action can occur when there is no direct oversight of the operation and maintenance of the system, and negligent work occurs. Participation is expected to reduce hidden action through monitoring the technical workers.	Questions to Respondents of how they monitor the operator
Ownership	A sense of ownership over the system is expected to lead to greater care in maintaining the system	Questions to respondents of their sense of ownership; observation of levels of maintenance

Participation is also expected to lead to greater equity within a community user group through mechanisms of institutional accountability and through improving access of all members to be able to voice concerns equally. These were measured in the following way:

[79] 'Hidden action' is an aspect of informational asymmetry whereby negligent work goes unnoticed that can lead to eventual losses in efficiency (Osmani 2006)

Measure	Description	Method Used
Voice and Inclusion	Inequitable systems base decisions only on the most powerful or most heard. Ensuring that all members are heard and included in the decision-making process will mean that the allocative decisions reached will reflect the mean of all preferences in the community	Questions to respondents on how meetings were run, whether they felt heard, whether everyone had an equal voice Participant observation of community meetings
Accountability	Measuring systems of accountability through provide a check on distributory policies that have been inequitable.	Questions on how operators and board members have been held accountable Participant observation of community meetings

This chapter presented the methods used during the field research that was conducted across six communities in Bahia, Brazil in April 2009. Annex 2 presents the questions used during field research. The next section presents the specific findings from the field research that related to questions of efficiency and equity within participatory institutions.

Chapter 5: Findings

This section presents the findings from the field research conducted in six communities that are a part of the Central program in Bahia, Brazil. The research aimed to address questions of the extent to which equity and efficiency are mutually compatible processes, and to what extent they may generate tradeoffs. As a result, the presentation of this section will first present the findings on allocative efficiency and equity, since the literature argues for a tradeoff between these goals. Next, the tradeoff between organizational efficiency and equity will be discussed, followed by a presentation of the extent to which goals of both equity and efficiency were achieved. All in all, support was found for all three models; outcomes of allocative equity and organizational efficiency were achieved simultaneously, but these both came at a tradeoff to their respective forms of efficiency and equity.

A. The Allocative Tradeoff

The allocative tradeoff, understood as the tension between cost recovery and sustainability and affordability, was present in the pricing system of the Central water supply system. This was determined using several measures of efficiency to determine how financially sustainable and allocatively efficient the Central system is. These measures were then contrasted with evidence on coverage rates and tariffs, as well as with perceptions of fairness and affordability. The evidence suggested that the system was very fair and considered affordable by all users. However, the prices that Central charges for water are subsidized both implicitly and explicitly, indicating that affordability comes at a cost to efficiency.

Measuring Efficiency

Three common measures of allocative efficiency in water supply systems are water pricing, customer satisfaction surveys, cost recovery, and subsidies. A second measure of overall efficiency is technical efficiency. Allocative efficiency, as measured by how close the system allocates water according to consumer preferences, is measured through consumer preferences and pricing systems. Cost recovery, also indicates allocative efficiency as measured by how effectively costs of production are recouped through tariffs. Technically efficient systems limit system losses, as defined by the IWA as "non-revenue water", and include system leakages as well as other losses and unauthorized consumption.[80] The water system, as measured by these three measures of efficiency, was not found to be completely efficient.

(a) Water pricing and customer satisfaction

Allocative efficiency is measured by how closely water resources are distributed to consumer preferences. This was measured in two different ways. First, consumers were asked whether they received the water that they desired. All respondents indicated that the amount of water that they were happy with the quantity of water that they received (100%; n=86). When these results were broken down by community, the results varied only slightly; although all respondents said that they were happy with the quantity of water, respondents in the medium and low participation communities were more likely to list complaints over the quality of

[80] Non-Revenue Water includes real losses, from leakages, as well as apparent losses (unauthorized consumption and metering inaccuracies) as well as unbilled authorized consumption.

water (n=9), the cost of electricity (n=9), or that water supply did not suffice for uses outside of the home (n=2) [81].

The second measure of allocative efficiency compares the price of water to the marginal cost of producing water, or P=MC. Price is typically compared to marginal cost because the price of water (or the tariff) approximates consumer's willingness to pay for one unit of water, and the marginal cost represents the cost to produce that same unit of water. If these are equal, the system is said to be allocatively efficient. In practice, water pricing structures often have different rate categories that apply different categories by consumption rates, by time periods, and that reflect different types of charges (e.g. connection charges, special rates for low income users, etc.). The typical goal for a water supplier is (i) to generate revenues that cover costs; (ii) to design costs that are allocatively efficient (to allocate costs for different types of users); and (iii) to determine rates that will signal to customers to use water efficiently for the overall sustainability of the resource (Hanneman 2006: 2). Fulfilling each of these goals necessitates perfect information, which is often not available, and, in practice, many water utilities focus on economic efficiency for their pricing strategies, or, when price is equal to marginal cost.[82]

For the purposes of this dissertation, price and marginal costs were calculated at the supra-municipal level (based on data available at Central's offices). This was done for two reasons. First, data are not collected at the community levels for price

[81] Central's position is that the water is priced progressively to ensure an adequate minimum consumption per household of 10 cubic meters, and that the system is not designed for irrigation purposes.

[82] Marginal cost for water utilities differs over the short and the long run. In the short-run, capital costs are fixed, and marginal costs come from the operating and management costs. In the long-term, marginal costs accounts for capital depreciation, in addition to operating and management costs. Thus, by definition, short-term marginal costs are less than long-term marginal costs.

and marginal costs. Second, the prices are determined by Central, and, as the water utility, it makes most sense to examine these variables at Central. The price of water was taken from water bills collected in the field that showed the tariff paid for water for different consumption rates. Central charges a flat fee of R$5,00 for the first 10 m^3 of water (irrespective of actual consumption rates). Prices after the first 10 m^3 follow a progressive block tariff system. The tariffs are given below:

Table 6: Tariff system for water supply under Central

Volume of water (m^3)	*Tariff per m^3 (R$)*	*Tariff per m^3 (US$)*[83]
Up to 10	0.50	0.27
11-15	0.68	0.29
16-20	0.81	0.35
21-25	0.95	0.41
26+	1.12	0.61

Source: own calculations from water bills

Because of data limitations[84], the calculations for the marginal cost of water are close approximations. This was done in the following manner:

1. *Calculating the volume of water produced per year:* Central does not keep records on the volume of water produced, since individual water pumps cover one, or at most a few, communities. Central did have records for the years 2003, 2004, and 2005 of the average liters consumed per person per day (which were 60, 63 and 55). In order to approximate the total volume of water produced, an average of these three numbers was taken (59.33),

[83] Exchange rate of USD1 to R$2.32 was used which represents the median exchange rate for January to June 2009.

[84] Central does not keep records of either the short-term or the long-term marginal costs, although financial data on the operating and management costs were available. Data were also not available for the total volume of water produced, or for the total consumption.

multiplied by 365 days (to arrive at annual consumption[85]) and multiplied by the total population served in 2008 (36,355). The total annual consumption of water in 2008 was approximated to be 787,328,117 liters, or 787,328 m3[86].

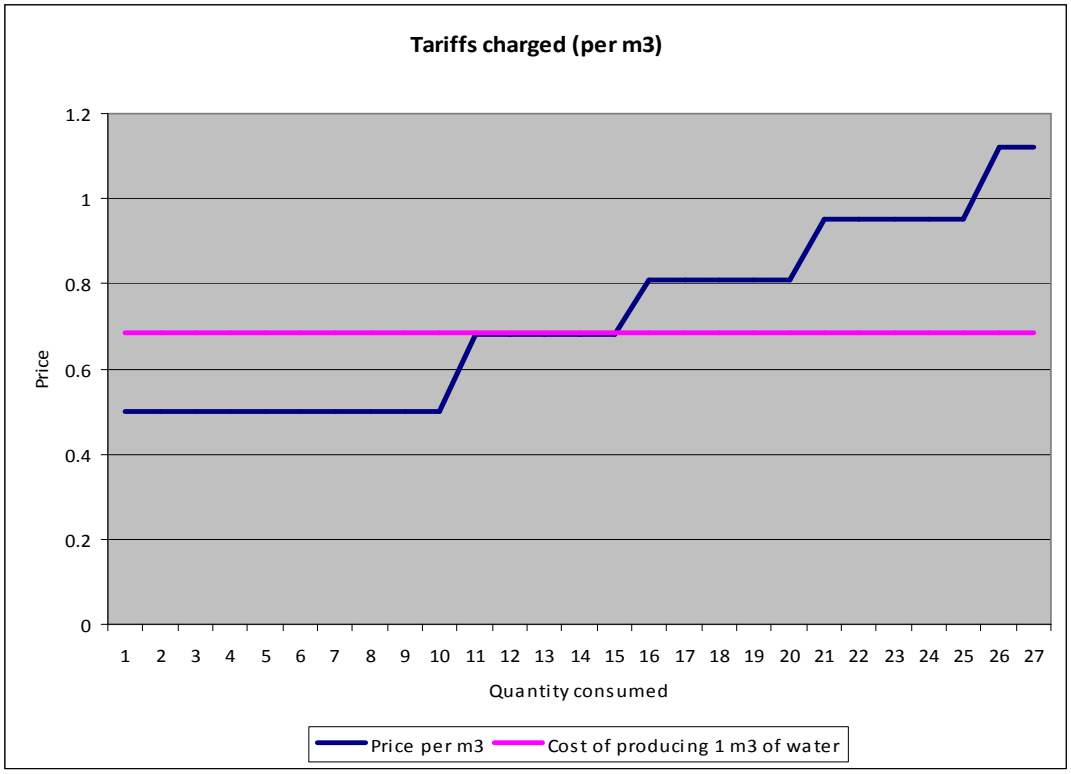
2. *Calculating the cost of producing one cubic meter of water:* Financial data from Central provided the operating and management costs for 2008, which were R$ 537,777. The total volume of water consumed was divided by the operating and management costs to derive an approximate cost of producing one cubic meter of water, estimated to be R$0.68. Since more accurate data on the volume of water produced, or the marginal cost of production, was not available, these calculations approximate the short-term marginal costs. The reason for this is that the gap between short- and long-term marginal costs in the water industry is typically quite high, given high capital intensity (Hanneman 2006: 3). Industry standards indicate that prices should never be set below short-term marginal costs, since revenues would not cover simple operating and management costs. But there is wide variation in how much higher prices are set (ibid).

The figure below presents the calculations on the price versus the marginal cost of water in the Central system.

[85] This measure is problematic because it only approximates the volume of water consumed and does not account for system leakages, or other losses. Anecdotal evidence indicates that the system losses are not high, meaning that these two figures would be fairly close, but this remains a rough approximation, at best

[86] One cubic meter of water is equal to one thousand liters.

Figure 16: Price versus Marginal Cost of Water in the Central System



What is clear from the figure above is that the initial volumes of water are priced below the marginal cost of producing water. However, Central uses a block tariff system, whereby consumers pay higher per unit costs the more they consume, thereby shifting some of the cost burden to those who can afford it. Interviews with Central indicated that the majority of households that partake in the program use around ten cubic meters of water per month (86 percent) (Geraldo 2009). This highlights an important tension in setting tariffs to remain affordable on the one hand, and to price water for improved conservation of water resources. Block tariff systems are typically credited with maximizing objectives of equity and water use efficiency, and are weaker in fulfilling goals of revenue collection or cost recovery. The table below shows the different tariff types by objective:

Table 7: Type of Tariffs by Objectives

TYPE OF TARIFF	OBJECTIVES						
	Equity(*)	Stability of Revenue Collection	Flexibility	Lower costs of implementation and control	Encourage water use efficiency	Simplicity	Facilitate cost recovery
Area tariff	+	+ ++	+	+ +++	+	+ ++	+
Volumetric tariff	+ +	+	++	+	+ +	+ +	+ +
Tired (Blockrate) tariff	+ ++	+	+ +	+	+ ++	+	+ +
Two-part tariff	+ +	+ +	+ +	+ +	+ +	+	+ ++
Tired two-part Tariff	+ ++	+ +	+ ++	+	+ ++	+	+ ++

Source: Varela-Ortega, 2003.

As seen from the table above, blockrate tariff systems are also expected to encourage water use efficiency, and there is some evidence that pricing strategies can lead to improved resource conservation[87]. The evidence from the Central program shows that average household water consumption rates are far lower than for many water supply and sanitation systems (although some of this might be due to the fact that these systems lacked sanitation facilities). The average consumption of water per person per day was estimated at 96 liters. This was based on calculations from water bills provided by Central. Similar statistics show that this is on the lower end, indicating that the tariff system is linked with lower water consumption. The table below shows averages of water consumption for Bahia, and elsewhere in Brazil:

[87] The evidence for this is not conclusive. As Nayar and James (unpublished) found in their study of Indian villages, improved conservation occurred not as a result of pricing strategies, but because of intensive outreach programs that focused on conservation practices.

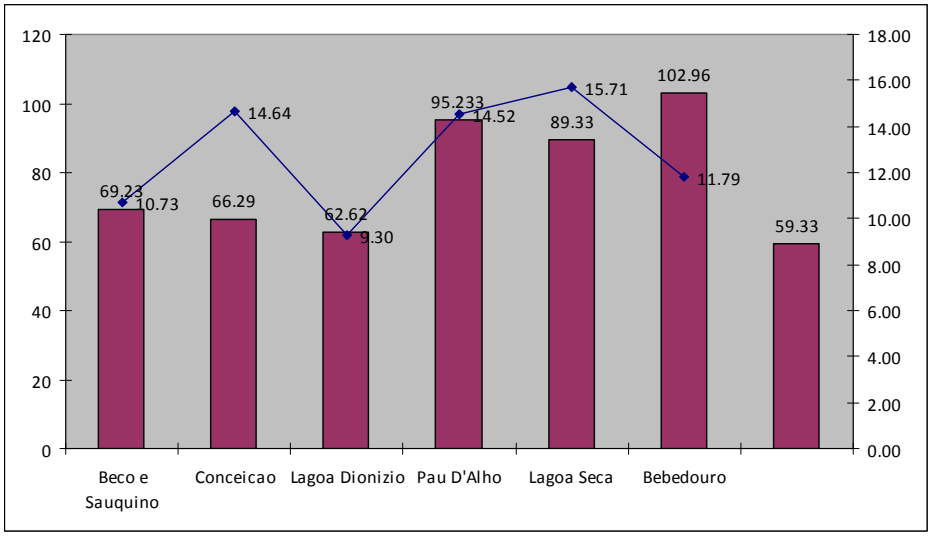
Table 8: Water Consumption (liters per person per day)

State/Region	*Consumption (liters per person per day)*
Central program (April 2009)	96
Bahia	122.1
North Region	134.1
Northeast Region	114.8
Southeast Region	173.8
South Region	134.9
Federal District	182.9
Central West Region	145.2
Brazil	149.6
USA	575.0

Source: Own calculations; SNIS 2008, HDR 2006

One reason often correlated with improved resource conservation practices that the pricing strategies more adequately reflect the value of water. If this relationship were to hold in the Central program, then communities that absorbed the full cost of water (including the administrative costs and utilities) would consume fewer liters per household per day. The figure below presents the average liters consumed per person per day compared to the average water bill for the community.

Figure 17: Average consumption (liters per person per day) and average water bill per household by community



The figure above shows that this there was no real relationship between those communities that paid closer to the full cost of water (as represented by higher bills), and the number of liters consumed per person per day in that community. What the figure does seem to indicate, however, is that fewer liters per person were consumed in the communities with high participation. This could be as a result of social mobilization campaigns carried out in these communities that focused on techniques to reduce water consumption. These practices, more than pricing strategies, have been found more effective in places like India at reducing water consumption rates (Nayar and James, Forthcoming).

In addition, the relationship between the pricing system and water use efficiency did not seem to hold when comparing similar data at the state level. While, Bahia's average consumption (liters per person per day) was 122.1, and the average from the sample communities was 96, the tariffs charged by both water supply services were similar. This would seem to indicate that the prices charged for water supply services do not necessarily result in reduced water consumption. Embasa's tariffs also use a blockrate tariff system that charges a flat fee of R$12,85 for the first ten cubic meters of water (as compared to a system wide average of R$11,96 charged by Central, inclusive of electricity). However, unlike Central, Embasa also has a "social tariff" that subsidizes low income households. These households are targeted through the federal government's targeted cash transfer program (*Bolsa Familia*). The social tariff for the first 10 cubic meters is R$6,05. The majority of the households surveyed in this research received cash subsidies under the *Bolsa Familia* program, and would thus be eligible for the social tariff with Embasa, essentially reducing the

average household water bill by 50 percent. Embasa's tariff structure is presented in the table below.

Table 9: Tariff structure for water supply (treated), Embasa

Volume of water consumed	*Embasa tariff Residential (normal)*	*Embasa tariff Residential (social)*
Up to 10 m^3	R$ 12,85 p/ month	R$6,05 p/ month
11 - 15 m3	R$ 3,59 p/ m3	R$ 2,65 p/m3
16 - 20 m3	R$ 3,83 p/ m3	R$ 2,88 p/m3
21 - 25 m3	R$ 4,28 p/ m3	R$ 4,28 p/m3
26 - 30 m3	R$ 4,76 p/ m3	R$ 4,76 p/m3
31 - 40 m3	R$ 5,23 p/ m3	R$ 5,23 p/m3
41 - 50 m3	R$ 5,71 p/ m3	R$ 5,71 p/m3
> 50 m3	R$ 6,66 p/ m3	R$ 6,66 p/m3

Source: EMBASA 2009

While some respondents surveyed indicated that they would also like to be part of the Embasa program (5%; n=86), the majority of respondents said that the Central program was very reliable (95%; n=86), since the program provided uninterrupted water service, and Embasa's service was reported to suffer from frequent service outages (n=12). While no precise figures were available for Embasa's service outages to corroborate the frequency of interruptions, a survey conducted on the national level indicated that service outages are very high in Brazil: of the water supply companies reporting (49 percent of the total), 73 percent reported supply outages (SNIS Diagnostico 2008, p 118).

(b) Cost Recovery

Cost recovery ratios were calculated from the financial data provided by the supra-municipal water supply company, Central. Cost recovery looks at how well the

tariff charges cover the cost of operating and maintaining the water supply system. Since one of the goals of the Central program is to be financially viable, this measure is especially important.

Cost recovery ratios were measured based on the sales and receipts from the financial data provided by Central.

Table 10: Central's financial position (2008)

Item	***Value (R$)***
Sales	**385,055.00**
Receipts	**380,488.00**
Non-payment	4,567.00
Non-payment (%)	1.2
Expenses	**438,195.00**
- Administrative	131,458.00
- Operational	306,737.00
Non-liquid assets (e.g. pipes, equipment, etc.)	**179,982.00**
Bank account balance	**197,463.00**
Tariff for first 10 m3 of water[88]	**5.00**

To calculate the cost recovery ratio of Central, the total expenses (R$438,195) (outputs) were divided by the total sales (R$385,055) (inputs). The ratio for this calculation was 0.87872, or 87.9%. When this calculation was done dividing the total expenses by the actual receipts (R$380,488), this ratio dropped to 0.8683, or 86.8%. Both of these ratios show that Central does not cover its costs.

However, two things should be noted. First, Central's financial position has improved since the first evaluation in 2006. At that point, non-payment rates had increased to 10.64%, due, in large part, to corruption at the association level; users paid bills at the association, but the association did not forward the water fees to

[88] This financial data is accurate as of September 2008. At the time of field research, the financial analysis for the calendar year 2008 was not yet available. In 2007 and 2008, the tariff for the first 10 m^3 of water was R$4,25. This was raised to R$5,00 in January, 2009, to address chronic budget deficits.

Central. In 2007, Central began requiring direct payment from consumers to Central, which has significantly reduced the non-payment rate (to 1.2% in 2008), and has raised the actual receipts. As of the end of 2007, however, Central faced a shortfall of R$171,154 in receipts from accumulated non-payment.

Data from 2008 shows Central to be operating at a deficit (R$438,195 in expenses and only R$385,055 in sales for a total operating deficit of R$53,140. This deficit has been cushioned in the short term by a fund that was set up by KfW upon exiting in order to bolster the sustainability of the program. The balance on the bank account, as of September 2008, was R$197,463[89]. One reason given for the operating deficit is that the optimal number of household connections has not yet been attained. Since water supply programs are capital intensive, there are economies of scale that need to be attained before the system no longer runs at a deficit. An economic study cited by Central staff indicated that the optimal number of connections for Central was 8,000 (Geraldo 2009). At present, the number of connections is 7,426. It is presumed that when Central reaches its optimal number, and if non-payment remains low, then Central's expenses will more closely match receipts.

Second, it is important to note that very few water supply companies cover their costs. One study, for example, showed that most water supply companies operate at a financial deficit, that has, at least until recently been covered by financial backing from governments (Swai, unpublished, see also Oliveira 2008). The state water company, EMBASA, does show a consistent profit in its financial profile, but

[89] I was not able to determine the original amount of this fund, but similar financial data for 2007 shows the balance on the account to be R$241,642.

arguably much of this profit is derived from the fact that it does not provide water to "unprofitable" areas, and leaves much of the state without water supply services.

(c) Subsidies

One further aspect of allocative efficiency that was measured was the level of subsidies in the system. Systems that are able to recover costs without any subsidies are considered to be efficient (and also sustainable). Several types of subsidies were uncovered. First, in some communities, the local government (*prefeitura*) paid for the electricity costs. This reduced the average water bill per household significantly; households averaged R$10-15 per month for water when electricity and other fees were included, whereas bills averaged R$6-8 for those communities where the costs of electricity were paid for by the local government. The cost of the water bill was not related to the level of participation in the community: the communities where the local government paid the electricity were both in the high and the low participation categories.

Table 11: Electricity subsidies

System by level of participation	***Electricity paid by***
High	
Beco e Saquinho	Community
Conceição	Community
Lagoa Dionizio	Municipal Government
Medium	
Pau D'Alho	Community
Lagoa Seca	Community
Low	
Bebedouro	Municipal Government

A further subsidy to the system is in the pricing structure of Central's water supply. As the section above showed, the price of producing water for the first 10 m3 of water is higher than the tariff charged. The tariff in this case is kept artificially low

for reasons of affordability (Geraldo 2009), creating an implicit subsidy in the system. Residents were aware of this problem:

> *"I think maintenance is expensive, sometimes I worry that the money we pay won't be enough. We couldn't do without water. And I'm not sure if we could afford to pay more" –Male 37, Beco e Sauquinho*

A final subsidy to the program is that the community organizations took over the systems after the hardware had been installed, effectively creating a subsidy for this. Water supply hardware is typically quite expensive, and the Central system provides meters for each household to measure consumption. These costs are not transferred to consumers, through connection or other types of fees. Central does calculate depreciation of fixed assets, although, given how capital intensive some equipment can be (especially pumps), Central staff indicated that the State Rural Engineering Company (CERB) often stepped in to provide these, when needed.

(d) Technical Efficiency

Technical efficiency of the system is an important measure of the long term financial sustainability of the system. Tariffs set to short-term marginal costs will not cover the longer term costs of replacing critical infrastructure that ensures the continued delivery of water services. Since I do not have data to calculate short term, versus long-term marginal costs, one measure of how well the system does in maintaining the water infrastructure can be assessed through water losses. While it is not a perfect measure, in general, the better a water system is maintained over the long term, the fewer water losses are present. High system leakages would increase the overall costs of water to the consumers, since more overall water would have to

be pumped for the desired amount to reach consumers. Thus, limited leakages in the system ensure that the cost of producing each unit of water is maximized.

Where historically, water losses was calculated as system leakages, recent attempts to standardize industry practice has highlighted various elements of what is termed "non-revenue water". Non-revenue included system leakages, but also accounts for unbilled consumption that also counts as system losses. The International Water Association (IWA) defines NRW with the table below:

Table 12: The IWA 'best practice' standard water balance

<table>
<tr><td rowspan="10">System Input Volume (corrected for known errors)</td><td rowspan="4">Authorized consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption (including water exported)</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="8">Non-Revenue Water (NRW)</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="6">Water losses</td><td rowspan="2">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td rowspan="4">Real Losses</td><td>Leakage on Transmission and/or Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tank</td></tr>
<tr><td>Leakage on Service Connections up to a point of Customer metering</td></tr>
</table>

Unfortunately, comprehensive data on water losses is not collected in the Central system. Since each water supply system is contained, covering one, or at

most a few, communities, the data would have to be collected at an individual community level. At present, when leaks do occur, the operator does his best to fix them, and, when that does not work, Central is called to replace the pipes or other faulty equipment.

In 2008, Central sampled the water losses in one community system to get an idea of technical efficiency. The variance in production and consumption rates for one water supply system was measured over a period of seven months to get an idea of how technically efficient the water systems are. The results of this showed that the volume of water produced was 25,562 m3 and the volume consumed was 22,082 m3, indicating losses of 13.61% (Geraldo 2009). This figure is quite low compared to EMBASA where losses were listed as 30 percent (EMBASA 2008). This also compares well to Brazil's water supply companies in general, where water losses were between 20 and 80 percent in 2008 (SNIS Diagnostico 2008). While some of the discrepancy may be due to the particular water system measured and relatively crude measures (it does not account, for example, of unbilled aspects of non-revenue water), the initial assessment of water losses in the Central system is quite low.

Measuring Equity

Equity was measured primarily through qualitative measures, since the notions of what is considered "equitable" and "fair" is locally determined. In terms of allocative equity, the questions focused on what respondents considered to be fair in terms of distribution and allocation of water resources. This also included their perceptions of the tariffs, since prices are a proxy for optimal allocation.

(a) Defining allocative equity

To measure outcomes of equity, first questions were asked of respondents as to what they considered to be "fair" in terms of distribution and allocation. For most respondents, the concept of "fair" was built around two themes: (a) that everyone got water (83%; n=86) and (b) that usage was transparent through the use of hydrometers (86%; n=86). Respondents indicated that equity of access was important in notions of fairness; many responses indicated that the system was fair because "everyone gets water" (78%; n=86). Some respondents indicated that this was particularly important given that unequal allocation had caused problems before (in Beco e Saqiunho, and in Bebedouro). Most respondents, irrespective of gender and level of participation, indicated that they considered the system to be more fair than before (56%; n=55).

The other prominent theme that emerged when respondents were asked about equity was that the system allowed for households to pay for the amount of water they used (64%; n=86), and that the hydrometer ensured transparency in consumption and billing. Several respondents indicated that the system relies on hydrometers ("we have hydrometers"; n=14) in response to questions about how distribution and allocation issues were addressed. Several respondents also indicated that everyone gets water because they have hydrometers (n=12), or that everyone gets water because households pay for what they use (n=15).

(b) Allocative equity

Respondents were asked about outcomes of allocative equity through questions on how fair the water system was in issues of distribution. The respondents

indicated that they did not discuss issues of allocation, since this was regulated by hydrometers (64%, n=86). Most respondents said that they believed allocation of water to be very fair (73%; n=86). Of those who said it was very fair, most respondents said that this was because the system was regulated by hydrometers (n=22). Hydrometers ensured equitable allocation because consumption is transparent, and because the progressive tariff system combined with measuring consumption meant that water was available to everyone. This was particularly evident in Bebedouro, where prior to Central, the municipal government had supplied water, and water was only available for half of the community. When Central took over the system and installed hydrometers, consumption dropped (as is evidenced by a drop in the monthly electricity bills from R$400 per month, to little more than R$125 per month), and water is now available for all community members. Respondents from these communities noted that Central was more fair in matters of distribution (n=8).

(c) Coverage rates

One further way that equity was measured was to do a simple accounting of the number of households in the community that were covered by the program. CENTRAL in Seabra keeps some records on this, and it shows that in the whole system, 98 percent of the populations are covered. Within the communities, there were typically only a handful of households that were not a part of the program. A few were cut off for non-payment of their water bills, and some had access to private wells and had opted not to participate in the program.

Table 13: Coverage rates of water supply systems (2008)

System by level of Participation	*Number of Houses*	*No of Water Supply Connections*	*Percentage of Households covered by Central*
High			
Beco e Saquinho	115	115	100%
Conceição	200	195	98%
Lagoa Dionizio	442	442	100%
Medium			
Pau D'Alho	200	158	75%
Lagoa Seca	220	190	86%
Low			
Bebedouro	120	119	99%

Rates of non-payment and disconnections were highest in the medium participation communities of Pau D'Alho and Lagoa Seca. These communities were facing several months of drought and several consecutive years of low rainfall which had made living on agriculture precarious. Rates of outmigration had increased significantly; while there were no figures available, one third (33.3%; n=18) of the respondents in Pau D'Alho had a husband or someone in the family who worked outside of the community (as a temporary worker, in construction or in other jobs in Salvador).

The Allocative Tradeoff

Based on the findings of allocative equity and efficiency, the classic allocative tradeoff exists in Central's water supply system. The allocative tradeoff for public service provision is typically visible in the tension between affordability (or, equity of access) and efficiency (or, cost recovery). Allocative efficiency is attained when water is distributed to those who value (and by extension, are willing to pay) the

most. However, this goal conflicts with the distribution for all consumers, where everyone needs water and should have equal access to water.

Public water utilities typically face budget shortages in the attempt to maintain affordability. However, if public subsidies do not exist for the water system, then the issue of sustainability becomes important, and the need to recover costs for adequate maintenance becomes a challenge. Within the Central water supply system, the findings indicate that the program is allocatively equitable, as measured by coverage rates, and perceptions of equity. Everyone in the community who would like to be a part of the water system will have a hydrometer installed and can opt to join and participate in the community organization. In addition, most respondents said that the allocation of the water was fair and that the amounts sufficed for household consumption.

Broad coverage (98% system wide, and between 80 to 100% in the communities sampled) indicates that the tariffs are affordable to the majority, if not all, households in the system. Households are disconnected from the system for cumulative non-payment (three months, and even then, if it is a financial issue, they can apply to Central for a monthly installment plan to pay off their debt). While non-payment is not inactive of an inability to pay, it is nevertheless impressively low in the system, indicating widespread affordability.

However, this affordability has come at a cost to allocative efficiency and cost recovery. Allocative efficiency is typically maximized when water is allocated to those consumers who will pay the most for it. The Central pricing structure includes an aspect of this, by creating progressive tariff systems to shift the cost recovery

burden to consumers who use the most water (and, by extension, are willing to pay for it). But there are still implicit subsidies in the systems that are in place to ensure equal access for all consumers. These include the pricing structure of Central, but also subsidies for hardware, such as pumps, pipes and meters. Thus, allocative equity has come at some cost to allocative efficiency.

B. The Organizational Tradeoff

The organizational tradeoff, as described by Weber (1978), indicates that even local level organizations that promote equality can often be undermined by concerns over efficient administration, or by questions pertaining to technical efficiency. Both of these concerns result in a preference being given to those participants who have the required time and/or knowledge to the detriment of others in the organization. Thus, while the organization may create conditions for a direct democracy with equally weighted voices for all, these arrangements, Weber (1978) argues, are often undermined and typically short-lived. This research found that within each of the community organizations, some form of elite capture had occurred, indicating that efficient administration tended to win out over concerns of equality. Technical knowledge was also required, although in concentrating the technical experts within the maintenance association that remained external to the community organization, the tradeoff between technical knowledge and equality was minimized.

Efficiency in Administration

Efficiency in administration was measured in three ways. First, participant observation of the meetings revealed the organizational structure and rules and procedures for the meetings. This was done to compare the organizational structure to the Weber's description of a "direct democracy". Second, respondents were asked about their perceptions of leadership and technical expertise needed within the community organization. If both of these factors are present in the community organization then it could expedite decision-making, since both of these groups would be deferred to, given their relative expertise.

(a) Organizational rules and procedures

An examination of the rules and bylaws of the community associations was done to compare them to the types of organizations that Weber (1978) defined as being a direct democracy. For Weber, these types of organizations were particular to the post-Enlightenment era, since they were fundamentally associations of individuals who created rational type organizations that intended to maximize equality. The description of these types of organizations is one where there is:

> (a) Short terms of office, if possible only running between two general meetings of the members; (b) Liability recall at any time; (c) The principle of rotation or of selection by lot in filling offices so that every member takes a turn at some time. This makes it possible to avoid the position of power of technically trained persons or of those with long experience and command of official secrets; (d) A strictly defined mandate for the conduct of office laid down by the assembly of members. The sphere of competence is thus concretely defined and not of a general character; (e) A strict obligation to render and accounting to the general assembly; (f) The obligation to subject every unusual question which as not been foreseen to the assembly of members or to a committee representing them; (g) The distribution of powers between a large number of offices each with its own particular function; (h) The treatment of office as an avocation and not a full time occupation (Weber 1978: 289)

From an organizational perspective, the community associations in the sites visited fulfilled Weber's basic criteria. Terms of office for the president, secretary and treasurer of the associations were two years, and there were procedures in place to recall any member of the positions by majority vote. No member of the board could serve for more than two terms, to ensure the rotation of selection. Each of the positions came with a clear mandate that was outlined in the statute of the organization: the president was responsible for presiding over the meeting, the

secretary was responsible for taking minutes of the meetings, and the treasurer was responsible for overseeing the community funds. All of the community organization meetings presented an agenda before community meetings. The president would open and close the meeting. Comments were heard through raising hands and addressing the group, and votes were done in the open (raising hands in favor). The majority vote ruled. Minutes of the meeting were presented at the end, and all community members voted in favor of the minutes. The minutes were recorded in a community book.

From an organizational perspective, the community associations were designed to provide a form of administration whereby decisions could be reached (thereby ensuring a level of efficiency) but that the rules and procedures ensured that everyone was heard (thereby ensuring a level of equity). However, Weber noted the tension between these two goals, arguing that concerns over efficient administration could undermine the delicate balance with equity. This could either come as a result of leaders who tend to dominate positions of administration, or through deference to technical experts.

(b) Efficient leadership

Respondents were asked about elite capture within their communities through questions on leadership ("Are there any community members you would designate as a 'leader'?"), qualifications to run for the board ("Are there any or certain people who you consider to be more qualified to run for board positions in the community?") and

questions about how long the current board members have served on the board[90]. These questions were designed to determine if leaders in the community tended to dominate board positions in the interest of more efficient administration. Weber (1978) defined these leaders as people:

> (1) whose economic position permits them to hold continuous policy-making and administrative positions in an organization without (more than nominal) remuneration; (2) who enjoy social prestige of whatever derivation is such a manner that they are likely to hold office by virtue of the member's confidence, which at first is freely given and then traditionally accorded (Weber 1978: 290).

In the high participation communities, there were instances of explicit and implicit elite capture. In Beco e Sauquinho, the current president had served in the position for eight years, and was also the operator in the community.[91] The president/operator indicated in the interview that he served in the position of president because no one else wanted to. Interviews with community members indicated mixed feelings on this arrangement, however. On the one hand, several community members that were interviewed indicated that the president was in the best position to run the community association, and he had all the relevant technical knowledge to be able to address issues with the water system:

> *"[The president] makes all the decisions, and he is the one who knows all about the technical matters" –Male, 45, Beco e Sauquinho*

[90] The community organization registration documents and standard procedures indicate that no board position can be occupied for more than two terms (each term is two years). The questions were asked to see if these procedures were followed and if anyone from the community could and did serve on the board.

[91] This has a clear problem of conflict of interest, since the board determines the wages paid to the operator.

A few community members, however, indicated their dissatisfaction with these arrangements, saying that the president did not really listen to other people's opinions at the association meetings (n=3). One respondent even argued that the president had used his position as operator to retaliate against them:

> *"I don't say anything at the meetings anymore. My husband disagreed with [the president] once, and we had our water cut off. I'm sure it was because we disagreed with [the president]" – Female, Beco e Sauquinho*

This community also had a relatively high number of respondents who were not aware how the community association worked (what the terms and responsibilities of the officers of the board were, etc.); 72% (n=11) indicated they did not really know this information and relied instead on the president to attend to matters of the community association.

The other two high participation communities, Conceição and Lagoa Dionizio, also showed patters of elite capture, although it was less explicit. In Conceição, a key informant interview with Central staff revealed that there were a small group of about five to eight people in the community with "the profile of leaders", who were merchants, business owners, and self-employed. Unfortunately, none of these people were willing or available to be interviewed and did not participate in the group interviews.

In Lagoa Dionizio, one local leader served as president twice (for eight years in total), and was, at the time of interviewing, the vice president on the board. This person was also a local teacher and is active in the community and in the community organization. The respondents indicated that the current vice president was a likely leader, and helped the local organization (57%; n=14), although they did not seem to

think this came at a cost to equality (the number of respondents who indicated that everyone participated equally was 64%; n=14).

In the medium participation communities, the pattern of elite capture also held. Active participation in the community had declined in Pau D'Alho when the local leader who had been involved in the community association had fallen ill and moved to the capital of the state, Salvador, to seek medical treatment. Several respondents noted that when she left, the association had stopped meeting regularly (n=8). More recently, another community leader had taken over as president of the association, but meetings were irregular. Several respondents indicated that it did not seem that he really wanted to be president (n=3), but that they relied on him as a community leader because he was a good and honest person (n=4) and because he was literate (n=3).

In Lagoa Seca, the community association also relied on a local leader for the community organization. Respondents indicated that previously, the association faced problems of corruption where money was stolen from the association (respondents declined to say from whom; n=3). A local teacher has recently assumed the presidency, and there is renewed enthusiasm for the community association and participation (n=4). The current president indicated that when he had left to complete his studies, community members continued to contact him to resolve local issues in the community. As someone with free time and skills, he felt it his duty to serve on the association board.

In the low participation community, Bebedoro, there was a unique form of administration. Under the previous water supply arrangements, there was no

metering, and water was provided free of charge. However, those located closer to the pump had continuous water service, while those further from the pump suffered from frequent water outages, when the supply did not suffice for all. The local community had divided over issues of water provision with two sides of the community barely speaking to each other. The side that did not receive water made a formal request to affiliate with Central, and founded a new community organization. People briefly joined the organization and voted to join Central. Central introduced metering and provided trainings on water conservation and use, and since the introduction of the new system, water is available to all residents with little to no service outages.

The community organization officially affiliated with Central does not meet anymore, since most community issues are discussed at the old association. Water bills assess the tariff for water supply, plus R$1,00 per household for the operator and R$1,00 per household for the new association. Residents did not know this, however, and most said that they paid R$2,00 for the operator. The new association does not meet, although it technically has a board (elections have not been held for some time). Since the old association did not address issues of water supply, respondents were not asked about elite capture.

(c) Technical Knowledge

Respondents were also asked questions as to how technical issues with the system were resolved. The intention of these questions was to determine if those with technical expertise were deferred to in matters of administration because of their unique knowledge. For Weber (1978), this occurrence represented an undermining of

equity, since the voices of the technically proficient were privileged above others in the community organization.

Respondents were asked the procedures for how technical issues were addressed in the community organization. The majority of respondents indicated that they would call the operator (45%; n=86) or Central (37%; n=86). In the high participation communities, residents indicated that they would first call the operator (87%; n=32) and, if the problem was not solved, then they would call Central (74%; n=32). In Beco e Sauquinho, most residents said that they would turn to the president with any and all problems (since he was also the operator) and that he would liaise with technicians from Central, if needed (88%; n=9). Interviews with respondents in Conceição indicated that a high satisfaction with the service in water supply. The community had gotten together to replace the operator once before when his work was not performed to a satisfactory level, and everyone interviewed (100%; n=15) said they had faith in the current operator to operate and maintain the system well. The respondents were all aware of how to call a meeting if there was a problem (100%; n=15). In response to the question of who to call when there were problems with the water system, most respondents said they would notify the operator, or notify Central. In the words of one respondent:

"I trust the technicians [to fix the system]" –Female, Conceição

In the medium and low participation communities, residents were more likely to call Central directly (67%; n=53) as opposed to talking to the operator first (43%; n=53). These communities also tended to have a higher number of people who did

not know who to call in the event of an emergency (n=7 versus n=1 in the high participation communities).

Organizational Equity

In order to measure equity within the community organizations, respondents were asked questions as to how they felt their and/or others' voices were heard in the community organization, and whether they considered the community organization to be equitable. Respondents were also asked to participate in a series of mapping exercises to link participation patterns with different types of people in the community. In this way, evidence could be gathered as to the extent to which broader patterns of inequality might be replicated within the community organizations, thereby undermining the equality of voice necessary for a direct democracy.

(a) Equality of Voice

The majority (75%; n=48) of respondents indicated that their voice carried the same weight as everyone else's ("same as everyone else"; "we are all/everyone is equally poor"; "everyone has equal opportunity"). Of the remaining answers, one person indicated that they were all equal to discuss issues, but that the president was the only one who knew the technical information. Two respondents indicated that they did not participate, one further respondent pointed out that the association did not meet very often anymore ("association has been abandoned") (This was in Pau D'Alho). Three further respondents said that the young don't participate very often (n=1) and that those who are relatively well off do not, or are not welcome to participate (n=2).

This result varied slightly by level of participation. In the high participation communities of Conceição and Lagoa Dionizio, respondents said that they considered the community organization to weigh all voices equally (74%; n=47). In Beco e Sauquinho, a few respondents complained about the prominent role that their president played in the community organization, saying that he had taken over, and did not listen to other people's responses. In the medium and low participation communities, while the majority did indicate that they thought the community organization was equitable, there were more complaints about people who did not participate or who did not feel welcome to participate (n=2). This result did not vary by gender. Men and women answered equally that they felt the system to be fair and considered all viewpoints. Results also did not vary by age.

When asked whether they considered the community organization to be fair, the majority of respondents also answered that the system was open to anyone who wanted to participate (74%; n=47). Respondents were asked if there were any rules or procedures in place to ensure that everyone was heard equally. Most people did not answer this question. Those that did said that there were no "rules" but that all viewpoints were considered (n=5). However, it is interesting to note here, that in communities where literacy was relatively low, those who were not literate did not think that they could serve on the board, and claimed that this was a barrier to becoming a board member (when, according to the statute, it is not).

The next way that the level of equity in voicing opinions or desires within the community association was measured was to ask respondents whether all opinions were given equal weight in the association meetings. The majority of respondents

(79%; n=48) said that all voices were weighted equally within the association ("we are all equally poor"; [voices are counted] "same as everyone else"; "everyone has equal opportunities"). Of the remaining respondents, 3 respondents said they did not participate (6% of total responses), 3 said that there was no equality ("no rules to ensure equality[92]"; "not equal" and "no voice in association, everything is decided by the president"). Two people indicated that young people and the well off do not participate, and one person said that the association has been abandoned.

In the high participation communities, there were a greater number of responses, and most people said that everyone participated on equal footing. In Conceição, 12 interviewees answered the question (75%; n=16), of which 11 said that they believed that voices were weighted equally (92%). One person responded that they do not participate often in the community association. In Lagoa Dionisio, 9 interviewees answered the question (60%; n=15), and all 9 indicated that they believed all participants to be treated as equals within the association. In Beco e Saquinho, 9 interviewees also answered the question (60%; n=15), of which 7 said they believed that their voices were weighted the same as everyone else's (78%). One participant who responded that voices were accounted for equally, followed up by saying that all technical matters were resolved by the president, since he had the technical knowledge and training. Two respondents said they believed that the president did not take anyone's opinion into account. In the medium participation communities, fewer respondents answered the question, and, of those who did, fewer

[92] The question asked if there were any rules in place to ensure that everyone had an equal voice. This person's response indicated only that there were no formalized rules in place to ensure that everyone had an equal chance to participate. However, the response has been categorized as indicating that there was some inequality within the participatory process based on other responses in his/her interview.

believed the association to account for all voices equally. In Pau D'Alho, only 7 interviewees responded to the question (30%; n=21), of which 5 said they thought the association was equal (71%). In Lagoa Seca, only 8 interviewees answered the question (50%; n=16), of which 5 said they believed the association to weight voices equally (63%). The remaining respondents either said they don't participate (1 response), that the association was abandoned (1 response); that certain groups were excluded (the well-off and the young) (2 responses); or that voices are not accounted for equally (1 response). In the low participation community, only 1 interviewee responded to the question (6%; n=16), and the respondent said that they do not participate.

There was no distinct pattern by gender in terms of these responses: 86 percent of women (n=22) and 82 percent of men (n=21) said they believed the association to weight voices equally. Women were more likely to say that did not participate (2 responses), and men were more likely to point out groups that had been excluded (3 responses).

(b) Equality in Leadership

Next, respondents were asked questions of the types of people that typically served on the board of the community organization. These questions aimed to get at whether there tended to be elite capture among these positions, or whether these rotated between all association members. A series of questions was asked of participants to determine (i) how well informed respondents were about the participatory process and their community organizations; (ii) why respondents choose

to participate or not participate, (iii) whether they could identify any barriers to participation.

Respondents were asked several questions about their community organization, including who the board members were, what the terms and responsibilities of each of the positions are, and what the process of recall is. Respondents in the high participation communities were more likely to know how the organization worked (85%; n=56). In the medium participation communities, respondents often knew the terms and the actual board members, but they were not as aware of the responsibilities of each of the positions ("don't know" – 75%; n=25). In the low participation community, respondents were not aware of how the association was organized, who was on the board, or what the process of recall was (73% answered "don't know"; n=15). However, in this community, there were two associations, and respondents from one side of the community actively participated in their association.

Next, community members were asked their reasons for participating, in order to gauge the importance of the community association. Of the respondents who indicated that they participated in the community association, most (65%; n=73) said that it was important to participate in order to know what is going on in the community. Many of these associations provided forums for issues that were important to the community, such as providing seeds, access to tractors, or debates over agriculture, etc.

Finally, in order to measure how equitable the association was in terms of voicing concerns and issues, community members were asked whether there were any

barriers to participation. This was approached in two ways. First, respondents were asked whether there were any particular qualifications needed to join the board. This question aimed to assess whether certain members were considered to have better qualifications to serve on the board, or whether certain knowledge was needed to be able to be on the board. This links to Weber's theory that any type of organization that seeks to minimize *Herrschaft* (or, is a "direct democracy"), can be easily undermined by an emphasis on technical knowledge, or by filling positions of authority with *honoratores*, or community leaders (who might have more time available).

Over half of respondents (51%; n=68) answered that having available time was critical to serving on the board ("must have free time"; "I don't have time"). Around 43% of respondents indicated that board members were some form of community leader, either exhibiting leadership skills, or trust (25%), or that they were willing to take on the positions of responsibility (28%). Other qualifications needed included some technical knowledge (18%) and literacy (15%). Of the respondents who indicated that literacy was an important criteria to being able to serve on the board, 60 percent were illiterate (n=10). The remaining respondents did not indicate whether they were literate or not. Only nine percent of respondents said that anyone could serve on the board, but all but one said that while anyone could serve, they have not run themselves (because of lack of time).

In the high and medium participation communities, the majority of responses centered around the issue of free time as necessary to serve on the board positions. In Beco e Sauquino, 50 percent of respondents said that people needed free time,

followed by desire (25%; n=16). In Conceição, free time (60%) was followed by the response that anyone could serve (who had the desire to take on the responsibility, or had free time 20%; n=16). In Lagoa Dionisio, 55 percent of respondents said that community leaders typically took up the responsibilities of serving on the board (n=9). The medium participation communities (Pau D'Alho and Lagoa Seca), most respondents also indicated that free time was essential to serving on the board (73 and 75 percent, respectively; n=15 and n=12). In the low participation community (Bebedouro), the responses were fairly evenly split between having free time, and that local leaders typically took over board positions (36 and 45 percent, respectively; n=11). Of the people who said that anyone can serve, all were located in high participation communities (Beco e Sauquinho and Conceição).

Responses showed some variation by gender. About 39 percent of women said that existing leaders in the community tended to assume board positions, 33 percent of women answered that those who served on the board needed free time, and 28 percent said that board members had some sort of qualification (technical knowledge) (n=36). Among men, 54 percent said that assuming board positions necessitated free time, and 37 percent said that community leaders typically took on positions on the board (they have "desire to serve" are "trusted community leaders" are "good representatives") (n=35).

(c) Community Mapping

Community mapping exercises were done both with individuals during their interviews, as well as during the group interviews. Respondents were asked to place people in their community along a continuum of participation, from little to no

participation, to active participation/leadership. In addition, respondents were asked to identify whether these people were male or female, rich or poor, and old or young. This exercise was designed to get at types of divisions within the community, and to see whether these tended to be replicated within the participatory organizations. As predicted, the communities that were classified as "high" participation communities (Beco e Sauquino, Conceição, and Lagoa Dionisio) saw more respondents rank themselves and other community members as "active" participants. In Beco e Sauquinho, 69 percent of respondents answered that they considered themselves to be active participants in the community association (n=13). In Conceição and in Lagoa Dionisio, 50 percent said that they were active participants, and the remaining 50 percent said that they ranked their participation as "medium" (n=14 and n=10, respectively).

The medium participation communities (Pau D'Alho and Lagoa Seca), respondents were less likely to rank themselves as active participants. In Pau D'Alho, 44 percent of respondents said they did not participate at all, or their participation was low, 25 percent ranked themselves as "medium" on the scale of participation, and 25 percent said they actively participated (n=16). In Lagoa Seca, 73 of respondents said that they actively participated in community association meetings, but 100 percent of respondents said that the young people in the community did not participate at all (n=15).

In the low participation community (Bebedouro), there are two community associations. One, called the "old" association, pre-existed Central. This community

association draws participants mainly from one side of the community[93]. The second association was founded to be able to affiliate with the Central program, and technically has a president, treasurer, secretary. However, the association does not seem to meet anymore. In the words of one respondent:

> "*Not many people are affiliated with the new association, and we don't have the need to talk about water anymore. So a lot of people are members at the old association*" Male, 45, Bebedouro (Side B)

When respondents were asked about their participation in the community association, they typically responded regarding their involvement with the "old" association, since that was where community issues were typically discusses. Of respondents from Side A of the community (that used to get water, and opposed the affiliation with Central), 44 percent ranked themselves as active participants of the community association (n=9). Of the respondents from Side B, only 29 percent described themselves as active participants in the old association (n=7). One respondent was on the board of the "new" association, and so described themselves as not participating at all in the "old" association, but as an active participant of the "new" association. The remaining respondents described themselves as never participating, or said that they could not answer the question because they did not attend community meetings.

[93] This community was served with water by the local government (*prefeitura*) prior to the Central program. However, water only reached the houses that were closest to the pump (about half the community). The half of the community that wasn't receiving water complained. Usage was not monitored, so electricity rates were very high, and the local government asked Central to take over the system. The side of the community not receiving water opened an association and affiliated with Central. Since Central introduced hydrometers, the water usage per household has fallen, as evidenced by the fact that electricity bills have fallen, and now the water suffices for the whole community. However, the "new" association does not meet (despite collecting fees from each household). Respondents from the "old" association typically spoke about their role in their association.

(d) Wealth mapping

Respondents were asked to map other participants in the community associations on a continuum from no/low participation to active participation or leadership position according to their wealth status. The goal of this exercise was to ascertain if there were major differences by wealth in terms of who was considered to actively participate or even take on leadership positions. Most participants did not delineate between the rich and poor in the exercise (98%; n=83), saying that everyone was equal in terms of income and wealth ("everyone is equally poor"). These responses were further supported in questions posed later in the interviews that asked participants whether voices were weighted equally in the community association (see section on equity).

Two respondents from Lagoa Seca answered that wealthy, or better off, members of the community did not participate much in the community association at all. One of those respondents answered that, because he was perceived as better off in the community, he did not feel welcome to participate in the community association because he was not "in need":

> "*I am not happy with Central, the water quality is terrible- too salty.... I pay an average of R$8,00 for water, but I spend another R$12,00* [every month] *buying drinking water, because I can't drink Central's water. But what to do? I don't participate in the association because I feel unwelcome. People regard me as someone who is not "in need", and I should leave matters in the hands of the ones who do have "needs"* [medical needs, improving schools, seeds, fields, crops, etc.]. *Everyone is pro-Central anyway, so my opinion wouldn't matter to anyone*" – Male, retired, Lagoa Seca

(e) Age mapping

Respondents were also asked to differentiate other community members by age in the continuum of participation. Irrespective of levels of participation in the communities (high, medium, low), young people did not seem to participate anywhere. In all six communities, young people were rated as never participating. In addition, those respondents who rated themselves as never participating were typically young (all were under 24). The most active participants were usually the elderly, and most participants made a distinction between men in the community and elderly men, as well as women and elderly women. Where the elderly (both men and women) were explicitly mentioned, they were always ranked as active participants, or holding leadership active participants, whereas 40 percent of respondents said that man were classified in the "medium" participation category (n=10).

Interestingly, however, four respondents also classified their husbands as active participants along with themselves (but two classified "men" separately in the medium participation category, and the other two did not classify "men" separately). In all three of these communities, many male respondents said that they did not actively participate because their wives or other females residing in the household (mother, mother-in-law, etc.) were more involved with the community association, and that only one person per household really needed to participate. In Pau D'Alho, 75 percent of respondents ranked women as active participants. What was different here than in the two previous communities, is that 81 percent of respondents ranked males (named either as "men", "husband", "elderly men", "son", etc.) as not participating at all (n=16).

In Lagoa Seca, males participated more actively in the association than women did: 87 percent of respondents ranked males ("males", "self", "elderly men", "husband", etc.) as active participants at the community association meetings (n=15). By contrast, 93 percent of respondents said that women did not participate at all, or rarely/occasionally participated in the community meetings (n=15). One third of respondents differentiated "elderly women", and ranked this group as participating about half the time (medium participation). The reason given for the gender discrepancy in this community was that the association typically dealt with community issues pertaining to agriculture- such as seeds, fertilizer, tractors, etc.- that was usually handled by men.

In the remaining communities, there was no real discernable pattern in terms of gender and participation. In Beco e Sauquinho, men and women were both ranked as active participants. One explanation for this could be that the current president of the association charges each member of the association, rather than one fee per household, so membership is based on an individual rather than household level. In Bebedouro, the largest division was between the two sides of the community (geographic). Even between these two sides, there were no discernable divisions between males and females in terms of participation. Men and women ranked themselves and other as not participating, as participating sometimes, and as actively participating.

The Tradeoff

The community organizations sampled exhibited signs of a tradeoff between equality and efficiency in administration, in both the technical and leadership aspects

of Weber's argument. On the latter point, all of the communities had local leaders who were active on the board, often rotating between positions (such as president and vice-president). However, in all but two communities sampled, most community members said that they felt their voices were all weighted equally, indicating that most people did not think this pattern was inappropriate.

The communities sampled also showed that the equality of the organizations was undermined by technical knowledge. Weber argued that when tasks became technically complex, a certain level of technical knowledge would be required, and those possessing that knowledge would also have voices that would be weighted more heavily than those without. This tradeoff, however, was not as clear cut in the communities sampled. The water systems did, indeed, require a certain minimal technical knowledge for the required operation and maintenance of the systems. Most people, outside of the operator, did not receive this training. However, since the operator was paid by the community members, he was called on to perform the operation and maintenance of the systems, and did not participate as the operator in the community association meetings.

What was more interesting was that the maintenance of the system was performed by Central, and they had a number of technical staff to replace pipes, pumps, hydrometers, or anything else that was needed. Because of this, on the one hand, the technical tasks needed to maintain the minimal level of operation and maintenance of the system were done efficiently, but this efficiency did not come at a direct cost to the equity in the community organization, since the technical staff was not a part of the community association.

On the other hand, this meant that the community no longer debated or discussed technical issues with the water supply system. Since they do not discuss the issues, the community members were also not typically knowledgeable of the technical issues or whether they were being performed adequately.[94] This could be problematic, because shoddy maintenance can often take years to show up as an issue; pumps that are not well maintained, for example, may need to be replaced before the expected time for replacement, and this cost could, in theory, need to be borne by the communities, and would result in higher tariffs or other assessments.

[94] Most had faith in the Central technicians, saying that the system worked well, so they weren't worried about it.

C. The 'Development Model'

While tradeoffs between equity and efficiency were present in the communities surveyed, outcomes of efficiency and equity were also attained simultaneously. Where allocative equity was achieved at a cost to allocative efficiency, organizational equity was sacrificed for improved efficiency. Thus, outcomes of both allocative equity and organizational efficiency were achieved.

The final step of the research was then to link these outcomes with participatory forms of administration. According to the development model, participation is the key input variable to attain outcomes of efficiency and equity. Thus, variations in participation should also reflect variations in outcomes of efficiency and equity.

Defining Participation

Chapter 2 traced the emergence of participation, and showed how its conceptualization is varied and multi-dimensional in origin. However, the adoption of participation and the participatory approach within public policy discussions has limited the scope for participation to be simply an exercise of "voice" (much as within Hirshman's *Exit, Voice, and Loyalty*), or the "influence" of stakeholders in decision-making over resources that directly affect them (such as defined by the World Bank 1996). The discussion as to whether this conceptualization of participation is limited in scope is an interesting one, but is beyond the scope of this dissertation.

Interviews with respondents both within the communities and at the municipal level (with CENTRAL staff) indicated that this slightly narrower conceptualization of participation was fairly accurate. Communities that were described by CENTRAL staff or self-described as having "high" levels of participation, indicated that this measure was primarily driven by the fact that members "actively contributed" (84%; n=73), or that many different members "contributed to discussions" and "helped to decide outcomes" (15%; n=73). Communities that were defined as having "low" participation (both by communities or CENTRAL staff) described indicated that this was due to "low attendance of meetings" (67%; n=68), and/or that "people don't talk" (55%; n=68). Very little was said about challenging unequal power relations, more control over setting rules and tariffs, or setting alternative goals. Instead, community organizations and participation were described mainly as vehicles for implementing water supply programs (or providing legitimacy), and as spaces for sharing information.

Linking Participation and Efficiency

In addition to measuring outcomes of efficiency, respondents were asked questions that aimed to measure the links between participation and efficiency. The development model argues that participation leads to improved efficiency through (i) reducing informational asymmetries; (ii) improving accountability; and (iii) increasing ownership over the system. In other words, the community is better able to monitor if there is negligence in the operation and maintenance of the water system through mechanisms of peer monitoring, and to hold local community leaders accountable. To determine whether this was the case in the Central communities,

respondents were asked what the recourse for action was if there is negligence in the operation or the maintenance of the water system, and by what mechanisms they held the board accountable.

The majority of respondents (68%; n=79) answered in some way or another that since the system seemed to be working well, and there was enough water for everyone, they were not worried about it ("system works well" (n=17), "the operator looks after the system, so I'm not concerned" (n=8), or "we pay Central directly so we aren't involved in monitoring" (n=7)). Several respondents replied in the theoretical, arguing that they were not concerned that negligence existed, but if they suspected it, they would call for a meeting (n=5), talk to the operator directly (n=5), and/or call Central (n=6).

Respondents from the high and medium participation communities were more likely to say that they didn't worry about negligence, since they trusted that the operator and/or central was doing a good job (67% of responses; n=25). Respondents from the low participation communities exhibited more distrust of Central, saying they weren't sure where the funds were going (n=3), or that they were overpaying Central (n=2). Women were less likely to know about community monitoring systems; 57% of female respondents replied DK/NR, whereas only 32% of men did.

In addition to reducing informational asymmetries, participatory institutions are intended to provide users with a greater ownership over the system. This is also expected to improve efficiency, since users are more involved in the operation and

maintenance of the system, and care for the system. Not one respondent (0%) replied that the Central system gave them more ownership over the system.[95]\

Unfortunately, since the outcomes of efficiency were measured on the supra-municipal level, it was not possible to link the varying levels of participation that the communities exhibited with variations in outcomes of efficiency.

Linking Participation and Equity

Participation is expected to improve mechanisms of accountability, thereby providing a check on distribution policies. In an attempt to measure this linkage, respondents were asked by what mechanisms the community monitored the operator and/or central to ensure equitable distribution. Most people replied that they did not discuss distribution and allocation, since the ten cubic meters of water and costs of maintenance and delivery were set by Central. In the words of one respondent:

> *"Distribution is no longer a problem since Central, we don't even talk about that. Before Central it was a huge problem, a lot of fights in the community"*
> –Male, Lagoa Dionizio

Respondents did not equate discussions over distribution and allocation as critical to voice, and most respondents who indicated that Central was the primary decision-maker for allocation and distribution still said that they felt they had about an equal of a voice as everyone else (67%; n=14). This response varied only in Bebedouro, where a few respondents indicated that contradicting the president/operator could result in water being shut off.

[95] Seems this was a problem of translation. People seemed a bit indignant, and seemed to think that the question was asking whether they would like to own the system.

Respondents were then asked to indicate whether they thought that participation had improved their sense of empowerment and social capital within the community. On the former, most respondents replied that they did not feel that they were more empowered as a result of the community association. This question may have been confusing to the respondents, since in five of the six communities, the community association had pre-existed the Central program, and the association addressed topics that were relevant to the community, not only water (for example, seeds, tractors, community needs, etc.).

However, when asked whether they would take water from the local government if it were offered for free, many respondents (26%; n=67) said that they would rather pay for the water than rely on the local government (*prefeitura*), indicating that in this way they had more power, or control, over the water resources. Within the community association, the participatory organization did not seem to change power relations; when respondents were asked whether board members were required to have any qualifications, one common theme was that they required leadership skills (15%; n=68). In other words, the community organization tended to replicate existing social relations within the community, with local leaders taking board positions in the association. This was further evidenced by the fact that young people were typically absent from association meetings.

On the issue of social capital, respondents were asked whether participation had resulted in people having been brought together in ways they might not have been before. Most respondents seemed confused by the question, and answered “I don’t know” (98%; n=86).

The role of participation

The communities surveyed exhibited various levels of participation, from high to medium, to low. This research sought to examine whether those levels of participation were linked to varying outcomes of efficiency and equity. In the end, there is no real conclusive evidence on this. The indicators on equity were largely gathered through community interviews, but much of the financial data and other indicators used for efficiency were calculated at the supra-municipal level, which provides a general outcome for all communities affiliated with Central, but doesn't allow for a breakdown of the results, by community.

Participant observation in the communities, however, didn't indicate significant differences in outcomes of equity and efficiency. Much of the decision-making for the water supply system does not occur on the community level, but rather on the supra-municipal level, and this removes the link between the community organization and some outcomes of efficiency and equity. For example, tariffs and rates are determined by Central, and decisions over maintenance of the system are also taken by Central. Thus, communities do not have to work together to determine the cost of water, or contribute time and labor for maintenance.[96] In this, Central acts as a water supply company, albeit without a profit motive.

However, while setting rates and providing technical expertise on the supra-municipal level ensured the efficient administration of the water supply system (from a technical perspective, not from a cost recovery perspective), the role of participation in ensuring reliable water supply that fulfilled goals of efficiency, equity and

[96] This is different than, say, in many water user associations in the world (especially around irrigation) where prices and rates are debated on an annual basis, if not more often (see, for example, Peter 2004).

sustainability was limited. On the one hand, this ensures the continued organizational sustainability of the water supply system, since varied levels of participation did not directly impact the level of service for water consumers. On the other hand, however, this undermined the role of the community to truly participate in their water provision. In essence, the relationship between Central and the communities was one of a water supply company with local consumers.

Higher levels of participation did seem to increase satisfaction with the water system, and provided residents with a forum to address issues of potential conflict over water distribution. In Lagoa Dionizio, for example, respondents were highly satisfied with the water system and with Central (79%; n=14). Much of this was because the previous water system had not supplied all residents with water. This uneven distribution had caused conflicts and grievances in the community. In the words of one respondent:

> *"Before Central, we all used water from the same well, but it didn't reach all the houses, and that caused a lot of problems. Central is 100% better"* –Female, 42, Lagoa Dionizio

Where participation did seem to be important was in addressing broader systems of patronage and water provision in the region. Paying for water gave community members a sense of voice and entitlement vis-à-vis their water services that did not exist when the water was provided free of charge. As one respondent noted:

> *"I don't trust them [politicians] anymore when they offer free water. They come, and they promise everything and then we are left with nothing. At least when I pay for it, I can demand some service, and I know it will come. Central is not playing politics"* – Female, 54, Beco e Sauquinho

Several respondents noted that water is often used as a political tool during elections (n=5), where political candidates offered water free of charge in exchange for votes. Once elected, the water supply systems typically stop working because of lack of funds for operation and maintenance of the system. Under the Central system, however, respondents felt that paying for water gave them entitlement to continued service (23%; n=86), since they could hold the water supply company accountable. While this did not necessitate participation, *per se*, the participatory organization did act as an information sharing arena in which the community members where news of local political leaders offering water was communicated, and the community discussed strategies for response and weighed the options together. In Lagoa Seca, for example, community members discussed a recent visit by a local politician, and his promises to deliver free water were discussed openly.

D. Conclusions

This chapter presented findings from field research conducted in April 2009 on outcomes of equity and efficiency, as well as patterns of participation. Overall, the evidence collected across six communities shows partial support for all of the models investigated. Specifically, the field research collected evidence on allocative efficiency and equity, and found there to be a tradeoff between the two, where explicit and implicit subsidies to the water supply system ensured allocative equity, but came at a cost to allocative efficiency. In addition, the field research indicated that the administration of community organizations had been deferred to technical specialists and community leaders, indicating that organizational efficiency that

undermined equality of membership. In other words, when the opinions of technical specialists and community leaders were weighted more than other voices, equality was undermined. Thus, a tradeoff existed between allocative efficiency and equity in favor of equity, and also between organizational efficiency and equity in favor of efficiency.

The field research also found evidence for the co-existence of efficiency and equity: data collected indicated that outcomes of allocative equity and administrative efficiency were achieved simultaneously. This provided some partial evidence for the development model, which argues that participation leads to improved outcomes of efficiency and equity simultaneously. With respect to participation, the research attempted to discern patterns of equity and efficiency that resulted from varied levels of participation, but the evidence on this was inconclusive. The next chapter explores what the implications of these findings are for water supply systems.

Chapter 6: Conclusions and Implications

This dissertation investigated the compatibility of outcomes of efficiency and equity within participatory water management institutions in Bahia, Brazil. Overall, the research found mixed support for the hypotheses investigated. The next section summarizes the findings and conclusions from this research. This is then followed by a section on the implications of the research and the broader contributions of this study.

A. Summary of Findings and Conclusions: Efficiency, Equity and Participation

The first step of this research was to measure outcomes of efficiency and equity to determine the extent to which these two outcomes are compatible processes. The findings from the field research indicate that certain types of efficiency can co-exist with certain types of equity, but that each of these generates tradeoffs with other types of efficiency and equity. Specifically, the research found that explicit and implicit subsidies to the water supply systems led to outcomes of allocative equity in the sites visited, but that these generated tradeoffs with allocative efficiency. In each of the sites visited, findings from the research also indicated that the community organizations were relatively efficient in their administrative practices, but that this efficiency came at a cost to equality of membership and voice in the community organization. Given that outcomes of efficiency and equity did result in tradeoffs with other kinds of efficiency and equity in the sites visited, the compatibility of these two outcomes was only partially achieved. This contradicted much of the literature

on participation in water management that argued for the compatibility of all outcomes of efficiency and equity. However, the research did show that allocative equity was compatible with organizational efficiency, indicating at least some level of compatibility of outcomes

The next step of the research was to link participation with outcomes of efficiency and equity. Specifically, the research aimed to investigate the hypothesis that participation introduces mechanisms of accountability, among others, that result in outcomes of both efficiency and equity. Here the findings of the research were less clear. First, the research hoped to capture variations in efficiency and equity that was linked to patterns of participation on the community level. Unfortunately, only municipal level data were available on allocative efficiency and equity, making it difficult to link any variation with differences in participation. And while community-level data were available for organizational efficiency and equity, there was no clear pattern linking variations in participation with outcomes of efficiency and equity. Second, the research attempted to link participation with evidence of intermediate mechanisms that led to outcomes of efficiency and equity, especially on accountability. Here there was also no clear pattern linking variations in levels of participation with consistent variations in accountability, or other intermediate mechanisms. Part of this is likely due to the small sample of communities visited; with only six communities it was difficult to ascertain patterns in participation that were not immediately attributed to local level characteristics or specific histories of the community for broader applicability. Thus, the hypothesis that mechanisms of

accountability introduced through participation were critical to outcomes of both efficiency and equity was not found to be substantiated.

B. Implications of the Research

The conclusions from this research have several broader implications for water management. The following section outlines each of these in greater detail.

(a) Self-governance and subsidies

The broader implications of these findings on water services are unclear. Much of the research on water management shows that most water supply companies sacrifice a certain level of allocative efficiency to ensure broader coverage. While issues of resource sustainability and minimizing losses are important within broader debates on efficiency, restricting access to critical resources is politically unpopular. Thus, policies continue to favor equity over efficiency in questions of allocation. While, at present, significant political support might sustain the Central program, the dependence on state financing to replace infrastructure and assist in technical trainings comes at a cost to some independence. Scholars critical of how participation has been co-opted within development argue that the dependence on state financing shapes the role of participants to be little more than the implementers of a state-driven program (Mohan and Stokke 2003) or the consumers of a state service (Darcy 1993). Here the emphasis of participation as challenging broader and potentially unequal power relations is lost.

If the relationship between allocative efficiency and equity is one of a tradeoff, as this research suggests, than the only method by which to attain greater levels of

independence vis-à-vis the state is to raise tariffs to cover costs of operation and maintenance. This would then provide the program with enough financial independence to be able to, in theory, establish fully self-governing water systems. However, raising the cost of water will negatively affect precisely the population that has been ignored under state development programs; since most of the beneficiaries of the Central program live on little more than R$450 per month for a family, raising the tariffs for water supply would price water provision outside of the reach of many consumers.

(b) Elite capture and water services

The impact of elite capture on water services was also unclear. In some sites, local leaders used their power to mediate access to water, whereas in other sites, leaders continued to serve on the board community organizations because they were perceived as the most capable. If this relationship were to hold on a broader level, then it is important to note that, true to Weber's prediction, equality is easily undermined even within local level organizations. Where Weber's insights into elite capture indicate that when one group or person's voice is privileged over others, then equality is undermined, there is no consistent pattern in the findings of this research to indicate that equality was necessarily linked to continued access to water supply services. Given that water is critical to human life, any inequality of access, even through elite capture, could have critical consequences. The appeal of the participatory approach to devolve decision-making to the local level is couched in the broader ideal of equity of access. Thus, even organizations that are participatory in

form, may operate in a way to maximize the administrative efficiency, which could come at a cost of access for some.

(c) Participation and Sustainability

This research also examined the role of participation in six community-managed water supply systems. Interviews with Central staff and state officials continuously underscored the need for participation in the water supply schemes as critical to its survival. However, in the six communities surveyed, participation was linked only loosely to outcomes of efficiency and equity. In fact, since much of the operation and maintenance for the water supply systems was done on the supra-municipal level, the role of participation did not seem to be critical to the sustainability of the water supply system. This was evidenced by the fact that water was delivered with the same reliability in communities were participation levels were low as in those where participation levels were high.

Where participation did seem to make a difference was in addressing broader issues of patronage and inequality. Water is a popular political commodity in the semi-arid region, and water is often promised free of charge in exchange for votes and other political favors. A large majority of respondents interviewed for this research indicated that, if promised water free of charge, they would turn it down, because paying for water gave them certain rights. Where politicians had come to communities with the promise of free water, information sharing at the community meetings allowed for community members to compare promises, discuss, and vote collectively. Thus, participants were informed as to goings-on in the community.

While information-sharing may not rank high in theories of participation and empowerment, water supplied through the Central system provided a critical alternative to the politics of water in the region. The Central program's mission is to provide water supply to rural communities, and operates as a non-profit association of communities. While the participatory link between the supra-municipal organization and local communities may not be extremely strong, the a-political orientation of Central means that water provision is open to all qualified communities. These communities then have rights for service over water, and are supplied clean water on a regular basis. In this way, water is removed as a political commodity, to be traded for votes and favors, and is supplied regularly and indefinitely. Thus, participation in the Central program seems to change the playing field a little for impoverished communities living in broader systems of political patronage.

This research indicated preliminarily that the participatory community-based institution could provide some counterbalance to broader systems of the politicization of water resources. This would be an important link to establish in future research programs, particularly since these broader issues of equity would add an additional dimension to the debates over compatibility of efficiency and equity within water resources management.

(d) Scaling up and broader issues of equity

Where this research looked primarily at outcomes of efficiency and equity within communities, broader issues of equity in water supply remain. Many rural communities in the semi-arid region continue to suffer from the lack of water provision, and are susceptible to drought. While the Central program offers an

example of water supply that is participatory and sustainable, the scope for expanding the program remains dubious. First of all, the Central program continues to operate because of significant implicit and explicit subsidies, without which it would not be able to recover the basic costs of operation and maintenance of the water system. At present, it is estimated that when the Central program reaches a total of 8,000 connections it will have attained economies of scale. But it is unclear whether expanding beyond 8,000 connections is financially feasible. It may be that, given the Government of Brazil's commitment to expanding water supply and sanitation services, subsidies will continue to be an acceptable way to provide water services.

Second, at present there are only limited regulations on the federal and state level for the distribution of groundwater. In addition, there are only a limited number of studies as to the amount of groundwater available in the semi-arid region. Given the intricate hydrological linkages between groundwater sources, and between ground and surface water, the expansion of water supply systems that draw on groundwater sources is precarious. This brings up broader issues of equity in the State of Bahia, where those communities who are currently provided with groundwater resources may be using these to the detriment of future resources, thereby severely limiting the ability of communities not yet provided water supply services to use these resources.

Finally, it is unclear that the Central program could be expanded to all types of communities. When the program was initially implemented, the number of communities wanting to join the program outweighed the spaces available. In the second district where the program was rolled out (Jacobina) the program was implemented in a mining community (that had actually not applied to the program).

The community experiences a lot of in and out migration, and high variability in income (since income is dependent on finding emeralds in the mines). In this community, rates of non-payment outweigh rates of payment, hydrometers were defaced, and high rates of migration have meant little continuity in the community organization. While the Central program has, overall, enjoyed quite a bit of support and enthusiasm from the communities affiliated with the program, part of this may be a function of hand-picking the communities to partake in the program. Global experiences have generated quite a bit of debate as to the "pre-conditions" necessary for community participation to succeed, and one success factor may be the predisposition for working together and relative levels of organization needed to have applied for the program to begin with.

C. Contributions of this study

This research contributes to debates in three broad areas. First, it speaks back to debates within water management, specifically to the challenges of governance and institution building. The Human Development Report (2006) argues that the primary challenge in addressing a global water crisis is not scarcity, but poverty, power and inequality, and that these are best addressed through appropriate management solutions. The widespread enthusiasm over the participatory approach to provide equitable water management solutions without loss to efficiency was found to be only partially true. However, depending on the types of efficiency and equity gains sought, there is scope for both of these goals to be achieved simultaneously. These insights inform alternative provision of water services to carefully assess the goals for water supply programs that are managed on a local level. As the competition for

water continues to intensify, the role of participatory institutions in water management may grow, and a careful understanding of outcomes of efficiency and equity could prove instrumental in staving off potential conflicts around water resources.

Second, this study contributes to theoretical debates within the Sociological literature on the compatibility of efficiency and equity within participatory institutions. Specifically, this dissertation examined Weber's insights on whether institutional processes that are originally designed to ensure equity tend to be displaced over time by concerns over efficiency. The findings from this research found Weber's predictions to be substantiated, thereby contributing to research done in this area. In addition, the application of Weber's theory to participatory water resources management is a unique contribution of this work, given the relative lack of sociological literature on the micro-level.

Finally, this study contributes to broader debates about the compatibility of economic growth (efficiency) and inequality in Latin America. Indeed, much of this literature has pointed to the relative dearth of institutional practices that can achieve both equity and economic efficiency (Fajnzylber 1990), and these concerns remain of crucial importance in the region today. While this dissertation was focused primarily on the micro-level, findings from the research indicated that within the communities surveyed, the participatory institution lent itself well to addressing broader issues of inequality and political patronage. This is particularly important given that Bahia's levels of poverty and inequality are some of the highest in Brazil, which already ranks

as one of the most unequal countries in the world.[97] Where the participatory approach does not solve the endemic problem of poverty and inequality, the reliable provision of water supply services does provide improved standards of living for the targeted populations, and allows them some form of voice over service provision. In addition, the provision of services is linked to improved levels of economic growth (World Bank 2005) meaning that the expanded provision of water supply within an institutional form that gives a certain level of voice and accountability could, in fact, lead to broader levels of efficiency and equity gains.

[97] In 2000 the gini coefficient for Bahia was 0.61 (Verner 2004) and the corresponding figure for Brazil in 2002 was 0.6 (World Bank 2003). Poverty in Bahia, however, was at 43% in 2003 (Verner 2004), and at 22% for Brazil as a whole in 2007 (World Bank 2007)

Annex 1: Simplified Water Supply Systems

This annex provides a technical overview of the simplified water supply systems installed under the Central program. The following section provides a step by step overview of the water system, and supplies photographs of the pumps, hydrometers and other technical details. All photos were taken during the field research.

Simplified water supply systems are designed for ease of operation and maintenance. These consist typically of a pump that extracts groundwater to a storage facility, such as a water tank. The photos below show pumps installed under the Central program to pump groundwater out of the ground:

Groundwater pumps	
	
	

In some systems, the water is pumped directly to the pumphouse to be treated. In others, it is stored in a larger concrete water storage tank, such as the one pictured below. Under this scenario, the operator is responsible for turning the pump on and off, depending on the levels of water in the storage tank.

Water storage tank

If the water is pumped based on use, then it is immediately treated with a simple mixture of hydrochloride to kill bacteria and other contaminants. The photos below show a pump with an adjacent pump house. The pump house is where the water is treated.

Pump and pump house

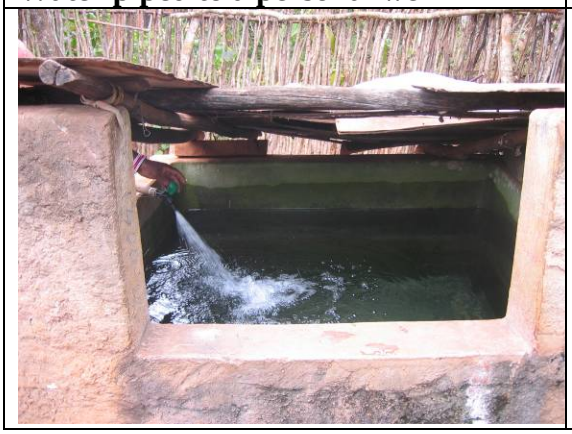
Inside the pump house, water is mixed with hydrochloride and sodium. The operator is in charge of making sure the water is treated. This process is pictured below:

Storage container for treatment	**Treatment mixture**
	

From the pump house, the water is distributed through underground pipes to the individual houses. The Central program installed hydrometers in front of each house to measure the individual consumption of the households. The photo below shows a hydrometer.

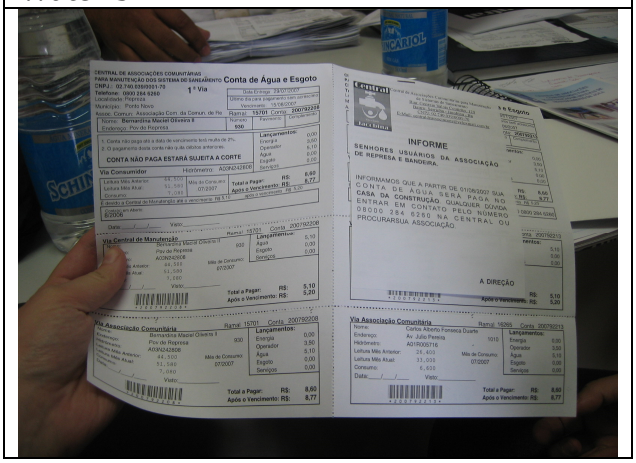
Individual Hydrometer


In some communities, the water is pumped to individual wells for consumption. In other communities the water was piped directly into the house.

Water piped to a personal well	Water piped into the house
	

The operator is responsible for reading the hydrometer of each household and reporting the units consumed to Central. Central then generates a bill for each household at the end of the month that charges a base fee of R$5,00 for water, and then a progressive tariff rate after that. The bills clearly show the breakdown of charges. If the household wishes to contest the charges, they can speak either to the operator, or call a service line at Central. The photograph below shows the bills that Central generates.

Water bill



Annex 2: Interview questions used during field research

Interview Guide 1: Key Informant Interviews (General)

1. What can you tell me about Community X?
    a. What is the average income in the community? What do people do for a living? How many people live here? How many houses are there?
    b. What are some of the community dynamics (i.e. lots of migration, fights within the community, do people get along, are there main families in the communities, etc.)?
    c. What is the layout of the water supply system? Is the pump far away? Is the village spread out? Does that affect performance? Do you pay electricity costs? Have you always paid them?
2. How long has the CENTRAL program operated in the community?
3. What did residents do for water supply before the CENTRAL program?
4. How well do you think the community association has performed since CENTRAL? Why?
    d. If people have stopped joining the community association, why?
    e. If there has always been strong participation, why?
    f. If the participation is linked to *farinha* cooperatives, do you think that there would be the same participation in this community without it?
5. Have there been any problems/issues with the operation of the system (i.e. has the operator not done his job well at times)? If so, how did the community address this issue? If not, why not?
6. What can you tell me about the community association board (president, secretary, treasurer)? How many terms have they served? Have there been other people in the community who have served? If so, why? If not, why not?
7. What kinds of training programs has CENTRAL provided for the operation of the system? Can anyone be operator? Have there been different operators? Have many people attended the training programs?

Participation: These questions get at issues of governance through participatory institutions.

8. Who participates? Map out participants in the community organization according to age/wealth/gender.
9. How are preferences expressed?
10. How are differences in preferences reconciled?
11. How is the community organization involved in monitoring and evaluating the operation and maintenance of the water supply system?

Efficiency: The following questions will be triangulated with data on the water supply system to ascertain technical and allocative efficiencies

A. Technical efficiency:

12. How much water is lost from the pump to each of the houses? Are there leaks in the pipes? Is water lost elsewhere in the system?
13. How often is the water system maintained? Is this preventative maintenance?
14. How often does the operator look after the water system? Is this adequate?
15. How has the community contributed local knowledge that has improved the water system (i.e. location of pump, water source, etc.)? (*hidden information)*
16. Have community members contributed local knowledge within the community organization that helped with the installation, operation and/or maintenance of the water system? (*hidden information*)
17. What does the community organization do if there is negligence in the operation and maintenance of the water system? (*hidden action*)
18. Does your participation in community meetings give you a greater sense of ownership over the water system? (*hidden action*)
19. How does the community ensure that the board collects and uses the fees for the operation and maintenance of the water system? (*accountability*)

B. Allocative efficiency

20. Do the fees collected for water services cover the costs of operating and maintaining the system?
21. Who pays the costs for electricity? Are there any subsidies in the water system?
22. Do you get the amount of water that you would like? How close is the amount of water delivered to you to the amount that you would like?

Equity: The following questions will be triangulated with data collected at Central on allocation to

23. How does the community ensure that water will be distributed fairly? (*accountability*)
24. Has participation in the community organization meant that everyone has an equal voice in decisions over distributing water?
25. Is the CENTRAL system more or less fair in the way that water is allocated compared to what existed before?
26. How much influence do you think you have in the decision-making in the process of participation or in the outcomes of the community meetings? (*empowerment*)
27. Has the community organization brought together people who might not otherwise have worked together? Are these new networks an asset to the community? (*social capital*)
28. Has the community organization made an effort to assist the poor?

Effectiveness in Participation: The development model argues that successful participation comes as a result of specific training to overcome three gaps:

A. **Capacity gap**: Successful participation occurs when participants have been trained in the process of governance.

29. What kind of training did you receive to understand how participating in the community organization would work? Was this training adequate?

B. **Incentive gap**: Benefits from participation must outweigh the costs of participating. Costs include opportunity costs, psychic costs (of participating), and costs of retribution from dominant classes.

30. Is it worth your time to participate in the community organization? Why or why not?
31. Are there people who have difficulty speaking up at the community meetings?
32. Has anyone ever had problems because of what they said at a meeting?

C. **Power gap**: asymmetric power relations are likely to be internalized and perpetuated within participatory organizations. Collective decision-making is expected to overcome these differences.

33. What kinds of rules exist at the community organization to ensure that every member can speak equally?
34. Are people who are poor or not as involved in the community able to participate on equal footing at the community meetings?
35. Does everyone in the meeting consider all of the suggestions or statements made equally?
36. Has the community organization created certain rules to make sure that the process of making decisions over water distribution will be fair?
37. How do people participate? Do they present reasons for their statements?
38. Was there any process of social mobilization that encouraged people to participate and provided trainings for this?

Weberian Model

A. Elite Capture:

39. Are there certain qualifications or certain people who are more qualified to run for board positions in the community?
40. When was the board first elected? Are there board members that have served for some time? Why?
41. Are there any community members you would designate as leaders in the community?
42. What would you say the structure of power is in the community (e.g. horizontal or vertical)?

B. Technical Expertise:

43. Are there any advisers to the community who help in the case of technical issues with the water supply system?
44. How are technical issues presented to the community (e.g. are they voted on)?
45. Is technical expertise taken into account when deciding on technical issues?
46. How are technical issues resolved if they conflict with other priorities in the community?

Other questions:

47. What is this community's relationship to the municipal government? Has the municipality ever offered water for free? What, in your opinion, are the key areas of corruption in the municipal government?

Interview Guide 2: Individual and Focus Group Interviews

Community Mapping:

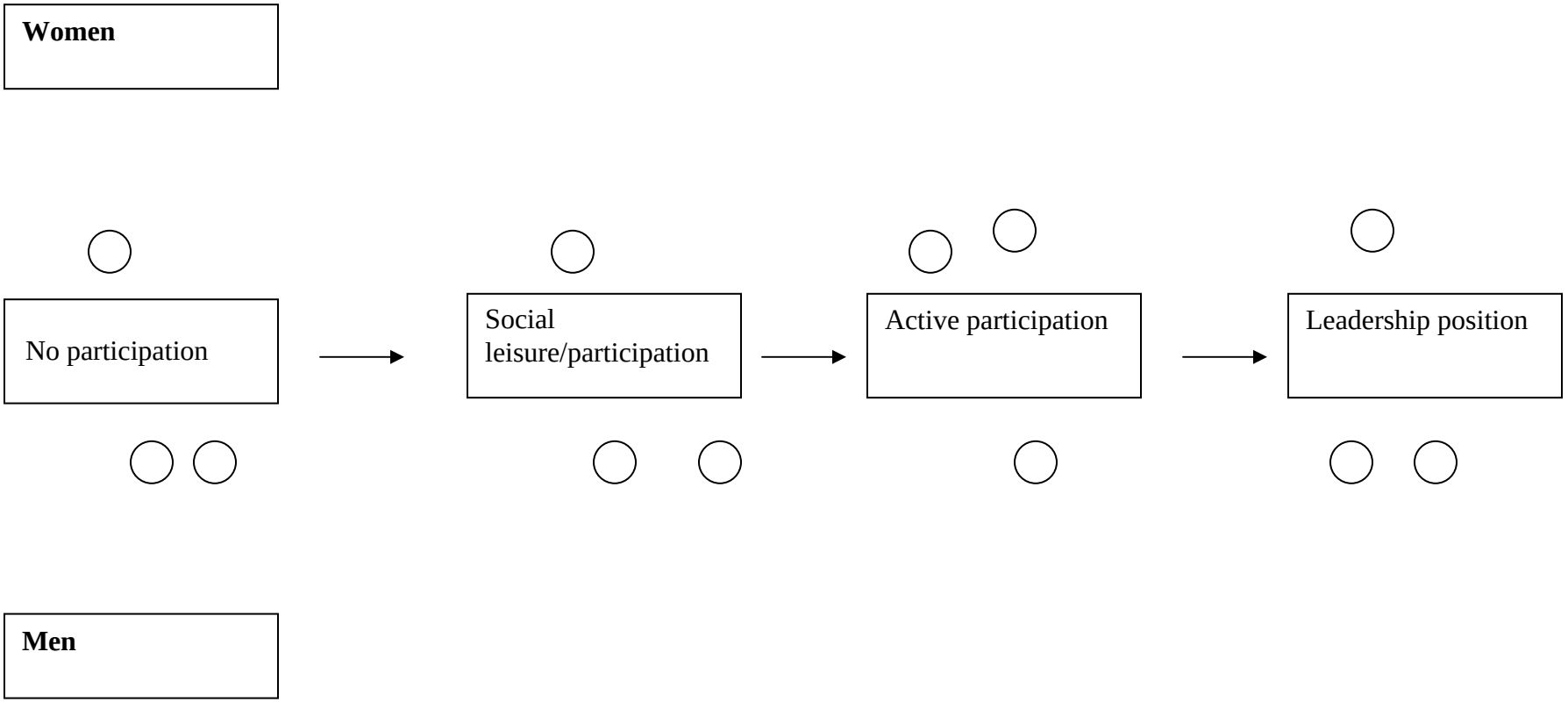
1. Tell me a little bit about your community. What is the history of your community? How long have you all lived here? Your families?
2. Where do you talk about the water system (i.e. community organization)? Is this only to talk about water or do you talk about other issues there as well? When was the association founded? For what purpose? Has this changed over time?

Participation

3. Tell me a little bit more about the community organization. What are the meetings like? Are most people members? Does everyone attend the meetings? Are there some people who talk more than others? Why/why not?
4. If we drew a scale of no participation to leadership positions (See Figure 1 for an example), where would you put yourself? Your neighbor? Who are other people in the community and where do they fall? How old is this person? Is he/she wealthy? Why does this person not participate etc.?
5. Who are the board members (president, treasurer, secretary)?
    a. Why were they voted in (i.e. because they had the time for it/because they are more qualified??)?
    b. Can anyone be a board member? Have any of you run for the board?
    c. Is there a certain type of person who should/could be on the board? Is there a type of person who could not be on the board? Why/why not?
6. What are the terms of office for each of the positions?
7. If one of the board members does not fulfill their functions, what is the process of recall?
8. What restrictions exist for terms of office? Is everyone required to serve?
9. What is the mandate for each of the positions?
10. What is the process by which the board notifies the members of decisions/discussions (e.g. minutes)?
11. Is it necessary to have certain technical knowledge of the water system to act as a board member?
12. What kind of training did you receive to participate in the community meetings? What kind of training did you receive to understand the water system?
13. How are preferences expressed?
14. How are differences in preferences reconciled?

15. How is the community organization involved in monitoring and evaluating the operation and maintenance of the water supply system?

FIGURE 1: COMMUNITY MAPPING



Efficiency: Let's talk a little bit about how well your water system delivers water to you.

16. What does the community organization do if there is negligence in the operation and maintenance of the water system? (*hidden action*)
17. Does your participation in community meetings give you a greater sense of ownership over the water system? (*hidden action*)
18. How does the community ensure that the board collects and uses the fees for the operation and maintenance of the water system? (*accountability*)
19. Do you get the amount of water that you would like? How close is the amount of water delivered to you to the amount that you would like? (*allocative efficiency)*

Equity: Let's talk a little bit about how fair you think the water system is.

20. How does the community ensure that water will be distributed fairly? (*accountability*)
21. Has participation in the community organization meant that everyone has an equal voice in decisions over distributing water?
22. Is the CENTRAL system more or less fair in the way that water is allocated compared to what existed before?
23. How much influence do you think you have in the decision-making in the process of participation or in the outcomes of the community meetings? (*empowerment*)
24. Has the community organization brought together people who might not otherwise have worked together? Are these new networks an asset to the community? (*social capital*)
25. Has the community organization made an effort to assist the poor?

Effectiveness in Participation: Let's talk a little bit about how the CENTRAL system was implemented.

26. What kind of training did you receive to understand how participating in the community organization would work? Was this training adequate? (*capacity gap)*
27. Is it worth your time to participate in the community organization? Why or why not? (*incentive gap)*
28. Are there people who have difficulty speaking up at the community meetings?
29. Has anyone ever had problems because of what they said at a meeting?

30. What kinds of rules exist at the community organization to ensure that every member can speak equally?
31. Are people who are poor or not as involved in the community able to participate on equal footing at the community meetings?
32. Does everyone in the meeting consider all of the suggestions or statements made equally?
33. Has the community organization created certain rules to make sure that the process of making decisions over water distribution will be fair?
34. How do people participate? Do they present reasons for their statements?
35. Was there any process of social mobilization that encouraged people to participate and provided trainings for this?

Technical issues: Sometimes problems come up in the water system that can be fixed with help from CERB or other technical experts. Could you tell me a little bit about how this process happened in your community?

36. Are there any advisers to the community who help in the case of technical issues with the water supply system?
37. How are technical issues presented to the community (e.g. are they voted on)?
38. Is technical expertise taken into account when deciding on technical issues?
39. How are technical issues resolved if they conflict with other priorities in the community?

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