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Community-based Water Management for Sustainable and Collective Action in Rural Costa Rica

Identifying Facilitators and Extending Common-Pool Resource Theory

by

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The aim of this study was to deepen the understanding of how community-based water management approaches facilitate sustainable and collective action (SCA) in the context of increasing water insecurity in Costa Rica. Applying a qualitative approach, based on fieldwork in Guanacaste, Costa Rica, including semi-structured interviews and a digital community survey, the study uncovers facilitating factors towards SCA. Addressing revealed shortcomings of Common-Pool Resource Theory, an extended framework, based on Ostrom's (1990) design principles for robust community-based organisations (CBOs) was applied, furthering this approach through the inclusion of sustainability dimensions, inner capabilities and an inclusion of the community's perception. The findings highlighted the importance of inner capabilities, communication, collaboration, gender diversity, and community support. The case study of ASADAS in Hojancha revealed unique and contextualized insights, and offered concrete policy advice for the context of Costa Rica. Furthermore, the Theory of Common-Pool Resources is advanced through the development of an extended framework, which addresses previous shortcomings in the theory.

Keywords: Community-based Organisations, Water Governance, Design Principles, Collective Action, Framework, Costa Rica, Qualitative Research

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

ASADAS	Asociaciones Administradoras de los Sistemas de Acueductos y Alcantarillados Comunales
AyA	Instituto Costarricense de Acueductos y Alcantarillados
CA	Collective action
CBOs	Community-based organisations
CBNRM	Community-based natural resource managment
CBMA	Community-based management approach
CBWM	Community-based water management
CPR	Common-pool resource
CPRs	Common-pool resources
CPRM	Common-pool resource management
CPRT	Common-pool Resource Theory
DP	Design principle
DPs	Design principles
SCA	Sustainable collective action

1 Introduction

“El agua es Vida, Cuidémosla” (in English: “water is life, let's take care of it”) is the front-page statement of Costa Rica’s governmental water agency, with which they point out a global resource problem (AyA, 2023). While we live on ‘the blue planet’, water is a scarce resource as freshwater makes up only 3 percent of all water, and is dramatically affected by climate change and demand increases (Ballestero et al., 2007; Kuzdas et al., 2015; World Wildlife Fund, 2023). In 2022, half of the world's population experienced severe water scarcity, at some point in the year (Caretta et al., 2022). With every degree of warming, these impacts are expected to grow further, exposing billions of people to physical water scarcity, while these impacts are not equally distributed (Caretta et al., 2022). The Central American dry tropics, which encompass “rural, developing and semi-arid regions“, are particularly vulnerable and exposed to these impacts, while being hardly covered in the literature, indicating the need for research with a regional focus (Ballestero et al., 2007; Kuzdas et al., 2015).

One of these regions is the dry tropics of Costa Rica’s north-western province - Guanacaste (Montero & Carlos, 2017). The region experiences an annual 6-month dry season, which is expected to intensify, due to less rainfall, further putting pressure on the population and increasing the vulnerability of the water systems (Edelman, 1999; Water Center for the Humid Tropics of Latin America and the Caribbean, 2008). Furthermore, the quality of surface water in Costa Rica has decreased due to the impacts of lacking wastewater systems and the usage of agrochemicals in agriculture, limiting the amount of available potable water (Madrigal-Solís et al., 2020). In rural areas of Costa Rica, water management is primarily delegated to community-based organisations (CBOs) known as ASADAS (Asociaciones Administradoras de los Sistemas de Acueductos y Alcantarillados Comunales) by the government (Dirección de Agua, 2023). Particularly citizens and smallholder farmers in rural areas, managed by ASADAS, like the village of Hojancha, are drastically affected by exploitation and climate change impacts (Kuzdas et al., 2015). Nevertheless, environmental projects are mostly focused on the need for reforestation to increase forest cover in Guanacaste, neglecting the important role of water management (Morataya-Montenegro & Bautista-Solís, 2020).

The organisation of water usage has grown in importance (Steins & Edwards, 1999). Today’s water governance and management approaches aim to respond to these issues and find effective solutions. Nevertheless, water scarcity persists and intensifies, indicating that the governance or management of water must adapt, or as Kuzdas et al. (2015, p. 254) put it: “People must ultimately ‘govern water differently if they are to resolve problems and achieve positive sustainability outcomes”. A dimension currently still overlooked is the role of communities in water governance, as literature commonly focuses on the levels of governance or households and individuals, although CBOs “are the connecting fabric between communities and institutions” (Grimley et al., 2022, p. 2). CBOs play a crucial role in fostering collective action

(CA), which can be understood as the collaborative effort of a group working towards a common objective, without solely relying on individual rational choices (Lejano & Fernandez de Castro, 2014). This approach is widely recognized as effective for addressing resource management challenges (Ostrom, 2010). In this thesis, the concept of sustainable collective action (SCA) is used as a synonym to long-term robust and "successful" CBOs.

1.1 Research Problem

With a global shift from centralized state control over water resources towards the integration of diverse actors, the term changed from water management to governance (Hall, 2002; Pahl-Wostl, 2015). As old governance or management forms become less relevant, due to changing environments and conditions, alternative approaches have emerged in the past two decades (Armitage, 2005; Biswas & Tortajada, 2010). Water governance by community organisations increased and started to receive more recognition (Armitage, 2005). Environmental issues connected to water have the characteristic of common-pool resources (CPRs), as it is difficult to exclude people from using water and one person's usage subtracts from the benefit of others, making the resource vulnerable to exploitation (Yoder et al., 2022). Hence, direct inclusion of the users in the governance process seems promising to overcome some of these issues and foster CA instead of maximizing individual benefits.

Currently, neither these new forms of governance through CBOs nor their design features are well understood (Kuzdas et al., 2015). Better understanding how CBOs can facilitate SCA to effectively address existing and upcoming environmental issues is of high importance, as communities hold crucial roles on a global scale regarding the conservation and protection of natural resources (Cox et al., 2010; Kuzdas et al., 2015). Particularly in the context of Central America, developing institutional designs and understanding how CBOs facilitate successful and sustainable water governance is critical, due to the region's vulnerability to climate change (Kuzdas et al., 2015).

1.2 Aim and Scope

Based on Ostrom's (1990) framework of design principles (DPs) for robust CBOs, and a threefold extension of it, this study aims to address the above mentioned gap and capture facilitating aspects for SCA of CBOs in rural Costa Rica. By this, it reveals drivers and obstacles for CBOs to facilitate SCA in local water governance and enables a more holistic understanding of CBOs in water-scarce dry tropics.

Ultimately, the scope of this study intends to answer the following research questions:

RQ1: How do community-based organisations (ASADAS) in Hojancha, Costa Rica, facilitate collective and sustainable action in local water management?

RQ2: How do the inner characteristics of the ASADAS facilitate collective and sustainable water management?

RQ3: How does the surrounding community enable collective and sustainable water management of community-based organisations (ASADAS)?

Despite, their high vulnerability towards climate change impacts, Central America, and Costa Rica, have so far been underrepresented in the literature on water governance and particularly community-based water governance (CBWM) (Abdullaev et al., 2010; Armitage, 2005; Blaikie, 2006; Morataya-Montenegro & Bautista-Solís, 2020; Muchara et al., 2014; Prokopy, 2005; Theesfeld, 2004). CBWM has emerged as a governance approach rather recently, hence many open questions remain, which ought to be addressed in future research (Ostrom, 1990; Schlager, 2004). To address some of these questions and contribute to better coverage of Central America, this research develops a case study about CBOs' abilities to facilitate SCA in rural Guanacaste, based on fieldwork in Hojancha. The theoretical framework applied is based on Ostrom's (1990, 2002) contribution to Common-Pool Resource Theory (CPRT) and her DPs for robust CBOs, and extended through the contribution of this thesis. These extended principles will be analysed for sufficient presence including the perspectives of the CBOs themselves, supporting organisations (like the local government and an association of CBOs) as well as the perspectives of the citizens of Hojancha. Adding these extensions to the existing framework of Ostrom is crucial, as its shortcomings have been raised continuously, while the validity of her DPs remain (Cox et al., 2010; Steins & Edwards, 1999).

The relevance of this study is reflected in recent publications of the IPCC (Caretta et al., 2022) or the UN-Water (2023), which highlight the potential and importance of inclusive community-based approaches in water governance. To achieve long-term effective adaptation, Caretta et al. (2022) found community-based approaches to be critical as context-dependency is strong in local measures. The utilization of local knowledge through community-based approaches has been found to help align climate action with clean water, increase the effectiveness of measures and maximize the local benefit (Caretta et al., 2022). To support the emergence and development of effective CBOs , it is crucial to understand how CBOs are currently facilitating SCA. CBWM is highly contextual, hence the generalizability is limited. While it must be acknowledged that generalization is not the goal of qualitative research (Ritchie & Lewis, 2003). The identification of DPs and facilitating abilities of CBOs can give insights into their inner workings. These findings can add critical value to local policy development, particularly in Costa Rica and Central America.

The contributions of this study to the field are threefold. First, it develops a case study revealing context-specific and novel insights into the case of rural CBWM in Hojancha, Costa Rica, through primary data collection. Second, it identifies concrete drivers and obstacles for SCA, which are fundamental for local policy development. Third, by critically assessing previously applied theoretical frameworks and adjusting for found shortcomings, this study further develops the theoretical model of DPs for CBOs. This is done by addressing normativity issues of 'success' in CBOs through an addition regarding sustainable action. Furthermore, inner

capabilities are analyzed in a structured way. Lastly, this study includes the surrounding environment by capturing community perceptions, adding a crucial perspective to the assessment of CBOs' abilities to facilitate SCA.

1.3 Outline of the Thesis

The thesis is structured in seven chapters. After giving an introduction to the topic and research questions in Chapter 1, Chapter 2 depicts the relevant background of the study, focusing on water governance, and describing the situation of Costa Rica and the location of the case study – Hojancha. Chapter 3 elaborates on Common-Pool Resource Theory, as the theoretical background of this study. Chapter 4 highlights relevant literature on water studies in Costa Rica, CBWM, and the DPs and develops the theoretical framework of this thesis. In Chapter 5, the methodological approach is explained, including the research design, case study selection, data sampling and collection, as well as data analysis, triangulation and aspects of ethics and limitations. The results of the study are presented and discussed in Chapter 6, distinguishing between the DPs, the role of sustainability, inner capabilities and the community. Finally, Chapter 7 concludes the findings of this thesis, indicates possible policy advice and points to desired future research.

2 Background

Community-based water management is embedded in the larger framework of natural resource management and water governance. These topics will therefore be explained in this chapter, followed by an overview of Costa Rica's water sector, to depict the context of this study. Finally, this chapter discusses the sustainable transformation of Hojancha, Guanacaste, and explains why this is an important example that shows how sustainable transformations are possible and how this example can be useful for the further development of CBWM practices, using the CBOs as a positive example.

2.1 Natural Resource Management – Water Governance

The management of natural resources is increasingly important due to population growth, extreme weather events, and climate change (Armitage, 2005; Biswas & Tortajada, 2010; Cox et al., 2016; Steins & Edwards, 1999). Simplifying natural resource management, it can be described as the management of interactions between the environment and humans (Cox et al., 2016). Finite environmental resources, like water, often appear infinite (Cairns, 2004), leading to specific consumption behaviours and the need for targeted rules. Various fields offer different perspectives on natural resource management (cf. Table 1), all falling under its umbrella (Cox et al., 2016). This study is located in the field of 'Collective Action and the Commons', which examines the outcomes of collective action approaches among users.

Table 1 Natural Resource Management Fields, based on (Cox et al., 2010)

NRM Field	**Description**
Political Economy	explaining the influences of political and institutional contexts
Resilience	explaining conditions that enable an ecosystem to remain stable
Environmental Economics	examining environmental policy instruments
Conservation Biology	dealing with conservation-based policies
Geography and Land Use	highlighting spatial land use dynamics
Political Ecology	which in comparison highlights power dynamics and their influence on social and environmental outcomes
Interdisciplinary	a field combining focus points across all these fields
Collective Action and the Commons	focussing on the outcomes of collective action approaches among users

As this study deals with the resource of water, which is widely agreed upon to qualify as a CPR (Gruby & Basurto, 2014; Ostrom, 2002), the Theory of Common-Pool Resources, from the field of 'Collective Action and the Commons' (Cox et al., 2016), is selected for this study. Four basic regimes exist for the management of CPR: "open access", describing a context in which no rules for usage and distribution are present, "public property", where rights are controlled and held by the state, "private property", where those rights are owned by individuals or companies and can be traded, and "common property", where "a set of rules is present to govern access to, allocation of, and control over the CPR" (Steins & Edwards, 1999, p.549). In the context of this study, water is managed in a hybrid form: partly as public property, as foundational legislations still come from the central government, but also as common property, as the CBOs facilitate the entire local management practice. Hence, the notion within CPRT of CA is regarded as fitting, as it addresses this community-based management approach, and will give the theoretical guardrails for this research. Theories emphasizing CA, focus on "the role of those actors in the design and enforcement of environmental policies", which aligns with the chosen research question and focus on CBOs in local water management (Cox et al, 2016, p.49). CPRT is regarded as a robust contingency theory suitable for guiding practice and building theory (Schlager, 2004). Thus, the theoretical framework for this study is based on Ostrom's work on common-pool resource management (CPRM) and CA, which will be discussed further in Chapter 3 (Ostrom, 1990, 2002).

2.2 The Water Sector of Costa Rica

Costa Rica, a small tropical country in Central America, has experienced significant development and gained global recognition for its environmental policies (e.g. Payment for Environmental Services programs) and achievements (The World Bank, 2023). With a protected territory covering 25.1 percent of its area and a population of around 5 million (United Nations, n.a), Costa Rica faces increased demand in its water sector due to ongoing growth (Morataya-Montenegro & Bautista-Solís, 2020). The success story of Costa Rica is further measured by its high ranking in the Human Development Index of the United Nations (United Nations, n.a), steady economic growth over the past 25 years and political stability (The World Bank, 2023).

The Costa Rican Institute of Water and Sewerage known as AyA (in Spanish: Instituto Costarricense de Acueductos y Alcantarillados), was established in 1961 to oversee and manage drinking water infrastructure in both urban and rural communities (Madrigal et al., 2011). Costa Rica has a relatively high percentage (81 percent, 2011) of the population with access to potable water compared to other Central American countries (World Bank, 2020). Drinking water is provided by water utilities and the AyA in urban areas, while CBOs, known as ASADAS, handle rural areas (Madrigal et al., 2011). The AyA delegated administrative tasks to ASADAS in many rural areas, allowing them to manage water withdrawal and distribution with

accountability to the central government (Madrigal et al., 2011). Currently, around 1,900 ASADAS serve approximately 60 percent of Costa Rica's rural population (UNDP, 2023), but variations in service quality and water quality exist among ASADAS (Madrigal et al., 2011).

2.3 Hojancha's Sustainable Transformation

Hojancha, the smallest canton in Costa Rica's dry tropics of Guanacaste, has undergone a remarkable sustainable transformation since the 1930s, making it an interesting study location (Memoria Ambiental, 2021). In the 1930s, the canton experienced a period of intense migrations, which increasingly put stress on the available natural resources. The effects of exploiting local soil and aquifers increased in the 1970s when economic activities intensified and water security issues appeared (Memoria Ambiental, 2021). By 1992, Hojancha was in a severe environmental crisis, with water shortages and significant population emigration (around 50 percent) (Esquivel, 2019; United Nations Development Programme, 2012). Further, the water flow of the Nosara river, which belongs to the largest river basin in Hojancha and is a fundamental source for "livelihoods, health, and community well-being", decreased by around 90 percent, (Esquivel, 2019; United Nations Development Programme, 2012, p. 6). The community responded to this. Started by a few individuals, who collected money to buy land from farmers for reforestation, the community developed a protected zone in Hojancha (Esquivel, 2019). In 1992, on this land, the Monte Alto reserve was founded and started to attract the public administration and international organisations which further supported the reforestation efforts and conservation of water sources, by expanding the reserve (Memoria Ambiental, 2021). A few years after its foundation, the reserve already covered 800 hectares (80 percent) of Hojancha's watershed area (United Nations Development Programme, 2012). Hojancha's successful community response to the environmental crisis, through reforestation and water source protection was recognized with the Equator Initiative prize in 2004, showcasing how unique such a sustainable transformation is, as Costa Rica is the only country globally that reversed deforestation (Tafoya et al., 2020). This history of Hojancha and its remarkable community efforts make it a highly interesting case to understand how CBOs function, motivating it as the location chosen for this study.

3 Theory

This study is embedded in the CPRT. Crucial concepts within CPRT are those of CA and DPs for robust CBOs. To provide the theoretical frame, the following chapter will provide definitions of CPRT and CA (Chapter 3.1), followed by an explanation of the theory's historical development in Chapter 3.2. Finally, Chapter 3.3 presents Ostrom's (1990) DPs, which function as the theoretical framework and foundation for the methodological approach applied here.

3.1 Common-Pool Resource Theory and Collective Action

Various resource types exist (cf. Figure 1), including private goods, club goods, commons/public goods, and CPRs (Choe & Yun, 2017; Ostrom, 1990). Private goods can be excluded from certain individuals, while club goods allow for non-rivalrous access (Choe & Yun, 2017). Shared ecosystems are often referred to as the "global commons" (Ostrom, 2008, p. 10). Public goods, such as the internet, cannot be limited in access, and usage does not decrease availability. CPRs, on the other hand, allow for exclusion but usage diminishes the total quantity (Ostrom, 2008; Steins & Edwards, 1999). These resource characteristics are relevant to many environmental problems today (Yoder et al., 2022), where the exploitation of resources for personal gain often leads to, what Hardin (1968) termed, the 'Tragedy of the Commons'. CPRT aimed, since its emergence, to explain these dilemmas and build theories to conceptualize what governance forms seemed to be successful at managing CPR.

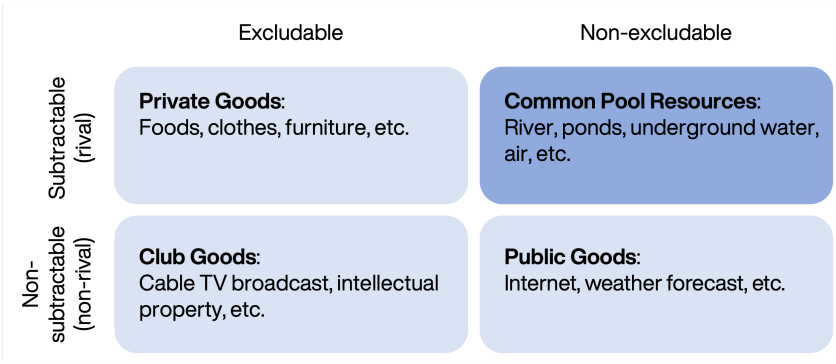


Figure 1 Resource Types, (authors elaboration based on (Choe & Yun, 2017))

To overcome these problems, a widely recognized strategy of users is to apply CA measures through community-based management approaches (CBMA) (Steins & Edwards, 1999). CA involves users cooperating for a common purpose, often driven by shared routines, culture, and historical developments that shape institutional formations (Lejano & Fernandez de Castro, 2014). Understanding how and when CA organizes has been a longstanding question in the field (Anderson White & Ford Runge, 1995). Ostrom (2002) identified attributes of the resource and the appropriator that determine the attractiveness of self-organizing through CBMA. These attributes influence the "benefits and costs of institutional change" (Ostrom, 2002, p. 1327), and can be influenced by factors such as resource scarcity and a common understanding of resource operations, as well as dependency on the resource (Ostrom, 2002). All attributes are listed in Table A1 in Appendix A. While CA approaches are widely applied, a deeper understanding of what enables certain organisations to be successful in the long-term and others not remains necessary. Again, Ostrom led this discussion by identifying a set of DPs related to sustainable operations of CPROs. These principles functioned as the guideline of many previous studies and will also do the same in this case study analysis of CBOs (Ostrom, 1979, 1990, 1998, 2002).

3.2 Historical Development of the Commons Theory

The research field of the commons has been in development for decades and builds on various scholars' remarkable contributions (Hardin, 1968; Olson, 1965; Ostrom, 1990, 2002; Schlager, 2004; Wade, 1994). To effectively apply the theory of CPRs, an understanding of its historical development is important, as the field shifted focus at various times (Cox et al., 2010; Hardin, 1968; Ostrom, 1990, 2002; Wade, 1994). For this reason, a brief overview will be given in this chapter. Araral (2014) differentiates the literature on the commons into three generations, which give a suitable overview of the historical development of the theory and literature published within the field (cf. Figure 2).

Beginning with Araral's (2014) *first generation*, Olson (1965) published a theory on collective action, concluding that individuals, even if they share a common goal, could not cooperate voluntarily to achieve that goal. Unless the users consist of a small group size, issues like free-riding, would always trump (Olson, 1965). Shortly after, Hardin (1968) popularized the concept of the 'Tragedy of the Commons', advocating for state regulation of natural resources to prevent exploitation. Ostrom (2002) later termed this literature as a variation of the CPRT known as the "simple theory". According to this theory, CPRs generate a predictable, finite supply of a resource unit (Ostrom, 2002). Appropriators are assumed to be homogeneous groups seeking short-term profit, each person can appropriate the resource, and there is no intention to change the open access condition. No communication or coordination occurs between appropriators, resulting in a game where individual rationality conflicts with collective rationality, leading to negative outcomes for everyone (Schlager, 2004, p. 147).

Governments reacted to these theoretical predictions, but the results were not satisfying. Despite applied measures, CPRs were exploited, and the general applicability of the model was consequently questioned in the mid-1980s (Schlager, 2004). In many cases, cooperation and self-organisation did indeed seem possible and successful, and carefully developed rules within these self-organised organisations appeared to have helped define their success. (Schlager, 2004, pp.148-149). Scholars have confirmed this in the last decades and concluded that the 'Tragedy of the Commons' is no longer the only model capable of explaining the management of CPRs (Araral, 2014). Further, they established that humans cannot only prevent tragedy but, they can, under certain conditions, organize themselves to address resource exploitation, and these conditions have been studied empirically (Schlager, 2004, p.146).

The *second generation* focused on effectively managing CPRs, leading to the development of principles for successful CPR organisations (Ostrom, 1990, 2002; Schlager, 2004; Wade, 1994). In 1983, the National Research Council established a research committee to investigate CPR user problems, emphasizing the need for deeper understanding and further research on CPR governance (Cox et al., 2010). Elinor Ostrom emerged as a thought leader in this generation, earning the Nobel Prize in 2009 for her work on 'Governing the Commons' and developing eight DPs for robust community-based CPRM organisations, which will be further explained in the following chapter (Ostrom, 1990). Likewise, Wade (1994) developed a set of 14 criteria for CPRM organisations, largely overlapping with Ostrom's. Ostrom further refined her theory in 2002 by identifying attributes of resources and appropriators that facilitate CA (Ostrom, 2002). However, these conditions are not sufficient for the emergence of self-organizing organisations or the willingness of appropriators to actively change established rules and processes (Schlager, 2004). Contextual factors play a crucial role in the theory, and the relationship between variables is contingent and configurable (Schlager, 2004).

Emerging as the *third generation* are studies which distance themselves from the work of second-generation authors (Ostrom, 1990, 2002; Schlager, 2004; Wade, 1994). These studies question established theories by examining their applicability to large-scale commons resources and the generalizability of Ostrom's (1990) DPs (Agrawal, 2014; Cox et al., 2010). Exploring new methodologies in this field requires further research efforts, as many questions remain unanswered, leading to the purpose of this study, which is also positioned in the third generation. By extending Ostrom's concept of DPs for CBOs, this study expands the theoretical debate to include previously uncovered dimensions - sustainability as a goal, inner capabilities of CBOs and the surrounding community. The details of this approach are elaborated in Chapter 4.4.

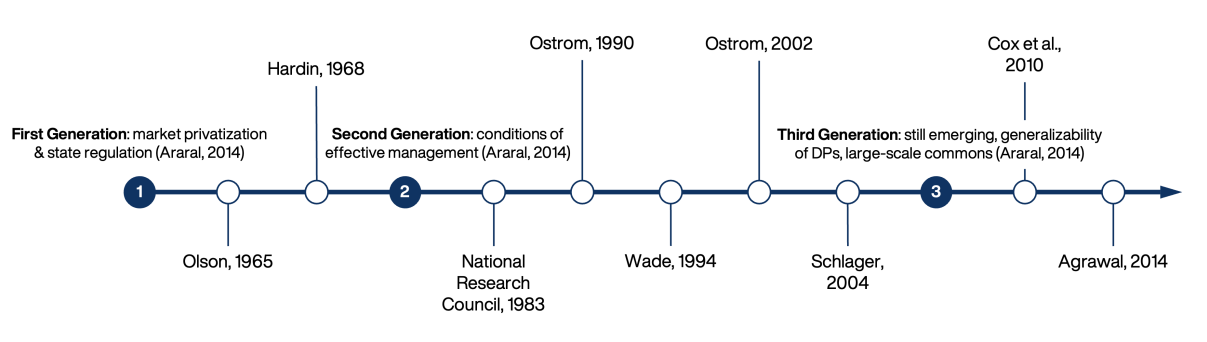


Figure 2 Timeline of Historical Development of the Common-pool Resource Theory, (authors elaboration based on (Araral, 2014))

3.3 Design Principles

Authors like Ostrom (1990) and Wade (1994) attempted to develop criteria to understand the effective management of CPRs by CBOs. Deriving a generalizable set of rules that describes the characteristics of self-governing communities proved to be a great challenge, which led Ostrom to develop a set of DPs, which give insights into the composition of applied rules in an organisation (Ostrom, 1990). Her DPs were the dominating and direction-giving example of principles, on which subsequent authors developed their interpretations and extensions (Cox et al., 2010; Schlager, 2004; Wade, 1994). While Ostrom did not claim that these principles are necessary for success, Schlager (2004) recognized their crucial role in sustaining resources and gaining generational compliance. Despite criticism and further development, these principles remain central in current CPR research (Cox et al., 2010; Lopez-Gunn, 2003; Steins & Edwards, 1999), providing a strong theoretical foundation for future studies (Agrawal, 2014). This chapter will delve into each of Ostrom's (1990, 2002) DPs in detail (cf. Table 2), as they form the theoretical framework of this study.

Ostrom's (1990) first DP (DP1) is *'clearly defined boundaries'*. This entails both geographic boundaries of the resource in question, as well as legal boundaries, referring to clearly defined rights of usage. Her second principle (DP2) refers to *'congruence'* and consists of two parts. Congruence shall exist between the benefits and costs assigned through the rules, with a focus on these rules being perceived as "fair and legitimate by the participants themselves" (Ostrom, 2002, pp. 1331–1332). The second part focuses on a sufficient adaption of these rules to local circumstances. That those affected by rules and regulations can participate in their modification is important for CBOs and summarized in the DP three (DP3) of *'collective-choice arrangements'*. Ostrom's (1990, 2002) fourth DP (DP4) is concerned with the *'monitoring'* of set rules. Without monitoring most set-up systems derail as the required information is not available to evaluate developments and rule breaches. Appropriators must know that their behaviour is noticed (Ostrom, 2002). This leads to the necessity of '*graduated sanctions'*, which is the DP five (DP5) and refers to the consequences which follow a rule breach (Ostrom, 2002).

These sanctions should follow a scale according to the severity of the breach and therefore encourage appropriators to follow defined rules, according to Ostrom (1990). In collective management approaches within communities, conflicts are expected. DP six (DP6) thus addresses *'conflict resolution mechanisms'*. This entails "rapid access to low-cost, local arenas to resolve conflict among appropriators or between appropriators and officials" (Ostrom, 1990, p. 90). Finally, CBOs are still embedded in a wider context, which is why *'minimal recognition of rights to organize'* (DP7) by external governmental institutions is necessary to enable their independent action. Ostrom's (1990) eighth DP (DP8) is *'nested enterprises'*, which addresses the management of resources throughout multiple layers and scales in the economy and applies to large-scale resource systems. These originally proposed DPs for robust self-organizing CPR organisations can be seen in Table 2 below.

Table 2 Original Design Principles by Ostrom, based on (Ostrom, 1990)

Design Principle by Ostrom (1990)			Explanation
DP1	**Clearly Defined Boundaries**		*"Individuals or households with rights to withdraw resource units from the common-pool resource and the boundaries of the common-pool resource itself are clearly defined."*
DP2	**Congruence**	Benefit-cost Balance	*The distribution of benefits from appropriation rules is roughly proportionate to the costs imposed by provision rules.*
		Related to local conditions	*The distribution of benefits from appropriation rules is roughly proportionate to the costs imposed by provision rules.*
DP3	**Collective-choice Arrangements**		*Appropriation roles restricting time, place, technology, and/or quantity of resource units are related to local conditions.*
DP4	**Monitoring**		*Monitors, who actively audit common-pool resource conditions and appropriator behaviour, are accountable to the appropriators and/or are the appropriators themselves.*
DP5	**Graduated Sanction**		*Monitors, who actively audit common-pool resource conditions and appropriator behaviour, are accountable to the appropriators and/or are the appropriators themselves.*
DP6	**Conflict-resolution mechanism**		*Appropriators and their officials have rapid access to low-cost, local arenas to resolve conflict among appropriators or between appropriators and officials.*
DP7	**Minimal recognition of rights to organize**		*The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.*
DP8	**Nested enterprises**		*The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.*

4 Literature Review

To better understand the academic context and debate in which this study is embedded, this chapter provides an overview of the present literature in the field. Studies addressing the water sector in Costa Rica and the current focus points within this strand of literature are presented in Chapter 4.1. In Chapter 4.2, an overview of studies on CBWM on a global scale is given. Lastly, in Chapter 4.3 literature applying Ostrom's (1990) DPs is brought forward, showcasing existing gaps and critique.

4.1 Water Studies in Costa Rica

While the governance of water has been widely covered in the literature (Lopez-Gunn, 2003; Morataya-Montenegro & Bautista-Solís, 2020; Pahl-Wostl, 2015), a more targeted analysis of water management in Costa Rica is currently not present. Nevertheless, a few authors have dealt with the topic, mainly applying qualitative approaches, and focussing on the topics of issues and sustainability of governance, as well as public perception and participation in governance.

Kuzdas & Wiek (2014), Kuzdas et al. (2014) and Cuadrado-Quesada et al. (2018) focus on the governance of water, applying qualitative approaches and highlighting shortcomings of current governance forms. Kuzdas & Wiek (2014) and Kuzdas et al. (2014) focus on the dry tropics of north-western Costa Rica. They found an issue of trust between actors' communication and collaboration and identified a need for improved institutional design (Kuzdas et al., 2014a). Cuadrado-Quesada et al. (2018) looked more specifically at the governance of the groundwater sector. With an empirical study consisting of 40 interviews with private and public stakeholders, they identified critical challenges and opportunities for groundwater law development. One of the findings they highlighted is that, unlike surface water, groundwater was not recognized as a public good for long.

Furthermore, Kuzdas et al. (2014b) address the topic of sustainability among governance processes, by conducting a sustainability appraisal. Using a criteria-based and participatory approach, they assessed the operation of governance systems with the conclusion that missing coordination regarding the use, management and protection of groundwater resources leads to service issues. Further, they critique the lack of leadership in establishing collective goals. As a recommendation they mention investment into collective organisations could benefit the sector, hinting at the importance of CBOs.

Another focus point of the existing literature lies on public perception and participation (Cuadrado-Quesada et al., 2018; Madrigal-Solís et al., 2020). Madrigal-Solís (2020) conducted a quantitative-descriptive study with 800 citizens of Costa Rica to capture the public's

perception of Costa Rica's water sector. Their main findings include an overvaluation of water availability and the presence of an abundance mindset. 22 percent of the participants identified supply problems that they attribute to administration and management issues, while only a minority considered taking better care of resources as a possible solution (Madrigal-Solís et al., 2020). This indicates a lack of awareness about sustainability relations among the wider public. Cuadrado-Quesada et al. (2018, p. 484) also found a "lack of recognition of the importance of having public participation in decision-making regarding groundwater permits/concessions, planning or other management tools" for groundwater sources. However, they also highlighted the impact ASADAS can have in protecting groundwater resources, as they have the mandate and motivation to do so.

4.2 Community-based Water Management

The literature on natural resource management aims to address how to effectively, justly, and sustainably manage natural resources, including CPRs (Agrawal, 2014; Hess, 2006; Ostrom, 1990). It is widely recognized that understanding existing water management systems and developing new ones is crucial to meet challenges and user needs (Kuzdas & Wiek, 2014). While centralized control or privatization has historically dominated water management (Armitage, 2005; Steins & Edwards, 1999), community-based management has gained attention for its successful approaches (Madrigal-Ballestero et al., 2013; Steins & Edwards, 1999). This study focuses on community-based CA for water management (Abdullaev et al., 2010; Armitage, 2005; Blaikie, 2006; Cox et al., 2016; Da Costa Silva, 2011; Madrigal et al., 2011; Muchara et al., 2014; Rodriguez de San Miguel et al., 2015; Theesfeld, 2004). CBWM has been studied in a global context, covering South America, Asia, Africa, but less so Europe, North America and Central America. Especially, within the context of Costa Rica, the present literature coverage is thin (cf. Table 3). Most studies on community-based management have emerged in the past 10-15 years, indicating decreased academic attention in this field. Within the field of CBWM, a few focus areas have crystalized in the previous literature, consisting of adaptive capacities, the performance of CBWMO, the applicability of CBWM, as well as public contribution and participation (Armitage, 2005; Muchara et al., 2014; Theesfeld, 2004).

Addressing adaptive capacities of CBWMO, Armitage (2005) identifies a gap in the inclusion of exogenous and endogenous variables which influence the ability of CA in CBNRM. Using examples from Canada and Indonesia, cases are depicted including their socio-institutional environment (Armitage, 2005). The commonly recognized DPs are challenged by Armitage (2005) as being static and a set of variables (e.g. "learning to live with uncertainty") are applied to analyse how adaptive capacity and CBNRM are intertwined, emphasizing a systems-perspective. Likewise situated in Latin America, Murtinho, Eakin, López-Carr and Hayes (2013) conducted a mixed-methods analysis of 111 rural Andean communities in Colombia. While they state that communities, despite their motivation, often require external funding for water management, they find that depending on whether the community requested the external

funding or not the impact on the community's adaption capability varies. Without a funding request, they observe a crowding-out effect of community engagement.

Furthermore, the applicability of CBWM practices is a question which has been addressed in previous studies. Theesfeld (2004) analysed the applicability of measures for CA to enable self-governance in water irrigation systems in Bulgaria, highlighting the negative influence of asymmetric power within a community on CA. Within Central Asia, Abdullaev et al. (2010) looked at the emergence of water user groups, which replaced a less effective and top-down organisation. They conclude on the future potential of these water user groups for effective water management through their intrinsic features of being more inclusive, user-driven and based on local knowledge. Blaikie (2006) and Rodriguez de San Miguel et al. (2015) both highlight the influence of the political and institutional environment on the applicability of CBWM approaches. From this perspective, both structural obstacles and the neglect of individual communities' local complexity and the interconnection between communities and CBWM programs were found to hinder the participatory approaches of CBWM. Furthermore, Da Costa Silva (2011) emphasizes the need to incorporate justice dimensions into CBWM, addressing questions of decision-making and beneficiaries.

Another topic has been public contribution and participation in CBWM organisations. Aiming to identify determinants for participation in CA (Muchara et al., 2014), and to evaluate the relation between participation and performance outcomes of CBWM organisations (Prokopy, 2005), quantitative approaches were previously applied. These two studies demonstrate the importance of community participation. More inclusion led to more positive project outcomes, for example in the form of user satisfaction and equal access (Prokopy, 2005). Muchara et al. (2014) additionally direct to the need for fitting institutional policies. This topic is particularly important in the governance form of CBWM, as it is intrinsically formed and maintained by community efforts. Hence, furthering the understanding of the role of communities in the performance of CBWM organisations remains a topic for future studies.

At last, another string of literature focuses on capturing the performance of CBWM organisations. Madrigal-Ballestero (2013) and Madrigal et al. (2011) both focus on rural Costa Rica and capture determinants of performance by identifying case mechanisms (like local accountability, working rules, information transparency, gender equality and capacity of local leaders) which are linked to high performance, and by capturing the public's perception of performance. In line with previous findings, Madrigal et al. (2011) also highlight the need to recognize local complexity and defer from blueprint approaches. Madrigal-Ballestero et al. (2013) analyse characteristics of infrastructure, governance structures, and attributes of locals and how they influence performance perception. In line with the study of Madrigal et al. (2011), they highlight the importance of downward accountability, a demand-driven approach, and human capital. Additionally, they identified some shortcomings of CBWM organisations in their "chlorination practices, accountability mechanisms, and the training of local committee members" (Madrigal-Ballestero et al., 2013, p. 54).

Table 3 Overview Literature on Community-Based Natural Resource Management

Author	Title	Year	Method	Region	Focus/Findings
Armitage	Adaptive Capacity and Community-Based Natural Resource Management	2005	Comparative case study	Canada & Indonesia	Adaptive Capacity
Madrigal-Ballestero et al.	Public Perceptions of the Performance of community-based drinking water organizations in Costa Rica	2013	Quantitative	Costa Rica, rural	Public Perception of Performance
Madrigal & Alpízar	Determinants of Performance of Community-Based Drinking Water Organizations	2011	Case study	Costa Rica, urban	Determinants of Performance
Da Costa Silva	Assessing environmental justice of community-based watershed management: a tool to build adaptive capacity in Latin America?	2011	Comparative case study	Latin America	Justice
Murtinho, Eakin, López-Carr and Hayes	Does External Funding Help Adaptation? Evidence from Community-Based Water Management in the Colombian Andes	2013	Mixed-method	Colombia	Adaptive capacity and external funding
Rodriguez de San Miguel et al.	Community Water Management in Latin America and the Caribbean: Challenges for Mexico	2015	Comparative case study	Latin America & Caribbean	Structural obstacles
Prokopy	The relationship between participation and project outcomes: Evidence from rural water supply projects in India	2005	Quantitative	India	Household contribution and involvement
Blaikie	Is Small Really Beautiful? Community-based Natural Resource Management in Malawi and Botswana	2006	Case study	Malawi & Botswana	Political conditions and nature of state - Shortcomings of blueprint approaches
Muchara et al.	Collective action and participation in irrigation water management: A case study of Mooi River Irrigation Scheme in KwaZulu-Natal Province, South Africa	2014	Case study, Quantitative	South Africa	Determinants for local participation; the importance of fitting institutional policies
Abdullaev et al.	Water User Groups in Central Asia: Emerging Form of Collective Action in Irrigation Water Management	2010	Case study	Central Asia	Emergence of water user groups
Theesfeld	Constraints on Collective Action in a Transitional Economy: The Case of Bulgaria's Irrigation Sector	2004	Comparative case study	Bulgaria	Applicability of measures for collective action

4.3 Design Principles in the Literature

While current studies give a foundational understanding of present challenges and drivers of CBWM around the world (see Chapter 4.2), and also in parts of rural Costa Rica (Madrigal et al., 2011; Madrigal-Ballestero et al., 2013), a need remains to better understand what factors enable communal management forms for natural resources to be effective (Kuzdas et al., 2015). DPs for CBOs, offer a tool to facilitate such understanding. Throughout the last decades, research has been conducted on identifying, analysing and testing DPs (Folke et al., 2005; Ostrom, 1990, 2002). Ostrom's work dominates the literature (Araral, 2014; Cox et al., 2010), although it has been subject to extensive debate and evaluation (Afroz et al., 2016; Cox et al., 2010; Lopez-Gunn, 2003; Steins & Edwards, 1999). The literature can be split between those applying the DPs to a case of CPRs, and those analysing various aspects of the DPs themselves. On overview of this literature can be seen in Table 4 below.

In the literature that applies Ostrom's DPs, some patterns emerge. The principles appear suitable primarily for case studies. Lopez-Gunn (2003) applies the principles in a comparative case study of three aquifers in Spain, emphasizing the role of trust and institutional design in sustainable management. Afroz, Cramb and Grunbuhel (2016) broaden the perception of the DPs based on a case study in Bangladesh, highlighting the influence of economic incentives, social structures, and norms on participation. Sarker and Itoh (2001) as well as Quinn et al. (2007) use the DPs to understand how CBOs achieve high performance and validate their presence. Quinn et al. (2007) stress the importance of boundaries, conflict resolution, and flexibility for effective CBO operation.

Several critiques can be summarized, focusing on the *incompleteness* of the principles, the questioning of *validity* and *normativity*, and the *scalability* of the concept (Cox et al., 2010; Steins & Edwards, 1999). Regarding their *incompleteness*, Cox et al. (2010) analysed 91 studies applying the DPs and confirmed their incompleteness, recommending additional criteria for sustainable management to address shortcomings. They also highlight the absence of external factors in Ostrom's principles (Cox et al., 2010). This lack was already critiqued by Steins & Edwards (1999), as they also found a lack of including the surrounding environment and context within which an organisation is embedded.

In terms of the *validity* of the DPs, Steins & Edwards (1999) raise some questions. Although they found all DPs present in their case study, they observed that CA did not sustain long-term, challenging the ability of the principles to account for successful CA. Likewise, Cox et al. (2010) tested the empirical validity in their study and found sufficient support strengthening the usage of DPs in future studies.

Normativity is also questioned, as defining "success" from a single perspective may not reflect the perspectives of all stakeholders and individuals (Steins & Edwards, 1999, p. 534).

At last, the question of the *scalability* of the DPs is addressed and criticised (Agrawal, 2014; Cox et al., 2010; Ostrom, 2002; Schlager, 2004). Cox et al. (2010) and Quinn et al. (2007) argue

that applying the principles as a blueprint to different scales may lead to misapplication. This critique connects to theoretical puzzles regarding the influence of organisational size and the heterogeneity of appropriator groups on CA (Ostrom, 2002; Schlager, 2004). So far, no significant evidence has been found to indicate the influence of organisation size or user heterogeneity on abilities to facilitate CA. (Schlager, 2004). Despite this ongoing debate and critique, the DPs remain empirically valid for analysing CPRM organisations (Agrawal, 2014; Cox et al., 2010). In response to these critiques, an iterated and extended application of the principles was conducted in this study.

Table 4 Overview Design Principles in the Literature

Author	Title	Year	Method	Region	Focus/Findings
Cox et al.	A Review of Design Principles for Community-based Natural Resource Management	2010	Quantitative	global	Validity of design principles
Steins & Edwards	Collective Action in Common-Pool Resource Management: The Contribution of a Social Constructivist Perspective to Existing Theory	1999	Case study	Ireland	Design principles
Lopez-Gunn	The Role of Collective Action in Water Governance: A Comparative Study of Groundwater User Associations in La Mancha Aquifers in Spain	2003	Comparative case Study	Spain	Social capital (trust)
Afroz, Cramb and Grunbuhel	Collective Management of Water Resources in Coastal Bangladesh: Formal and Substantive Approaches	2016	Case study	Bangladesh	Design principles and the social context
Sarker & Itoh	Design principles in long-enduring institutions of Japanese irrigation common-pool resources	2001	Case study	Japan	Application of DPs
Quinn et al.	Design principles and common pool resource management: An institutional approach to evaluating community management in semi-arid Tanzania	2007	Case study	Tanzania	Application of DPs – highlighting the need for flexibility

4.4 Theoretical Framework – Extending the Design Principles

In response to critiques and to advance the theory, the study addresses five gaps and develops extensions to build an adequate theoretical framework and drive the theory forward. Firstly,

Central America is underrepresented in the literature despite experiencing climate change impacts and being at the forefront of anticipated impacts and catastrophes, for example regarding drought (Water Center for the Humid Tropics of Latin America and the Caribbean, 2008).

Secondly, by focusing on a rural part of Costa Rica's driest region, Hojancha in Guanacaste (World Bank, 2021), the study contributes to contextualized case studies. While furthering this debate through additional empirical evidence is important, maintaining theoretical and methodological consistency allows for continuity in the field (Ostrom, 2002).

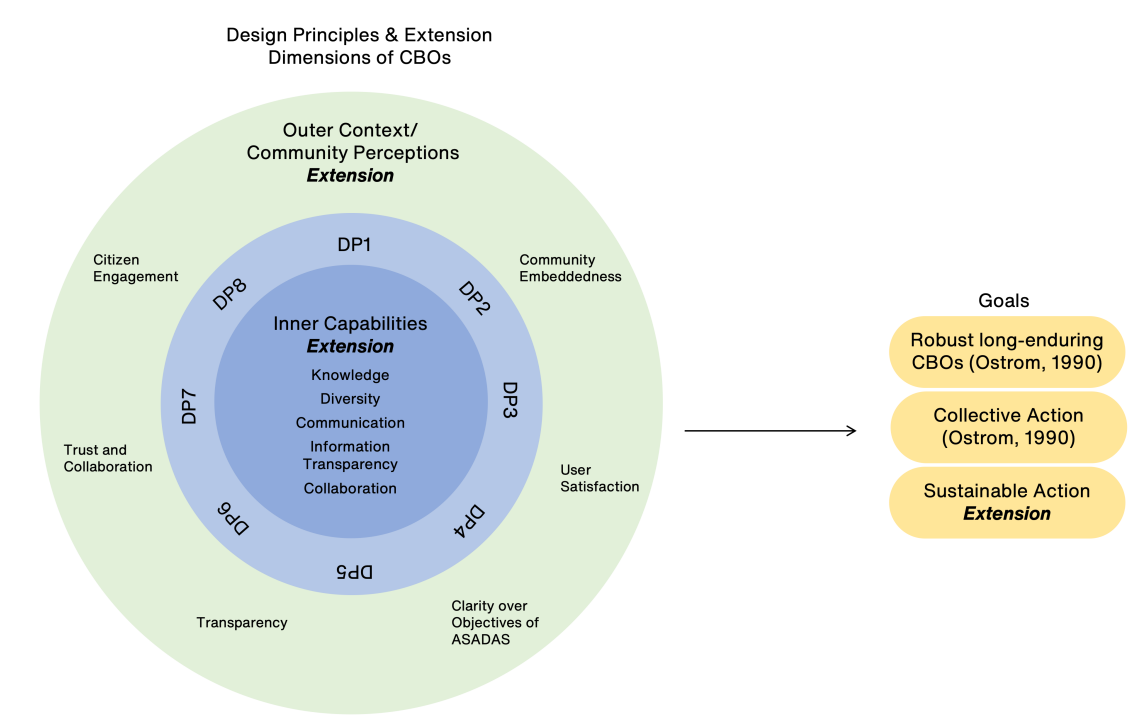


Figure 3 Theoretical Framework, (authors elaboration based on (Abdullaev et al., 2010; Braadbaart, 2007; Gil-Garcia, Gasco-Hernandez & Pardo, 2020; Haroon & Malik, 2018; Hasenfeld, 2010; Lopez-Gunn, 2003; Madrigal, Alpízar & Schlüter, 2011; Madrigal-Ballestero, Alpízar & Schlüter, 2013; Malik et al., 2020; Muchara et al., 2014; Ostrom, 1990, 2002; Prokopy, 2005; Quinn et al., 2007; Smith & Sharicz, 2011; Theesfeld, 2004; van Reijsen et al., 2015; Wagner & Fernandez-Gimenez, 2008))

Thirdly, the framework is extended to address sustainable action of CBWM, as CA itself is not the goal of the formation of CBOs, but sustainable and effective management of natural resources. While ultimately, "success" is a subjective definition, the ecological impacts of a water management approach must be an integral part of such a definition. As the aspect of sustainability is not covered by any of the previously developed sets of DPs an extension is developed for this study (Ostrom, 2022; Schlager, 2004). This extension includes the understanding of sustainability, the presence of the topic within the CBO, as well as concrete

initiatives. Their choice is based on agreed-upon sustainability criteria from previous literature (Malik et al., 2020; Smith & Sharicz, 2011).

Fourth, responding to the critique of Lopez et al. (2003), who point out the incompleteness of the original DPs and the importance of social capital in CBOs performance, the framework is further developed (cf. Figure 3). Dimensions which are commonly connected to social capital and widely recognized in the literature are: knowledge (van Reijsen et al., 2015), diversity (Hasenfeld, 2010), communication (Gil-Garcia et al., 2020; Haroon & Malik, 2018), information transparency (Braadbaart, 2007), and collaboration (Gil-Garcia et al., 2020; Wagner & Fernandez-Gimenez, 2008). Hence, the theoretical framework is extended by these dimensions to capture internally present characteristics of the ASADAS.

Fifth, to extend the principles towards the surrounding environment and to capture the context and social capital of trust in a community, the perspective and perceptions of citizens were captured, to offer a more holistic understanding (Lopez-Gunn, 2003). This is particularly crucial, as CBOs performance ultimately must be assessed by the communities themselves. Through the literature review, six dimensions have been identified, which constitute this extension towards the community. These are: clarity over objectives (Abdullaev et al., 2010), citizen engagement possibilities (Quinn et al., 2007), trust and collaboration (Muchara et al., 2014; Prokopy, 2005), transparency (Madrigal et al., 2011; Madrigal-Ballestero et al., 2013), user satisfaction (Abdullaev et al., 2010; Madrigal-Ballestero et al., 2013) and community embeddedness (Theesfeld, 2004). By adding these extensions, the study aims to provide a more effective strategy to answer research questions. Refer to Table 5 for a summary of the extensions.

Table 5 Original Design Principles and Extensions, (authors elaboration based on (Ostrom (1990))

Design Principle by Ostrom (1990)			Explanation
DP1	**Clearly Defined Boundaries**		*"Individuals or households with rights to withdraw resource units from the common-pool resource and the boundaries of the common-pool resource itself are clearly defined."*
DP2	**Congruence**	Benefit-cost Balance	*The distribution of benefits from appropriation rules is roughly proportionate to the costs imposed by provision rules.*
		Related to local conditions	*The distribution of benefits from appropriation rules is roughly proportionate to the costs imposed by provision rules.*
DP3	**Collective-choice Arrangements**		*Appropriation roles restricting time, place, technology, and/or quantity of resource units are related to local conditions.*
DP4	**Monitoring**		*Monitors, who actively audit common-pool resource conditions and appropriator behaviour, are accountable to the appropriators and/or are the appropriators themselves.*

DP5	**Graduated Sanction**	*Monitors, who actively audit common-pool resource conditions and appropriator behaviour, are accountable to the appropriators and/or are the appropriators themselves.*
DP6	**Conflict-resolution mechanism**	*Appropriators and their officials have rapid access to low-cost, local arenas to resolve conflict among appropriators or between appropriators and officials.*
DP7	**Minimal recognition of rights to organize**	*The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.*
DP8	**Nested enterprises**	*The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.*
Extension of this study		
E1	**Sustainability**	*Understanding of concept; the presence of topic; perception of contribution towards sustainability; definition of concrete initiatives*
E2	**Inner capabilities**	*Knowledge development and sharing, diversity of gender and professional backgrounds; communication (internal and external);information transparency; collaboration between ASADAS and within the community*
E3	**Community**	*Perception of ASADAS' performance, level of trust, satisfaction with communication and engagement*

5 Methods

A case-study approach within a qualitative research design is chosen to analyse how CBOs influence SCA. The research is based on fieldwork on the ASADAS in Hojancha, which was conducted from January to April 2023. The choice of research design is motivated in Chapter 5.1, followed by an elaboration on the selected case study (5.2), data sampling (5.3), collecting (5.4) and analysis strategy. (5.5). In Chapter 5.6 the data triangulation approach is explained and Chapter 5.7 concludes with ethical remarks and limits of the methodological approach.

5.1 Qualitative Research Design

Qualitative research covers various research approaches, however, the common aim of these is to develop and interpret an understanding of "the social world of research participants by learning about their social and material circumstances, their experiences, perspectives and histories" (Ritchie & Lewis, 2003, p. 3). An important school of thought to understand "the nature and form of (a) phenomenon" in qualitative research is that of 'interpretivism', which uses methods enabling a holistic analysis of study objects in a contextualized manner (Ritchie & Lewis, 2003, p. 82, 2003, p. 7). The reasons for choosing a qualitative interpretivist approach are twofold:

First, a positivist approach simply does not fit. As in positivism reliability of findings through repeated measurement is important, e.g. in natural science, this strategy cannot encompass the level of individuality of interpretivist studies (Sandberg, 2005). In interpretivism, the world is perceived as an experienced world and its aim is to develop an understanding of this lived experience and the interactions between study objects (normally individuals or groups) and its context (e.g. society or community), instead of finding reproducible truths (Sandberg, 2005; Whitley, 1984). This advocates for a qualitative interpretivist approach, as it enables the inclusion of the context of the CBOs in Hojancha, interactions between the CBOs and the community and multiple perspectives, hence it facilitates a more holistic analysis (Da Costa Silva, 2011; Kaplan & Maxwell, 2005; Whitley, 1984).

Second, with a qualitative interpretivist approach, it is possible to collect highly detailed data and conduct in-depth analysis open to "emergent concepts and ideas" (Ritchie & Lewis, 2003, p. 5). An exploratory research design allows for a structured procedure, as well as enables a certain degree of flexibility in the research design (Sandberg, 2005). This methodology therefore enables rich and detailed data, while individuality of responses is still allowed (Gill et al., 2008). To be able to understand the influencing conditions of the ASADAS on SCA

explorative data collection is essential, as previous research or databanks do not exist in such detail and for the concrete location of the study.

5.2 Case Study Selection and Description

In this research, a case study approach is selected to enable a holistic analysis and include multiple perspectives, positioned in its research context (Berg & Lune, 2017). A case study can be described as an "intensive, detailed description and analysis of a particular individual, group or event", often utilizing interviews or observations for data collection (Taylor et al., 2006, p. 26). This approach is suitable when addressing a topic that is underexplored or sparsely covered, focusing on exploring interactions and describing rather than seeking generalizable truths (Taylor et al., 2006; Whitley, 1984). The flexibility of the case study approach to capture individual details and context dependency is considered one of its strengths (Berg & Lune, 2017). In this research, multiple CBOs (ASADAS) in Hojancha are studied to identify common principles that facilitate SCA in local water management, combining them into a single case study (Ritchie & Lewis, 2003). The study is static and analyses data collected in March 2023.

Figure 4 Map of Costa Rica and Hojancha, (authors elaboration)

CBOs (ASADAS) for rural water management are common in Costa Rica (Madrigal-Solís et al., 2020). However, not all CBOs for water management achieve the same results regarding sufficient quantity and quality of drinking water (Madrigal et al., 2011). This study focuses on ASADAS of a canton which achieved a high reputation for sustainable development in the last decades – Hojancha. The canton of Hojancha is situated in Guanacaste (cf. Figure 4), one of the driest areas in Costa Rica, which must deal with water scarcity in the dry season (from

December to May) (Morataya-Montenegro & Bautista-Solís, 2020). As explained in Chapter 2.3, Hojancha has undergone a remarkable transformation for sustainability (Tafoya et al., 2020). By resurrecting riverbeds and ecosystems, Hojancha has effectively found solutions to overcome environmental crises since the 1970s (United Nations Development Programme, 2012), making the canton an interesting case for research regarding community-based efforts of resource protection. Therefore, the ASADAS of Hojancha are attractive case study objects, as the community appears to have developed an approach or composition which enables them to deliver satisfactory business service while protecting the environment. Out of the twelve ASADAS in Hojancha, eight were included as case study objects for this research on CBWM organisations.

5.3 Data Sampling

In a qualitative research design, non-probability samples are used to "reflect particular features of, or groups within a sampled population" (Ritchie & Lewis, 2003, p. 78). In contrast to quantitative research, the sample does not desire to be representative, but instead, population characteristics are used as criteria (Berg & Lune, 2017). In this study, a purposive sampling approach was employed to choose ASADAS from Hojancha that represent successful cases of service provision in Guanacaste. An intensity sampling strategy was used to focus on cases that "strongly represent the phenomena of interest", which is effective SCA (Ritchie & Lewis, 2003, p. 79). To ensure diversity, ASADAS of different sizes and individuals with varying positions, backgrounds, educations, and genders were selected for interviews (Berg & Lune, 2017).

Firstly, desk research was conducted to get an overview of the presence of ASADAS in Hojancha. Twelve ASADAS were identified from a publication by the AyA (AyA, 2020), which functions as the sample frame for this study (Ritchie & Lewis, 2003). Through the practice of the fieldwork, contacts were established with the community, which enabled the identification of a gatekeeper to contacts from the organisation Liga Communal del Agua (Liga), that supports the ASADAS of Hojancha, Nicoya and Nandayure. Through this person, contact could be established with 16 individuals, of which 13 responded, and finally, 10 were available for interviews. A total of eight ASADAS were analysed, with one representative from each ASADA interviewed. In one case, two individuals were interviewed based on a referral. Interviews with the Liga and the Municipalidad (Muni) were altered to capture their perspectives on ASADAS and their cooperation with the organisations. It must be disclaimed that the interviewees from the municipality and the Liga, both also were members of ASADAS.

For the community survey, a gatekeeper sampling strategy was employed, to cover a largely diverse range of citizens of Hojancha. Through previously established contacts to the ASADAS, their established digital communication channels were used to share the survey and reach the sample. Additionally, the Liga was used as a gatekeeper to additional chatgroups.

5.4 Data Collection

Data collection in qualitative research aims to gain a deeper understanding of the desired phenomena of study (Ritchie & Lewis, 2003). This study utilized a two-stream approach to data collection during a 12-week fieldwork period in Costa Rica. Semi-structured interviews and a descriptive survey were chosen as the methods to address the research questions. Semi-structured interviews capture in-depth perspectives and explore individual views of CBO members (Gill et al., 2008). This approach enables data collection to answer RQ1 and RQ2. However, RQ3 requires a different kind of data. A descriptive survey is used to capture the knowledge, attitude and perception of the surrounding community of the CBOs in question (Bowling & Ebrahim, 2005). This approach is particularly suitable to cover larger samples, hence it complements the interview approach sufficiently (Bowling & Ebrahim, 2005). The interview approach to data collection will be explained in Chapter 5.4.1. Followed by an explanation of the survey strategy in Chapter 5.4.2.

5.4.1 Interviews

Semi-structured interviews were conducted following the methodological approach of Madrigal-Ballestero et al. (2013). These interviews provided in-depth insights into the organisations and allowed for flexibility while maintaining comparability. In qualitative research, the use of structures is crucial, as generated data can otherwise quickly drift off-topic which would lead to a loss of focus in the research (Ritchie & Lewis, 2003). Therefore, a topic guide will be used to "ensure consistency in the data collection process, while allowing some flexibility" (Richie et al, 2003, p.149). The, in Chapter 4.4 developed and extended, theoretical framework functioned as the guideline for the interview guide, which can be found in Table B2 in Appendix B. All interviews were conducted in-person in Hojancha, in March 2023. In total 10 interviews were conducted, with 8 different ASADAS to collect in-depth insights and explore different views, while asking about the same topics (Gill et al., 2008). Additionally, two context interviews were done with supporting organisations of the community – the Municipality and a Liga. This enabled a more accurate positioning of the ASADAS in Hojancha, as it gave insights into the context of the CBOs.

5.4.2 Descriptive Survey

A survey approach was used to capture the perceptions of the community, complementing the interview approach, through a larger sample coverage, focussing on the unit of an individual (Bowling & Ebrahim, 2005). Surveys enable a collection of the same, comparable, data from each individual and in this case are used as a snapshot of the population's perception of the ASADAS. Through this approach critical data could be collected from a wider population, which gave indications about the community perceptions of ASADAS. This procedure was fundamental to answer RQ3. The survey included 21 questions which were, besides

demographic information, focused on six topic fields, which were derived from findings of previous studies, as well as the captured critique of these, explored in Chapter 4.2 (cf. Appendix B). To accurately measure the perceptions of the citizens in Hojancha, an online survey was developed and shared via the ASADAS online communication channels, as well as through the Liga.

A problem with this data collection method was the low number of participants. Based on the 2011 Census, Hojancha has a population of around 7,200 (INEC, 2011). With a participant size of 53 this does not ensure representability, as the minimum of 10 percent is not surpassed (Krejcie & Morgan, 1970). Nevertheless, used as a descriptive study the survey estimates still give an indication and will therefore be discussed in Chapter 6.4. Out of these participants, 52.8 percent indicated to be male, and 47.2 percent female, giving fairly balanced participation. A variety of ages participated, with the largest shares, each around 20 percent, for the age groups: 30-40 years, 40-50 years and 60-70 years, indicating low participation of the youth. 45.2 percent indicated to have been involved with voluntary work either currently or in the past, which shows a quite high level of engagement in the community (Salamon & Sokolowski, 2001). In terms of backgrounds, the participants largest share, with 15.2 percent, is involved in agriculture, but a high variety of professional backgrounds participated. Additionally, 37.7 percent declared to hold a bachelor's degree, showing a relatively high educational background for this survey sample. Furthermore, significant difference were found regarding the participation of different districts of Hojancha. This might disclose a bias of the chosen digital medium, as well as indicate different levels of community closeness.

5.5 Data Analysis

Two analysis approaches are chosen respectively for the generated primary data. The interviews were recorded, transcribed in Spanish, and afterwards translated into English, to ease the analysis process. For this, the support of a translator tool was used to ensure accurate translations, with reducing the loss of meaning to a minimum. To analyse the transcripts the qualitative software NVivo was applied to enable a structured categorization and coding of the data. Codes were applied to categorise the statements into fitting subgroups to answer the research question. In the first phase, more detailed-level codes were applied to the text. In a second step, these codes were grouped and matched to the final category codes which are based on the theoretical framework and can be seen in Table 6 below, as well as in an extended version in Table B3 in Appendix B. In the next phase, these codes were then analysed for "sufficiency" in representing the presence or absence of the respective DP, by Ostrom (1990). To evaluate sufficiency, comparisons to previous studies (Lopez-Gunn, 2003) were conducted to lean on previous experiences within the field. In the comparison between the eight ASADAS, similarities and differences were then identified, allowing more precise assumptions and statements to be made about how ASADAS in the canton of Hojancha enable SCA in water management. In the context of the extension of this study, the ASADAS were analysed

regarding the presence and degree of sustainability criteria and inner capabilities and concrete examples were chosen to showcase, the ASADAS.

Table 6 High-level Codes for Data Analysis, (authors elaboration based on (Ostrom, 1990))

Codes	Clearly Defined Boundaries (DP1)
	Congruence (DP2)
	Collective Choice Arrangements (DP3)
	Monitoring (DP4)
	Graduated Sanctions (DP5)
	Conflict Resolution Mechanisms (DP6)
	Minimal Recognition of Rights to Organize (DP7)
	Nested Enterprises (DP8)
	Sustainability (E1)
	Inner Capabilities (E2)

The second analysis focused on the conducted community survey. The indicated levels of satisfaction of the users regarding the topics of interest can be deducted from the survey estimates, while it must be regarded that these are always subject to error (Bowling & Ebrahim, 2005). The purpose of this survey was to be descriptive, as the collection of the citizens' perception of the ASADAS in Hojancha at the given moment is of interest. Therefore, its analysis also remains on a descriptive level, obtaining indications of the citizens' satisfaction with the operation of the ASADAS.

5.6 Triangulation

In case study approaches, the triangulation of generated data is crucial (Flick, 2017). To ensure this, data was generated from multiple sources: primary data was collected through interviews with the organisations, which then was validated through additional background interviews with individuals outside of the organisations. These background interviews' function was to generate a more holistic understanding of the context and history of Hojancha and the ASADAS and to embed the generated data into a wider context. Furthermore, the citizen survey allowed to gain an additional perspective on the statements made during interviews. To triangulate further, secondary data and previous academic papers were used.

5.7 Ethics and Limitations

At last, it is important to reflect on the ethical implications and the limitations of this research. The study is based on fieldwork in rural Costa Rica, Hojancha, in collaboration with the Universidad Nacional, which facilitated connections with the local community. However, working in a foreign country required time to adapt and understand the context. The research and interviews were conducted in Spanish, which is not the researcher's native language, posing a limitation. Language is a crucial component in qualitative research, which is why also the translations of the data can be seen as an issue in the data collection (Flick, 2014). To address this and assure accuracy and adequacy to the highest possible degree, translations were assured by the support of a translator tool. Nevertheless, minor interpretation errors might still be present.

The researcher's worldview and background inevitably influenced the observed scenario due to the interpretivist approach taken (Ritchie & Lewis, 2003). The researcher's position as a foreigner and outsider may have introduced a social desirability bias (Bergen & Labonté, 2020), although efforts were made to create a private and trusting environment during interviews. Personal biases were minimized, but they remain a limitation of this qualitative research approach (Yanos & Hopper, 2008).

Another shortcoming is the sampling strategy within this case study approach as not all ASADAS of the canton of Hojancha responded to the research request. Furthermore, the channel of the contacts gatekeeper of the Liga might also have influenced who responds, or feels like they should respond to the research request. In qualitative research, however, it must be expected that never all perspectives can be included, as this would render the qualitative approach unfeasible. Additionally, a substantial shortcoming of the survey is the non-representative participation number of 53 participants. The digital distribution of the survey may have systematically excluded certain citizen groups, although efforts were made to engage water appropriators using a widely used digital communication platform.

Furthermore, when collecting individual perceptions, the safety and privacy of the interviewees are crucial aspects to ensure in this form of research. Confidentiality agreements were explained and signed (cf. Appendix B), and personal preferences for anonymity and privacy were respected to uphold informed consent principles (Ritchie & Lewis, 2003). In conducting qualitative research in a global context, it is crucial to share findings and make them accessible to all stakeholders to avoid unilateral benefits (Flick, 2014). For this purpose, the findings and analysis were presented at an event in Hojancha at the end of April 2023. All involved individuals, as well as the wider community, were invited to this sharing event and discussed the findings of this study. The results will additionally be summarized in a policy brief to provide to the local stakeholders.

6 Results and Discussion

This chapter presents and discusses the empirical findings of this study to immediately embed the findings in the context of the theoretical framework and previous findings. The data acquired through interviews and obtained from the community survey will be discussed to answer the three imposed research questions. The theoretical framework of the DPs by Ostrom (1990), as well as its extensions and additional literature from the field of CBOs, are used to embed the findings in a wider context and evaluate the fulfilment of these principles. In Chapter 6.1, the main research question is addressed by focussing on the core DPs. Followed by the discussion of the role of sustainability in the ASADAS in Chapter 6.2. In the third part (6.3) the role of ASADAS inner capabilities is addressed and last (6.4) the enabling functions of the surrounding community are assessed using survey data.

6.1 The Design Principles

To answer the first research question (RQ1): ”How do community-based organisations (ASADAS) in Hojancha, Costa Rica, facilitate collective and sustainable action in local water management?”, the eight original DPs for robust CBOs, proposed by Ostrom (1990), will be discussed and their fulfilment assessed. All results are displayed in Table 7 below.

6.1.1 Clearly Defined Boundaries (DP1)

The *first design principle* (DP1) refers to the *geographical boundaries* of the operation areas of an ASADA, as well as defined *user boundaries or water rights*. Legally defined and confirmed through the interviews, the AyA transfers power to the ASADAS by giving them a delegation regulation, which is always connected to a certain territory (Liga; Madrigal et al., 2011).

Yes, there are areas where they are defined. The ASADAS work mainly in villages, rural villages that are far from the centre, for example, in the urban centre of Hojancha, the one that administers the aqueduct is the AyA. (ASADA7)

While some ASADAS still share aquifers or collaborate on administrative tasks, the geographical boundary can be interpreted as fulfilled (ASADA2, 5).

Water rights, also referred to as user boundaries, have been found to be established in all interviews (ASADA1-8). In 1942, water was declared a public good, clearly prohibiting privatization and defining water rights (Global Water Partnership, 2014).

We have regulations from the AyA, the Institute that protects water from aqueducts and sewers, has an exclusive regulation for the ASADAS, so we stick to the regulations, for example, the conformation of the ASADA, the functions of the ASADA, what the ASADA should do, what an ASADA should not do. (ASADA8)

The boundaries for usage are agreed upon by permits, given by the ASADAS to the users, to distinguish between private households and commercial use. Furthermore, the mandatory meters in every house measure the quantity of water used, but the quantity itself is solemnly regulated by a price tariff (ASADA1, 6). An understanding exists that citizens perceive these rights as beneficial and positive, hence the principle can be regarded as fulfilled (ASADA1-6). This is in line with Quinn et al.'s (2007) findings, that clear boundaries are important for long-term operating CBOs.

6.1.2 Congruence (DP2)

The *second design principle* is the presence of *congruence*, with *local conditions* and between the *benefits of appropriation and costs of provision* (Ostrom, 1990). A major finding of this research is the lack of regulatory adaption to local conditions (ASADAS1-8). Widely regulations were perceived to be too complex, standardized and bureaucratic, limiting the communities' creativity and not meeting the ASADAS' needs (ASADA1, 5-8). These included a regulated minimum water pressure, which not all sources can provide, forcing ASADAS to shut down service occasionally or struggle to protect water sources (ASADA6-8). Further, the funding options of ASADAS are limited by regulations often leading to difficult financial situations making larger investments impossible (ASADA4, 8). Particularly, smaller ASADAS find it more difficult to comply with the regulations, as the size classifications are too wide to accurately address the needs of the smallest CBOs (ASADA8). While some training is provided by the Liga, these options remain inaccessible due to travel and loss of work expenses for many CBOs (ASADA1, 5, 7/Muni). Concluding from these insights, congruence to local conditions cannot be regarded as a fulfilled principle. This need for flexibility has also been highlighted in Quinn et al.'s (2007) findings. Further, Blaikie (2006) and Rodriguez de San Miguel et al. (2015) found a fitting political and institutional environment as crucial criteria for long-term robust CBOs. Likewise, Abdullaev et al. (2010) refer to the need of including local knowledge in effective management approaches. These previous findings all back up the need for addressing this shortcoming of local congruence in the case of Hojancha's ASADAS, to be able to facilitate collective action in the long-term.

There are many other things that the ASADAS are also limited in because they are small or perhaps lack knowledge of some of the training they give us. We are lacking. We need more flexibility in the regulations for the ASADAS, but as the general rule, we have to stick to what we can. (ASADA8)

However, coming to the second aspect of this DP, the ASADAS declared that citizens have costs for provisions, as the transportation of water, infrastructure and aqueducts maintenance, repairment and development is charged, but the benefits overweigh (ASADA2, 4-8). These benefits are, first and foremost, as stated during all interviews, a continuous service of potable water, enabling health, well-being, and the possibilities of development (ASADA1-8). This led

to the impression that congruence between appropriation and provision does exist, which fulfils the second part of the principle.

I feel that there are more benefits for the subscribers than what costs, because water is water is fundamental and if there is no water there is no life. (ASADA6)

6.1.3 Collective-choice Arrangements (DP3)

The *third DP* addresses the presence of *collective-choice arrangements* and entails that all individuals affected by decisions can partake in them. A key finding of this research is strong collective-choice arrangements within the ASADAS (ASADA1-8). All citizens (and the ASADAS's members) are equally affected by the decisions of the CBOs, and openly accessible arenas for collective-choice exist (ASADA1-8). Annual general assemblies are used to share information with the community and elect the board and president of the CBOs (ASADA1, 3-5, 7, 8). Further, in this event, citizens can add and modify regulations (ASADA1-5, 8). The ASADAS highlight that *"decisions are made altogether"* (ASADA1). These findings align with those of Madrigal et al. (2011), who found that a clear, transparent and accessible process of board elections in CBWM organisations is connected to high performance. The usage of mailboxes for collecting complaints was also explained (ASADA6). While the perception of the municipality was that throughout the year, the citizens lay their trust in the ASADAS to make the best decisions for all, one ASADA emphasized that only emergency decisions are done excluding the community (Muni, ASADA4). This shows divergent understandings of how decisions are made, while it crystalizes that ASADAS strongly focus on performing these collectively.

They [the ASADAS] work for the people. (ASADA8)

These findings are validated by the survey findings, in which 62.3 percent stated that they feel like they can voice their opinion to the ASADA, and another 24.5 percent that they can do this partially. Concluding, the found arrangements align with previous findings which indicated their driving characteristics for CA in CBOs. Madrigal et al. (2011) Muchara et al. (2014) and Prokopy (2005) all found that a proactive desire to participate and community ownership is beneficial for robust CBOs. Further, Theesfeld (2004) found a negative influence on CA through asymmetric power in a community, which is backed up by Kuzdas et al.'s (2015) advocation for horizontal governance in CBOs. Concluding, this principle can be rated as fulfilled for all ASADAS.

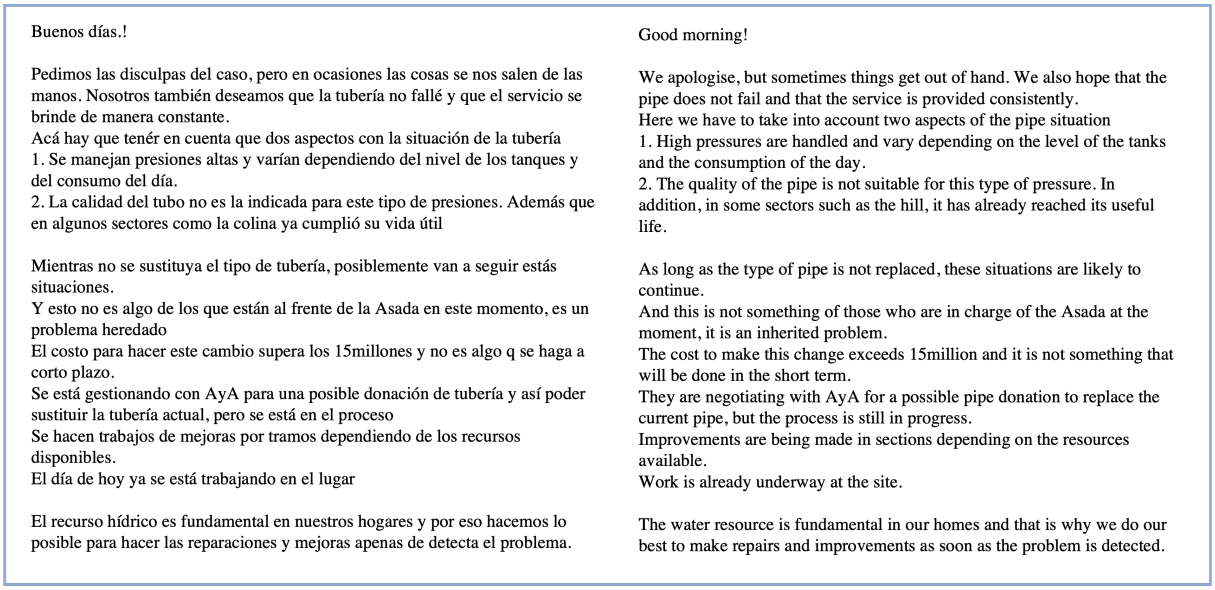
6.1.4 Monitoring (DP4)

Fourth is the principle of *monitoring*, which encompasses resource conditions and user behaviour. The mandatory instalment of meters, since 2000, covers the monitoring of user behaviour, as violations against this are prosecuted (Liga). In terms of resource condition monitoring, concrete and regular procedures could be found, indicating the presence of this principle. A range of actors (Ministry of Health (MoH), Liga, private Labs and the ASADAS) conduct weekly (ASADA4, 5), monthly (Liga), and half-yearly (MoH) quality tests of the

water. The ASADAS take on accountability for these controls towards the citizens, communicate results as reports and ad-hoc notification (cf. Figure 5) and report to the AyA, while some issues regarding the digitalization became apparent and often reports are only accessible in physical version at the CBOs offices (ASADA1-7).

Now through the networks it's very easy, you have a group of all the aqueducts and they ask questions and the one who knows answers them. (...) It's just that you have to communicate. (ASADA2)

This direct communication about resource conditions has also been found as a key driver for CA in previous studies (Kuzdas et al., 2015; Madrigal et al., 2011).



Buenos días.!

Pedimos las disculpas del caso, pero en ocasiones las cosas se nos salen de las manos. Nosotros también deseamos que la tubería no fallé y que el servicio se brinde de manera constante.
Acá hay que tenér en cuenta que dos aspectos con la situación de la tubería
1. Se manejan presiones altas y varían dependiendo del nivel de los tanques y del consumo del día.
2. La calidad del tubo no es la indicada para este tipo de presiones. Además que en algunos sectores como la colina ya cumplió su vida útil

Mientras no se sustituya el tipo de tubería, posiblemente van a seguir estás situaciones.
Y esto no es algo de los que están al frente de la Asada en este momento, es un problema heredado
El costo para hacer este cambio supera los 15millones y no es algo q se haga a corto plazo.
Se está gestionando con AyA para una posible donación de tubería y así poder sustituir la tubería actual, pero se está en el proceso
Se hacen trabajos de mejoras por tramos dependiendo de los recursos disponibles.
El día de hoy ya se está trabajando en el lugar

El recurso hídrico es fundamental en nuestros hogares y por eso hacemos lo posible para hacer las reparaciones y mejoras apenas de detecta el problema.

Good morning!

We apologise, but sometimes things get out of hand. We also hope that the pipe does not fail and that the service is provided consistently.
Here we have to take into account two aspects of the pipe situation
1. High pressures are handled and vary depending on the level of the tanks and the consumption of the day.
2. The quality of the pipe is not suitable for this type of pressure. In addition, in some sectors such as the hill, it has already reached its useful life.

As long as the type of pipe is not replaced, these situations are likely to continue.
And this is not something of those who are in charge of the Asada at the moment, it is an inherited problem.
The cost to make this change exceeds 15million and it is not something that will be done in the short term.
They are negotiating with AyA for a possible pipe donation to replace the current pipe, but the process is still in progress.
Improvements are being made in sections depending on the resources available.
Work is already underway at the site.

The water resource is fundamental in our homes and that is why we do our best to make repairs and improvements as soon as the problem is detected.

Figure 5 Ad-hoc Communication by ASADA (Spanish and English), shared screenshot published with permission

Furthermore, a finding addresses the environmental monitoring of ASADAS, which develop water balances to determine an upper limit for extraction in line with the water law (ASADA6). The ability to enforce national law, or at least try to, has been previously connected to the long-term abilities of CBOs to facilitate SCA, which is why it could also be a driver in this case (Madrigal et al., 2011, p. 1667). Additionally, ASADAS fence-off pumps, springs, and recharge zones to protect the surrounding environment of the water sources, contributing to strict environmental monitoring (ASADA8). This ability of ASADAs to protect water sources has also been found by Cuadrado-Quesada et al. (2018), which validates this finding. Interesting is the finding of ASADA2's perception, of a collective monitoring responsibility of the community, indicating the embeddedness of the CBO and strong community engagement. In line with Muchara et al.'s (2014) and Prokopy's (2005) findings, this level of community participation would speak for their strong SCA facilitation abilities. On another level of monitoring, the AyA ranks every ASADA regarding their performance (AyA, 2023, Liga). This research revealed a discrepancy between the stated (and perceived) rankings that the ASADAS received by the AyA and the last published records, in which Hojancha's ASADAS perform worse than it was declared in the interviews, showcasing a potentially dismorphed self-

perception of the CBO and community. This was further supported by solemnly positive statements during the interviews regarding the water service provided in Hojancha, which might also indicate a presence of social desirability bias (ASADA1-8; Berg & Lune, 2017).

We guarantee the water to the citizen, we guarantee water that is 100% drinkable. (ASADA8)

Nevertheless, as monitoring procedures are established and accountability towards the users is held by the ASADAS, the principle can be declared as fulfilled.

6.1.5 Graduated Sanctions (DP5)

Graduated sanctions constitute the *fifth principle*. This research found a clear preference of the ASADAS to resolve conflicts informally and verbally, and escalating to a more official level (like including lawyers) is only used when all other approaches fail (ASADA1-8).

They must be told what they are doing wrong […] so we communicate and the first time they are pardoned, the second time they are found guilty of an illegal reconnection. (ASADA8)

The degree and scale for sanctions are defined by the AyA and partially by the MINAE, when violations concern trees or protection zones (ASADA,1, 6, 8, Liga). The boards are then responsible to initiate sanctions (ASADA,1, 6, 8, Liga). Important is a previous agreement on the sanction by the board (ASADA8). This presence of clear rules and sanctions has been previously identified in studies and aligns with them (Madrigal et al., 2011; Madrigal-Ballestero et al., 2013). A surprising find is the widely captured perception that not many violations, and hence sanctions, are present in Hojancha (ASADA1-8).

We haven't had any problems here, people are quite responsible. (ASADA1)

When a violation occurs it is mostly due to delayed payments for the service, and the ASADAS seem to provide flexible sanctions to this and at first always get in contact with the person and offer them a time window to pay (ASADA1, 6, 8). The ASADAS stressed the present respect between citizens and CBOs, and also towards regulations like the meters, that enable this system to run smoothly (ASADA2, 8). The importance of respect, trust and open communication between the CBO and its community has been found as crucial for SCA in previous studies, which supports this findings impact (Kuzdas et al., 2013; Theesfeld, 2004).

So no, no, here the people only passed that [the regulation] one time and no more, everyone in the world totally respects [the ASADA and the regulations]. (ASADA2)

Additionally, the ASADAS themselves can face sanctions from the AyA. Furthermore, citizens have the power to elect members and, in times of crisis, can also initiate recalls (Liga). These findings show that graduated sanctions are present but the CBOs of Hojancha found alternative sanctioning approaches, which are more fitting and effective in their context, giving enough evidence that this DP can be regarded as fulfilled.

6.1.6 Conflict-resolution mechanisms (DP6)

Access to local, fast and low-cost *conflict-resolution mechanisms* is the *sixth principle*. Closely connected to the previous principle, it was found that ASADAS prefer direct and informal communication to resolve conflicts fast and effectively (ASADA1-8).

It is resolved very informally because generally people don't ever ask for anything in writing, they complain verbally. (ASADA7)

Likewise, the boards are responsible for analysing, discussing and proposing a resolution, hence they define the time, format and space for it (ASADA1, 3, 5, 6, 8), while the ASADAS can receive help from the Liga (ASADA1, Liga). If a solution cannot be found, the conflict escalates to the next level of government bodies (AyA), closely relating this process to government activities (ASADA7/M, Liga). However, previous findings of this study were reassured as most interviewees stated that hardly ever conflicts occur (ASADA1-3, 8), if conflicts occur this is due to illegal connections, wrong usage or additional fees (ASADA1, 8). Solely one ASADA said that they have daily conflicts, hinting that the CBOs might be conflict-averse (ASADA4), and another shared a situation where a director was regarded as unfit and recalled by the citizens (ASADA8).

We haven't had any problems with conflicts like that, everything has been very passive, very possible. (ASADA8)

Conflicts arise almost every day. (ASADA4)

The findings highlight the trust which ASADAS receive from the citizens, to resolve conflict competently. ASADAS themselves, regard these processes as sufficient and effective (ASADA2-4, 6-8).

"*People have trust in them*" (ASADA2)

A critical perspective by the Liga, however, voiced their dissatisfaction with the abilities of managers to solve a conflict, as empathy is often missing, suggesting targeted training in this:

I think there is a lack of training for managers, they are often defensive. And they lack more empathy to put themselves in the shoes of the water user. And so I think we need more training, more training and to promote a culture of conflict resolution. (Liga)

Having defined rules of how violations, like breakages, are dealt with in CBOs has been previously found to "provide the incentives and quality assurance necessary for a good performing system", while good performance is to be understood as long-term CA(Madrigal et al., 2011, p. 1667). Likewise, Quinn et al. (2007) found clearly established and accessible conflict and negotiation processes to be relevant for effective management in CBOs. Context-adapted accountabilities and procedures are established in Hojancha to solve conflicts, which can be interpreted as sufficient evidence for this principle. Hence, the findings of this study align with those of previous studies, speaking for the SCA facilitating characteristic of present conflict-resolution mechanisms in the ASADAS.

[What we do is] taking people to the sites and showing them the issues instead of just saying no. (ASADA4)

6.1.7 Minimal Recognition of Rights to Organize (DP7)

The seventh principle addresses a *minimal recognition of rights to organize* by the government. As ASADAS are legally constituted by a delegation agreement of the AyA (Madrigal et al., 2011, Liga), they are recognized for predefined functions (ASADA1-8). Additionally, springs are registered in the names of the ASADAS (ASADA2). The AyA, as a government institution, also encouraged cooperation and support by offering training to the ASADAS (ASADA2). Furthermore, a permit from the Ministry of Health is necessary for operation (ASADA3,5).

Each ASADA must have a delegation agreement issued by the AyA. We have the delegation agreement in order to be able to operate, and we also have the sanitary operating permit issued by the Ministry of Health. (ASADA5)

Interestingly, ASADA4 integrated another ASADA, which did not own an agreement, by this, they stated that both organisations benefit from shared administration. While the recognition to organize is present and the principle can be interpreted as fulfilled, it must also be brought forward that the Liga highlighted a lack of recognition from the government regarding the sacrifice many individuals have to make, as the majority of roles in ASADAS are voluntary. Blaikie (2006) and Rodriguez de San Miguel et al. (2015)both highlight the importance of a supporting institutional environment and while recognition to organize exists, the ASADAS' needs are still not being met by governmental support. For once, this can be pointed to standardizations, as institutional norms do not consider different scales of CBOs in Costa Rica (Pahl-Wostl, 2015), but it can also be connected to corruption issues of the AyA (Mesen, 2023).
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6.1.8 Nested Enterprises (DP8)

The last principle addresses a state of *nested enterprises*. As water is a public good in Costa Rica (Guzmán Arias & Calvo Alvarado, 2013), the management and governance of water resources are nested across multiple organisations, with ASADAS mainly responsible for the rural sites, and the AyA in most urban areas, this can be regarded as a system of nested enterprises. Further, various processes of the ASADAS, like their sanctioning system, and monitoring processes (as discussed above) are led by and embedded in regulations formed by the AyA and the government. ASADAS are regulated by the AyA and follow government legislature (AyA, 2023), for example with tariffs. In the interviews, predominantly the ASADAS highlighted the good relation and collaboration with various government layers, the Municipality, AyA, MINAE and Ministry of Health, while this is almost always present in the form of local action (ASADA1-8, Liga).

Good relations benefits water. (ASADA7 / Muni)
It is different here, the organisations are looking for ways to support the ASADAS. (ASADA6)

Table 7 Results Overview (authors elaboration)

Design Principles	Sub-principles	ASADA1	ASADA2	ASADA3	ASADA4	ASADA5	ASADA6	ASADA7	ASADA8
DP1 Clearly Defined Boundaries	Geographical Boundary	✓	✓	✓	✓	✓	✓	✓	✓
	Water Rights /User Boundary	✓	✓	✓	✓	✓	✓	✓	✓
DP 2 Congruence	Congruence with local conditions	✗	✗	✗	✗	✗	✗	✗	✗
	Appropriation and provision	✓	✓	✓	✓	✓	✓	✓	✓
DP3 Collective-choice Arrangements		✓	✓	✓	✓	✓	✓	✓	✓
DP4 Monitoring	Social monitoring	✓	✓	✓	✓	✓	✓	✓	✓
	Environmental monitoring	✓	✓	✓	✓	✓	✓	✓	✓
DP5 Graduated Sanctions		✓	✓	✓	✓	✓	✓	✓	✓
DP6 Conflict resolution mechanisms		✓	✓	✓	✓	✓	✓	✓	✓
DP7 Minimal recognition of rights to organize		✓	✓	✓	✓	✓	✓	✓	✓
DP8 Nested Enterprises		✓	✓	✓	✓	✓	✓	✓	✓
E1 Sustainable Action									
E1.1 Understanding of concept		✓	(✓)	✗	✓	✓	✓	✓	✓
E1.2 Presence of topic (perception)		✗	✓	✗	✓	✓	✗	✗	✓
E1.3 Contribution		✗	✓	✗	✓	✓	✓	✓	✓
E2 Inner Capabilities									
E2.1 Knowledge	Development	✓	(✓)	✓	✓	✓	✗	✗	✓
	Sharing	✓	(✓)	✓	✓	✓	(✓)	✓	✓
E2.3 Diversity	Backgrounds	✓	✗	✗	✓	✓	✓	✓	✗
	Gender	✓	✗	✗	✓	✗	✗	✗	✓
E2.4 Rituals		✓	✓	✓	✓	✓	✓	✓	✓
E2.5 Communication		✓	✓	✓	✓	✓	✓	✓	✓
E2.6 Collaboration	With ASADAS	✗	✓	✓	✓	✓	✗	✗	✓
	With other organizations	✓	✓	✓	✓	✓	✓	✓	✓

(✓) weak fulfillment ✓ present ✗ not present

6.2 The Role of Sustainability

The first extension by this study to the theoretical framework of Ostrom's (1990) DPs is that of *sustainable action* in CBOs, which was added to address the issue of normativity in the 'successes' of CA. An interesting finding is a discrepancy between ASADAS' self-image and their actual understanding and impact towards sustainability. Generally, a good understanding of the concept could be found (cf. Table 8) while the term 'sustainability' is used in a reserved way. Some ASADAS felt represented in their actions by the concept (ASADA4-6), while others could not find a connection to their organisation as they placed a focus on doing things well but not explicitly sustainably (ASADA1, 2), but they saw the need for this. Likewise, a disconnect to sustainability was found in the Municipality, and the Liga affirmed that ASADAS do not perceive themselves as drivers of sustainability.

[Sustainability is] not talked about often but should be major. (ASADA1)

However, there exists a discrepancy, as others clearly defined themselves as organisations that provide continuous water service, while conserving water resources (ASADA4), addressing their responsibility towards sustainability. Furthermore, when asked about their contribution to sustainability each ASADA could list clear aspects and past initiatives, like reforestation campaigns, river and beach clean-ups (ASADA2, 4, 5).

I think that we are an entity that not only has to stand out for being the one that regulates and sells water, but also for being the one that helps to conserve water. (ASADA4)

Additional contributions of the ASADAS entail buying land to establish protection zones (ASADA4, 5), the development of water balances and educational programmes for the community and in schools to raise awareness about water usage and protection (ASADA6, 8). This role of ASADAS in sustainability, aligns with previous findings of Cuadrado-Quesada et al. (2018). Regarding the dimension of social sustainability, ASADA4 declared that they can provide positions with insurance for their members, however this is not the case for most ASADAS.

The ASADAS have worked with the schools so that children from an early age begin to have the idea that we have to protect nature, that we have to take care of it, not throw rubbish away, recycle and take care of the water. (ASADA8)

Two more aspects were found which might drive the ASADAS' abilities to facilitate sustainable action. The first aspect is more long-term thinking, which was explained by an interviewee referring to infrastructure investments (ASADA2).

In those times nobody foresaw in the long term, almost all of the world did things in the short term. And now, well, some try to foresee in the long term, to put better materials, more well-placed things. (ASADA2)

The second is faster reparation time by the ASADA, which are up to 10 times faster (24h vs. 10 days) than solutions by the AyA (Liga). Faster reparations of aqueducts mean that less water is lost, ultimately protecting the resource better. This has been found as a benefit of localized

approaches in previous studies of CBOs (Madrigal et al., 2011). The explanation by Madrigal et al. (2011) for this is a crucial aspect of community-based activities, as ultimately everyone within the community is affected by issues like leaks and therefore reparation efforts likewise benefit oneself.

ASADAS play a crucial role in the sustainable management of water, but also of the forests, and social dimensions in Hojancha. While not all ASADAS concretely relate to the term and concept of sustainability, it seems to be a driving element in their daily actions. Mostly driven out of the urge of caring for their community, 'doing a good job', and responsibility for their environment and home, but also simply because they too are affected by breakages and crises, all ASADAS were able to demonstrate their contributions to sustainability and their mindset of wanting to further the sustainable development of Hojancha and trough this facilitate sustainable action.

Table 8 Understandings of Sustainability (authors elaboration)

Interviewee	**Understanding of Sustainability**
ASADA1	*"something that lasts and to protect water and the environment"*
ASADA4	*"Sustainability goes hand in hand with development and conservation"*
ASADA5	*"having a positive impact of humans on the environment over time"*
ASADA7 / MUNI	*"continuous water service" "ASADAS need good water sources and planning to be sustainable, and good education of the people to save water"*
ASADA8	*"Sustainability is a balance between humans and nature - to not exploit resources and protect them and water is one of the most vital"*

6.3 The Role of Inner Capabilities

This chapter addresses the research question of how inner characteristics of the ASADAS facilitate SCA in water management. Across the analysed dimensions of inner capabilities, various findings exert explanatory power towards the research questions.

6.3.1 Knowledge

The first criterion considered pertains to *knowledge development and sharing*. Various channels for knowledge development were found, including workshops by the AyA and Liga (ASADA1,4,Liga), as well as through team and project experiences (ASADA6). The accessibility of in-person training, however, was found as an issue (ASADA8).

They try month after month to train the ASADAS, before it was face-to-face, but it is a bit more difficult to mobilise people to a strategic point, but there are transport costs, work time costs, expenses, well, everything really, even food and everything to bring all the people together. (ASADA8)

Furthermore, a finding was the misfit of offered topics and needs of the ASADAS, which would benefit from training on chlorination practices, plumbing, digitalization and conflict resolution (ASADA8, Liga). Particularly small ASADAS have been found to be limited in their abilities to develop and share knowledge, due to resource shortages (ASADA8). To overcome such hurdles, it has been found in this research, that ASADAS dispose of a strong sharing mentality within their own CBO (ASADA2, 4-6, 8), less so between CBOs (ASADA1).

[Knowledge] must be shared for something to go well. (ASADA3)

This strong inner capability must be considered as a potentially facilitating component towards collective action, as knowledge sharing has been highlighted in previous studies as a driving factor for effective CBOs (Madrigal et al., 2011; Madrigal-Ballestero et al., 2013).

6.3.2 Diversity

The second dimension regards aspects of *diversity*. Human capital in the form of educational backgrounds, expertise and gender diversity has been found to play an important role in ASADA's performance (Madrigal et al., 2011). Within the ASADAS of Hojancha, a variety of backgrounds is present (law, tourism, teaching, plumbing, civil engineering, public work, and retiaries (ASADA1, 3-7)), with a dominance of agricultural professions (ASADA2, 8). A key finding here is that the ASADAS seem to be able to pull required knowledge from their community network, especially younger generations, in cases in which it is missing within the organisation (ASADA2).

We have trained people in the community. (ASADA2)

In terms of gender diversity, ASADAS show to have undergone a significant development, increasing the share of women. In 3 out of 8 interviewed organisations women hold managing roles, and one of them was the president of an ASADA (ASADA1, 4, 8).

Many times, [it is said that] a woman is weak, a good woman cannot be a plumber. A woman can't make decisions, a woman can't work and in today's times, in this village the situation has changed. (ASADA8)

However, the topic of gender equality, the past development, or its importance for the operations of ASADAS in the community have only been addressed by female interviewees,

keeping this as an issue mainly present for the individuals affected by it (ASADA1, 4, 8). One woman shared her perception of the presence of “Machismo” (in English: machoism) in the village and that the voices of women have been muted for long (ASADA8). She joined the ASADA to make a change and now she considers women to have an important role in the ASADAS. The role of women has been prioritized and those who were included in the interviewees said they felt empowered by it (ASADA1, 4, 8).

I say [this] so happy because the role of women in the ASADAS has been prioritised, we have been given the importance. (ASADA4)

It becomes apparent that development and change are happening, but a state of equality is not yet reached, as still women are underrepresented in the management of local water resources. This increasing importance of women's participation in ASADAS has also been found in previous literature, further validating the importance of gender equality in CBWM organisations (Madrigal et al., 2011). The importance of inclusivity towards all genders, as well as ages towards effective management of CBOs has been brought forward by Abdullaev et al. (2010). Putting the findings of this study into relations with previous ones, it can be concluded that the developments towards more equality might have a significant effect on ASADAS abilities to facilitate SCA, but many shortcomings and room for future improvement persists.

6.3.3 Communication and Information Transparency

A crucial criterion for success in CBOs is *information transparency*. Theesfeld (2004) stated that information asymmetry can hinder CA. The main communication mode found in this study is via a social network platform, on which every ASADA has an individual group with their community, for direct communication (ASADA1-8, Survey).

Well with regard to the citizens we have a WhatsApp group. We put any message there, for example, today the pipe is going to be repaired. (ASADA8)

Other modes include face-to-face, meetings, the general assembly (ASADA1-8), as well as printed newsletters to reach those without access to a smartphone (ASADA1, 3, 6). A strong focus and value of transparent communication to the citizens were found through this research (ASADA1, 2), which aligns with previous studies' findings of it being a driver of CA(Kuzdas et al., 2013; Madrigal et al., 2011).

I think that the importance here has really been communication. (ASADA2)

The close relation between a community and the committees (or here boards) to enable easy access for users to information and possibilities to raise concerns, has been found to enable CA in previous findings (Madrigal et al., 2011), which suggests that this factor can be a driving element of SCA in Hojancha.

6.3.4 Collaboration

When looking at inner capabilities, the ability of an organisation to *collaborate* is of significance to utilize all available resources and existing knowledge in the community (Muchara et al., 2014; Prokopy, 2005). Within ASADAS, fixed rituals, like monthly meetings, enable steady collaboration. A strength which was found in this research is the ASADAS' high level of collaboration with outside organisations, like the AyA, Liga, local organisations, ministries, as well as foreign embassies and the UNDP, to bridge over knowledge and expertise gaps (ASADA1, 3, 4, 6-8).

Yes, we collaborate more than anything else in what I told you, the truth is that we help them with infrastructure, mainly with materials, machinery or donation of land and things like that. (Muni)

At the moment, from what we know, the canton of Hojancha is one of the cantons that collaborates the most with the ASADAS. (ASADA6)

Madrigal et al. (2011) found that the existence of other networks in the community is supportive of CA, which might give a reason for the influence of the ASADAS' collaboration on facilitating CA. Further, the inclusion of the community (e.g. in the general assembly) enables community-wide collaboration, which is a clear driver of CA (Kuzdas et al., 2015; Madrigal et al., 2011; Muchara et al., 2014). Looking at the collaboration between ASADAS, this study revealed a shortcoming:

We as ASADAS sometimes … we don't care about our sister ASADAS. That is to say the ASADAs that are next to me, that I am saving myself with the cost, I don't know, sometimes we are selfish. (ASADA8)

ASADAS, as well as the Liga, perceive a lack of collaboration and exchange (ASADA5-8, Liga), while it was voiced as a desire to encourage more cooperation and even the merging of smaller CBOs (from the smaller CBOs), to share resources and expertise (ASADA1, 8). Barriers seem to exist making collaboration inefficient and only in emergencies they are obliged to work together (Liga). This shortcoming should be addressed in future projects to utilize this potential to further CA.

6.3.5 Additional Aspects

Through the semi-structured interview approach, space was allowed to explore other aspects. The findings of this approach cover the topics of *digitalization* and *finance* as obstacles to collective action. Manual invoicing is widely used by the ASADAS but has led to safety issues for the treasurers in the past, as payments were stored in their private homes (ASADA4). Digitalization efforts were tested by one ASADA, but the resistance within the ASADA, as well as from the citizens and the complexity of the implementation hindered the trial from succeeding (ASADA4).

Furthermore, the financing of many ASADAS was found to be a limiting factor, as poverty is present in villages and ASADAS are poorly financed, and income can only be generated through service fees and donations, hindering them to do long-term investments (ASADA3, 7).

Financially the ASADAS don't have much money, it is almost that what is collected for the services is barely enough for the administrative expenses for the whole operation, that's why the ASADAS can't invest much in infrastructure, they have to ask for help because they don't have many resources, so the administrative expenses are almost equal to what is collected, so financially, it is sustainable. (Muni)

Particularly smaller organisations are hindered in their abilities, as regulations do not incorporate their size. In line with previous studies, this shows the hindering factors of institutional norms which do not consider scales of CBOs (Pahl-Wostl, 2015).They are obliged to hire a plumber, which often results in their inability to provide insurance for their members (and plumber), leaving them understaffed and lacking capacity (ASADA1). This state is unrecognized by the AyA, and in the light of a currently revealed corruption scandal of the AyA (misappropriation of funds intended for ASADAS), this is hardly surprising (Mesen, 2023). Interesting is the finding indicating that the size of CBWM organisations might have a significant role in this context, while this is against the current line of arguments in the theory which cannot find a relation between performance and size of CBO (Ostrom, 2002).

The *intrinsic motivations* of members have been found as drivers for CA in this case study. One interviewee explained that they perceived the ASADA to *"handle things differently",* which woke their interest in engaging with the CBO (ASADA3). Predominantly, however, this motivation was found to stem from feelings of community responsibility and rootedness (ASADA1,2,3,8).

It is the normality of small communities to be involved. (ASADA1)

(It is) important for the community. (ASADA2)

(It is) a service to the people. (ASADA8)

This suggests that a common understanding regarding the value of CBOs in Hojancha exists, driving their ability to facilitate SCA (Madrigal et al., 2011).

6.4 The Influence of the Community

CBOs are situated in unique contexts, which makes the inclusion of their environment crucial to be able to assess them more accurately (Afroz et al., 2016). To answer the third research question: "How does the surrounding community enable collective and sustainable water management of CBOs (ASADAS)?", a self-conducted survey will be analysed on a descriptive level. The topics included in this survey were the community's clarity over objectives and benefits from the ASADAS, engagement, trust, collaboration, transparency, user satisfaction and community embeddedness of the ASADAS. The choice of these dimensions was based on previous literature, which connected them to the performance of CBOs (Abdullaev et al., 2010;

Madrigal et al., 2011; Madrigal-Ballestero et al., 2013; Muchara et al., 2014; Prokopy, 2005; Quinn et al., 2007; Theesfeld, 2004). Some perspectives from the interviews will additionally be used for a more holistic analysis.

6.4.1 Satisfaction with Service

Crucial to assessing SCA is the subjective perception of users of the service provided by CBOs, as CA could not be regarded as "successful" or sustainable, if it is not regarded as such by the community itself (Madrigal et al., 2011). Following Madrigal-Ballestero et al. (2013) a proxy for water delivery performance was used, by capturing the appropriators perception of availability and quality. The findings show that water users in Hojancha are in majority satisfied with the service the ASADAS provide (81.1 percent - water availability, 84.9 percent - water quality), while a larger share is more strongly satisfied with the quality of water (37.7 percent) than with the available quantity (30.2 percent) (cf. Figure 6 and 7).

The ASADA makes it possible to receive quality water at an affordable price for the entire population. (Survey comment)

ASADA does excellent work in our town. (Survey comment)

A high level of satisfaction was also perceived by the interviewees, which stated that users were perceived as partners, included in the process and particularly the ASADAS' transparency was highlighted as an enabling factor (Liga, ASADA1, 8). This inclusion of appropriators was referred to as a benefit of CBWM in comparison to centralized management approaches, where this level of inclusivity is not possible (Liga), which also aligns with the findings of Muchara et al. (2014) and Prokopy (2005). However, while majorities indicate a high level of satisfaction, contrary voices also raised critique, concerning the bureaucracy and ineffective leadership (ASADA4, Liga, Survey).

I think they should meet with the people, express their needs and difficulties, to find a solution together. (Survey comment)

There are many irregularities. (Survey comment)

These points raise serious concerns regarding the ASADAS' abilities to facilitate SCA. Nevertheless, in comparison to other findings, the shares of satisfied and unsatisfied users align, as Madrigal-Solís et al. (2020) found that 80 percent indicated no issue with the water provision.

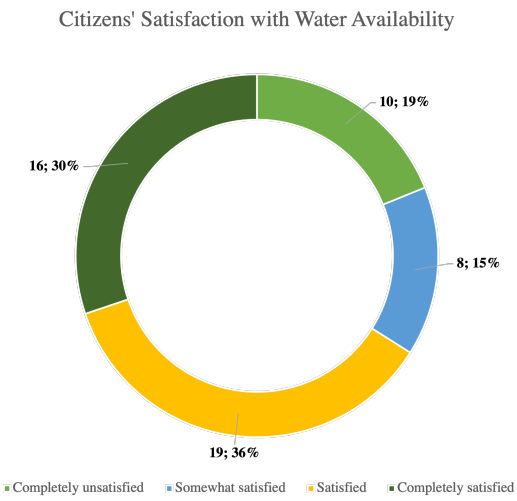

Figure 6 Citizens' Satisfaction with Water Availability, (authors elaboration based on survey findings)

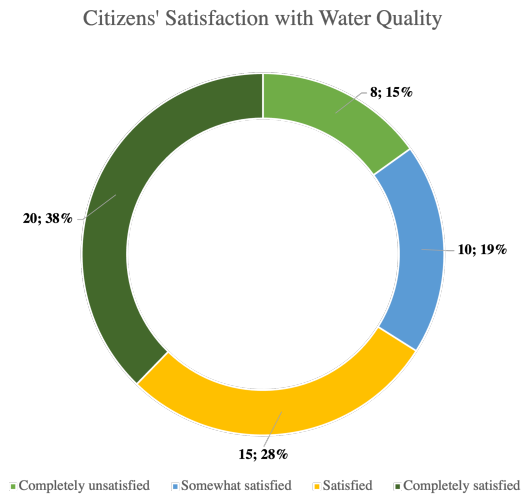

Figure 7 Citizens' Satisfaction with Water Quality, (authors elaboration based on survey findings)

6.4.2 Clarity over Objectives and Benefits

To be held accountable by the community, the CBOs' objectives must be understood. A key finding of this study revealed that most objectives, like supplying continuous water (83 percent), and ensuring water quality (75.5 percent) were understood by a majority of participants. While the clarity over other objectives, like compliance with regulations (62.3 percent), administration (41.5 percent) and maintenance (37.7 percent) as well as their responsibility to assure the ecological stability of rivers (41.5 percent) decreased. These findings are supported by Madrigal-Solís (2020), who also found that environmental protection responsibilities are less likely to be understood in the community. Surprisingly, the objectives of ASADAS to develop (28.3 percent) and construct (26.4 percent) infrastructure, are hardly recognized by the community. This could limit the community's ability to hold the ASADAS accountable, hence hindering their ability to facilitate SCA suggesting that more awareness towards these objectives should be built.

6.4.3 Engagement, Transparency and Trust

As previous studies have shown, the presence of engagement, transparency and trust between CBOs and the communities they are situated in or created by, are crucial foundations for successful CA (Da Costa Silva, 2011; Madrigal et al., 2011; Madrigal-Solís et al., 2020). The survey results indicated a regular engagement of the community, ranging from around 10 times a year (30.2 percent) to monthly (35.8 percent) and weekly (13.2 percent). Most citizens would get in contact to receive information (37.7 percent), to address an issue (24.5 percent), to collaborate (24.5 percent) or to share information (13.2 percent). Furthermore, transparency has been found as a perceived strength of the ASADAS, as 84.9 percent of participants stated to

regularly receive information and 77.4 percent are satisfied with the quality of this information. Transparency alone, however, does not enable CA, additionally, trust must be present (Kuzdas et al., 2013). In the case of the ASADAS, majorities were found that supported the presence of trust at least partially (92.4 percent), as the community sample stated to feel able to voice their opinion (86.8 percent) and needs (94.3 percent) to the ASADA, as well as implement ideas (88.7 percent). Additionally, statements from the interviews added the perception of the ASADAS, who perceive themselves as transparent, responsible, trustworthy, reliable and honest (ASADA8). Similarly, ASADAS' focus on user education contributes to the communities' abilities to participate in an informed manner (ASADA7, Muni). For effective operation of CBOs, transparency and trust have been found as significant enablers, which underlines their ability to drive CA in this case of CBOs in Hojancha (Kuzdas et al., 2013; Madrigal et al., 2011; Steins & Edwards, 1999). Theesfeld (2004) further supports this argument that trust is mandatory to set up community-based committees (here boards) for resource management for CA.

6.4.4 Community Embeddedness

At last, the embeddedness of CBOs in their communities is of high importance and influences their ability to perform (Madrigal et al., 2011). This has been found as a core driver within this research. A majority of 86.8 percent of participants indicated medium to strong community feeling, while 98.2 percent see their ASADA as an integral part of the community – validating the presence of community embeddedness. These found factors might contribute to the enabling abilities of the community of Hojancha towards effective SCA of the ASADAS.

7 Conclusions

This study aimed to deepen our understanding of how CBOs in rural Costa Rica foster SCA in local water management. By utilizing Ostrom's (1990) DPs as a foundation and extending them to include dimensions of sustainability, inner capabilities, and the role of the community, a more comprehensive understanding of the case study of ASADAS in Hojancha was achieved.

Applying Ostrom's DPs to answer the first research question: “How do community-based organisations (ASADAS) in Hojancha, Costa Rica, facilitate collective and sustainable action in local water management?”, it was found that most principles were present in the analysed ASADAS, indicating their long-term effectiveness in facilitating CA. Notably, the recognition of rights to organize, and transparent and inclusive decision-making, as well as, informal and accessible conflict-resolution processes stood out as key strengths. However, the principle of congruence to local conditions was lacking, with complex regulations hindering operations, particularly for smaller organisations. While the DPs provided some insights into CA, they alone were insufficient to explain sustainable outcomes. To address this, the study extended its scope to examine sustainability dimensions. ASADAS demonstrated varying self-perceptions regarding their role in sustainability, but all organisations contributed to environmental protection through measures like establishing protection zones and conducting clean-ups. The awareness of the community's dependence on the environment drove the ASADAS' SCA.

Addressing the second RQ: “How do ASADAS develop capacities for effective and sustainable water management?”, the study also identified the influence of inner capabilities on collective and sustainable water management. Sharing knowledge, leveraging community networks, and the increasing role of women were identified as drivers of CA, while obstacles included limited training accessibility, lack of collaboration between ASADAS, and administrative issues due to a lack of digitalization.

To answer the third RQ the community perspective was captured. The study found that while there was clarity regarding most ASADAS' objectives, some misunderstandings remained, particularly regarding environmental conservation and infrastructure development, which might be obstacles to long-term SCA of ASADAS. On the other side, engagement, trust, and satisfaction with ASADAS' services have been found as crucial factors in facilitating SCA.

Overall, the case study of Hojancha's ASADAS exemplified effective CPR management by CBOs, highlighting the importance of inner capabilities, communication, collaboration, gender diversity, and community support. Sustainability and the enabling factors of communities played vital roles in their effectiveness. However, it is important to acknowledge the context-dependency of CBOs and CPR management, as unique environmental, social, and institutional

factors shape their effectiveness. The DPs and extensions presented in this study can serve as a useful framework for similar case studies, particularly in developing and emerging countries.

In conclusion, this study has made significant contributions to the field on multiple levels, successfully fulfilling its aims. At the first level, it addressed a geographical and data gap in the literature by focusing on the rural location of Costa Rica, specifically the ASADAS in Hojancha. Through meticulous fieldwork and qualitative data collection, this study provided detailed and rich insights into the facilitating and hindering factors for CBOs in facilitating SCA. By incorporating the DPs by Ostrom (1990), sustainability dimensions, inner capabilities, and the community's perceptions, this study offered unique and valuable perspectives to the existing literature.

On the second level, this study represents a theoretical extension and a push in CPRT. As part of the third generation of CPRT literature, it critically questioned the pure application of the DPs and sought to go beyond existing frameworks. The study successfully extended the framework built by Ostrom in 1990, based on the critique and findings of previous literature, which had not been done before. By testing the applicability of these extensions and finding that they largely align with previous findings while also revealing unique insights, this study has demonstrated the usefulness of the extended framework in understanding how CBOs facilitate SCA. This advancement in CPRT pushes the field forward and opens up opportunities for more holistic studies in the future.

Overall, this study has not only filled important content gaps by providing in-depth data on CBOs in a rural Costa Rican context but has also contributed to the theoretical development of CPRT. Its findings and extensions offer valuable insights for researchers and practitioners seeking to understand and enhance the effectiveness of CBOs in promoting SCA in managing common-pool resources.

7.1 Policy Advice

To address the shortcomings, which were revealed in this research some policy advice will be provided. Regulations should be more adaptable to the local context, as these appeared to be less flexible than necessary, and became an obstacle, particularly for smaller organisations. Therefore, a more flexible regulation is advised which takes much smaller CBO sizes into account. Furthermore, more external support and capacity building is required regarding the digitalization of the CBOs and training opportunities catering to the ASADAS' needs. This would include chlorination practices and conflict-resolution approaches. As the collaboration between ASADAS seemed to be very low, implementing encouraging measures to increase such collaboration and exchange further is advised. At last, community understanding of the environmental conservation role of ASADAS in Hojancha should be increased, as this enables the community to hold the CBOs accountable for this task.

7.2 Future Research

As CPR management requires highly contextualized approaches, a multitude of future research possibilities exist. To further apply a more holistic perspective to CBOs a gender analysis could be an interesting tool. Additionally, building on the survey approach applied here, a more widespread capturing of the community perception remains crucial to understand the successes and failures of CBOs. At last, the extended methodology of DPs for robust organisation can be further applied to a larger variety of case studies, driving a more holistic understanding of how CBOs globally facilitate sustainable and CA.

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Appendix A

Table A1 Attributes of Resources and Appropriators, based on (Ostrom, 2002, p.1325)

Attributes of the Resource	**Explanation**
R1. Feasible improvement:	Resource conditions are not at such a point of deterioration that it is useless to organize, or so underutilized that little advantage results from organizing.
R2. Indicators	Reliable and valid indicators of the condition of the resource system are frequently available at a relatively low cost.
R3. Predictability	The flow of resource units is relatively predictable.
R4. Spatial extent	The resource system is sufficiently small, given the transportation and communication technology in use, that appropriators can develop accurate knowledge of external boundaries and internal microenvironments.
Attributes of the appropriators	
A1. Salience	Appropriators are dependent on the resource system for a major portion of their livelihood.
A2. Common understanding	Appropriators have a shared image of how the resource system operates (attributes R1, R2, R3, and R4 above) and how their actions affect each other and the resource system.
A3. Discount rate	Appropriators use a sufficiently low discount rate in relation to future benefits to be achieved from the resource.
A4. Distribution of interests	Appropriators with higher economic and political assets are similarly affected by a lack of coordinated patterns of appropriation and use.
A5. Norms of trust, reciprocity, and punishment	Appropriators trust one another to keep promises and relate to one another with reciprocity.
A6. Autonomy	Appropriators are able to determine access and harvesting rules without external authorities countermanding them.

A7. Local leadership and prior organisational experience	Appropriators have learned at least minimal skills of organisation through participation in other local associations or learning about ways that neighbouring groups have organized.

Appendix B

Table B1 Interview Sample (authors elaboration)

Interviewee(s)	Description	Date	Setting
	(Roles within ASADAS: president, treasurer, administrator, secretary, board member)		
ASADA1.1	President of ASADA	13.03.23	Face-to-face, interviewee's home
ASADA1.2	Treasurer of ASADA	24.03.23	Face-to-face, interviewee's village, public bench
ASADA2	President of ASADA	15.03.23	Face-to-face, interviewee's home
ASADA3	Treasurer of ASADA	13.03.23	Face-to-face, Room in the Municipality
ASADA4	Administrator of ASADA	15.03.23	Online (Microsoft Teams)
ASADA5	Administrator of ASADA	16.03.23	Face-to-face, ASADAS' office
ASADA6	President of the ASADA, board member	21.03.23	Face-to-face, ASADAS' office
ASADA7 / Muni	Urban Planning at the Municipality, member of ASADA	23.03.23	Face-to-face, at the Municipality
ASADA8	Secretary of ASADA	29.03.23	Online (Microsoft Teams)
Liga	Director of Liga, member of ASADA	23.03.23	Face-to-face, interviewee's home

Table B2 Interview Guide (Spanish and English) (authors elaboration)

Topic	**Questions**
Place of Living	¿En qué pueblo vive actualmente?
	Socorro
Background	¿Cuál es su formación de trabajar?
Size of ASADA (employees)	¿Cuántos empleados trabajan en esta ASADA?
	¿Cuántas mujeres trabajan en la ASADA, en comparación con los hombres?
Role in ASADA	¿Cuál es su función en la ASADA? (Sus responsabilidades)
	¿Cuál es su función en la Liga?
Starting time	¿Cuándo empezó a trabajar para la ASADA?
Motivation for Working @ASADA	¿Cuál fue su motivación para participar en la ASADA? (¿Ha cambiado esta motivación con el tiempo?)
Other professions	¿Tiene otras profesiones (trabajos)? ¿Cuáles son?

Interview Guide #2 - Main Part (ES)

Design Principles	**Derived Question**
1. Clearly Defined Boundaries (DP1)*Individuals or households with rights to withdraw resource units from the common-pool resource and the boundaries of the common-pool resource itself are clearly defined. (geographic boundaries and the clear definition of water rights) (3)*	¿De qué zona geográfica es responsable esta ASADA? ¿Operan conjuntamente con otras organizaciones la gestión del agua de determinadas partes? (¿Existen solapamientos o lagunas en los territorios de las ASADAS?) ¿Existen normas y leyes para la gestión del agua? ¿Quién ha definido esta normativa y leyes? (En caso afirmativo), ¿afectan estas normativas y leyes a su trabajo? ¿Cómo percibe esta normativa y

	leyes (como un apoyo, neutral o un obstáculo)? // ¿Existen normativas que definan quién utiliza qué?
2. Congruence (DP2) *A. The distribution of benefits from appropriation rules is roughly proportionate to the costs imposed by provision rules.B. Appropriation roles restricting time, place, technology, and/or quantity of resource units are related to local conditions. (1)*	¿Influye en los ciudadanos el cumplimiento de la normativa ASADA? ¿Implica el cumplimiento de las normas y reglamentos de la ASADA **costes para los ciudadanos** (también costes indirectos como perderse algo)? → Me refiero a si el cumplimiento de las normas y reglamentos de la ASADA por parte de los ciudadanos puede implicar restricciones o costes para ellos. ¿Conllevan las normas y reglamentos de la ASADA **beneficios para los ciudadanos**? ¿Cree que hay **más beneficios o costes** para los ciudadanos? x Según la temporada, ¿ofrece la ASADA diferentes cantidades de agua a los usuarios?
3. Collective-Choice Arrangements (DP3)*Most individuals affected by operational rules can participate in modifying operational rules. (3)*	¿Cómo se toman las decisiones en esta ASADA? ¿A quién afectan las decisiones **(y acciones)** de la ASADA? ¿Participan estas personas en el proceso de tomar las decisiones? ¿Pueden modificar las normas? xx En caso afirmativo, ¿cómo se hace?
	junta directiva is boss
4. Monitoring (DP4)*Monitors, who actively audit common-pool resource conditions and appropriator behavior, are accountable to the appropriators and/or are the appropriators themselves. (2)*	¿Cómo se controla el uso del agua en términos de infraestructura y comportamiento? ¿Quién es responsable de auditar la calidad y cantidad del agua y de los acueductos? ¿**Son responsables** ante los ciudadanos y usuarios ? →Por ejemplo, si surge un problema debido a un control deficiente o a la falta de control, los ciudadanos pueden dirigirse a esta persona. ¿Cómo se comunican a los ciudadanos los resultados del control de la calidad y cantidad del agua y de los acueductos?
5. Graduated Sanctions (DP5)*Appropriators who violate operational rules are likely to receive graduated sanctions (depending on the seriousness and context of the offense) from other appropriators, from officials accountable to these appropriators, or from both. (3)*	¿Cómo se **sancionan las violaciones** de las normas y reglamentos? ¿**Quién inicia** la sanción? ¿Existe **un plan** que determine **el grado** de la sanción? ¿Se aplican las sanciones? ¿Con qué **frecuencia se imponen** las sanciones?x
6. Conflict-Resolution Mechanisms (DP6)*Appropriators and their officials have rapid access to low-cost, local arenas to resolve conflict*	Cuando surge un conflicto, ¿**cómo se resuelve?** - ¿Existe un proceso específico? - ¿Quién modera el conflicto? - **¿Cuánto dura por término medio** la resolución de un conflicto? - ¿Dónde tendría lugar esta resolución? (en línea, en Hojancha, en la oficina de

among appropriators or between appropriators and officials. (2)	ASADAS)? ¿Cómo percibe el proceso de resolución de conflictos en la ASADA? ¿Hay algún aspecto concreto que destaque por su eficacia o ineficacia? ¿Este proceso está **relacionado con las actividades del gobierno**?x // ¿Hay algo que le gustaría cambiar en la forma en que se resuelven los conflictos en esta ASADA?
7. Minimal Recognition of Rights to Organize (DP7)*The rights of appropriators to devise their own institutions are not challenged by external governmental authorities. (1)*	¿Está esta ASADA **legalmente reconocida** por el gobierno y los ministerios oficiales? ¿Está esta ASADA **también reconocida en la práctica** por el gobierno y los ministerios oficiales?
*For common-pool resources that are part of larger systems:****8. Nested Enterprises****Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.*	¿Cuál es su relación con el gobierno / las instituciones? ¿**Cómo colaboran con las instituciones** regionales y nacionales hasta llegar al gobierno central?
THEORETICAL EXTENSION	
Let them define sustainability	¿Podría definir lo que entiende por sostenibilidad?
Sustainability Definiton (Backup)	La sostenibilidad consiste en satisfacer las necesidades de las generaciones actuales sin comprometer las necesidades de las generaciones futuras, garantizando al mismo tiempo un equilibrio entre el crecimiento económico, el cuidado del medio ambiente y el bienestar social.
Sustainable Action (E1)	¿Cómo **interpretaría la contribución** de ASADAS a la sostenibilidad del agua en Hojancha? // Ya ha hablado de los aspectos de sostenibilidad social, ecológica y económica. Veamos también los demás aspectos. ….
Sustainability Definitions	"**La sostenibilidad ecológica** incluye todo lo relacionado con los ecosistemas de la Tierra. Entre otras cosas, incluye la estabilidad de los sistemas climáticos, la calidad del aire, la tierra y el agua, el uso de la tierra y la erosión del suelo, la biodiversidad (diversidad tanto de especies como de hábitats) y los servicios de los ecosistemas (por ejemplo, la polinización y la fotosíntesis)." (KTH) **La sostenibilidad social** (...) integra temas que incluyen pero (...) no se limitan a; salud y equidad social, derechos humanos, derechos laborales, prácticas y

	condiciones de trabajo decentes, responsabilidad social y justicia, desarrollo y bienestar de la comunidad, responsabilidad del producto, resiliencia de la comunidad y competencia cultural. (Balaman, 2019) **La sostenibilidad económica** se refiere al "crecimiento económico, que se considera sostenible mientras aumente la cantidad total de capital". (KTH, 2020)
Sustainable Action (E1) Part 2	¿**Considera que** la ASADA **también contribuye** a la sostenibilidad social, ecológica y económica? Es la sostenibilidad un **tema presente** en la organización? → If yes → ¿Puede describir cómo se integra actualmente la sostenibilidad en las operaciones y procesos de toma de decisiones de ASADAS? Se han definido **objetivos o iniciativas concretas** para contribuir al desarrollo sostenible?
Internal Capabilities/Capacities (E2) - Knowledge - Diversity -Rituals -Communication	¿Cómo se **desarrollan los conocimientos**? // ¿Se ha impartido formación individual o en equipo? ¿Cómo se **comparten los conocimientos** en la organización? (maneras informales y formales) ¿Cuál es la formación profesional de los miembros de esta ASADA? ¿Qué rituales utilizáis (reuniones semanales y otros formatos) para colaborar y trabajar juntos? ¿Qué formas de **comunicación utilizan dentro** de la ASADA? ¿Qué formas de **comunicación utilizan con la comunidad en general? el mismo grupo ¿Sigue la ASADA algunos principios en el trabajo?** (Como, por ejemplo, la igualdad) **¿Colabora con otras** ASADAS? san isidro ¿Considera necesaria una mayor cooperación entre las organizaciones de Hojancha?
	¿Cree que existe confianza entre los ciudadanos y las ASADAS? - Por que? ¿Cree que los ciudadanos están satisfechos con el trabajo de las ASADAS?
	Hemos llegado al final de mis preguntas. **¿Desea añadir algo más?**

Interview Guide #1 - General Questions (EN)

Topic	**Questions**
Place of Living	Where do you live currently?

Background	What is your trained or studied background?
Size of ASADA (employees)	How many employees work at this ASADA?
	How many women work in the ASADA?
Role in ASADA	What is your role in the ASADA? (Your responsibilities)
Starting time	When did you start working for the ASADA?
Motivation for Working @ASADA	What was your motivation for engaging with the ASADA?
Other professions	Do you have any other professions (jobs) ? What are these?

Interview Guide #2 - Main Part (EN

1. Clearly Defined Boundaries (DP1)*Individuals or households with rights to withdraw resource units from the common-pool resource and the boundaries of the common-pool resource itself are clearly defined. (geographic boundaries and the clear definition of water rights) (3)*	For which area is this ASADA responsible? Are there overlaps or gaps in the territories between the ASADAS? Are regulations of water management clearly defined? Who defined these regulations? If yes, do these regulations affect your work? How do you perceive these regulations (supporting, neutral or hindering)? // Do regulations exists which define who uses what?
2. Congruence (DP2) *A. The distribution of benefits from appropriation rules is roughly proportionate to the costs imposed by provision rules. B. Appropriation roles restricting time, place, technology, and/or quantity of resource units are related to local conditions. (1)*	Does complying to rules and regulations of the ASADA lead to costs for citizens (also indirect costs like missing something) ? Do the rules and regulations of the ASADA lead to benefits for the citizens? How would you assess the balance between the costs these rules impose on citizens and the benefits citizens gain from them? Depending on the season, does the ASADA offer different quantities of water to the users?
3. Collective-Choice Arrangements (DP3) *Most individuals affected by operational rules can participate in modifying operational rules. (3)*	How are decisions made? Who is affected by decisions made by the ASADA? Do these people participate in the process? Can they modify rules? If yes, how does this happen?
4. Monitoring (DP4) *Monitors, who actively audit common-pool resource conditions and appropriator behavior, are accountable to the*	How is the infrastructure (aqueducts, meters) and correct behaviour of water usage monitored? Who is responsible to audit the condition of the water (quality and quantity) regularly? Are they

appropriators and/or are the appropriators themselves. (2)	accountable to the participants? How do they communicate results to the citizens?
5. Graduated Sanctions (DP5) *Appropriators who violate operational rules are likely to receive graduated sanctions (depending on the seriousness and context of the offense) from other appropriators, from officials accountable to these appropriators, or from both. (3)*	How do you sanction breaches of rules and regulations? Who initiates the sanction? Is there a plan in place, determining the degree of the sanction? Are these sanctions applied? How often are sanctions imposed?
6. Conflict-Resolution Mechanisms (DP6) *Appropriators and their officials have rapid access to low-cost, local arenas to resolve conflict among appropriators or between appropriators and officials. (2)*	When a conflict comes up, how do you solve it? - Is there a specific process in place? - Who moderates the conflict? - How long does the resolution of a conflict on average take? - Where would this resolution take place? (online, in Hojancha, in the ASADAS office)? How do you perceive this approach? Is this process connected to activities of the government? // Is there something you would like to change with the way conflicts are resolved in this ASADA?
When a conflict comes up, how do you solve it? - Is there a specific process in place? - Who moderates the conflict? - How long does the resolution of a conflict on average take? - Where would this resolution take place? (online, in Hojancha, in the ASADAS office)? How do you perceive this approach? Is this process connected to activities of the government? // Is there something you would like to change with the way conflicts are resolved in this ASADA?	Is this ASADA legally recognized by the government and official ministries? Is this ASADA also in praxis recognized by the government and official ministries?
Is this ASADA legally recognized by the government and official ministries? Is this ASADA also in praxis recognized by the government and official ministries?	What is your relation to the government / institutions? How do you collaborate with regional and national institutions up to the central government?
Theoretical Extensions	
Sustainability Definition	“Ecological sustainability includes everything that is connected with the Earth's ecosystems. Amongst other things, this includes the stability of climate systems, the quality of air, land and water, land use and soil erosion, biodiversity (diversity of both

	species and habitats), and ecosystem services (e.g. pollination and photosynthesis)." (KTH) Sustainable water management means **using water in a way that meets current, ecological, social, and economic needs without compromising the ability to meet those needs in the future**. (Water Foundation)
Let them define sustainability	
Sustainable Action (E1)	How would you interpret the ASADAS contribution to sustainability for water in Hojancha? // You have talked about aspects of social / ecological / economical sustainability now. Let us look at the other aspects as well. ….
Sustainability Definitions	"**Ecological sustainability** includes everything that is connected with the Earth's ecosystems. Amongst other things, this includes the stability of climate systems, the quality of air, land and water, land use and soil erosion, biodiversity (diversity of both species and habitats), and ecosystem services (e.g. pollination and photosynthesis)." (KTH) **Social sustainability** (…) integrates topics includ(ing) but (…) not limited to; health and social equity, human rights, labor rights, practices and decent working conditions, social responsibility and justice, community development and well-being, product responsibility, community resilience, and cultural competence. (Balaman, 2019) **Economic sustainability** refers to "economic growth, which is considered sustainable as long as the total amount of capital increases". (KTH, 2020)
Sustainable Action (E1) Part 2	Do you also see contributions of the ASADA to social / ecological / economical sustainability? Is sustainability a present topic in the organisation? → If yes, how? Are goals or specific initiatives defined to contribute to sustainable development?
Internal Capabilities/Capacities (E2) - Knowledge -Diversity -Rituals -Communication	How is knowledge developed? // Does individual or team trainings have taken place? How is knowledge shared in the organisation? (informal

and formal ways) How would you describe the different educational and professional backgrounds present in this ASADA, through its members? Do you use rituals you use (weekly meetings and other formats) to collaborate and work together? What are your used forms of communication within the ASADA? What are your used forms of communication with the wider community? Do you collaborate with other ASADAS?

Table B3 NVivo Codebook (authors elaboration)

Name	Files	References
Background	0	0
Function	9	13
Other occupations	6	7
Starting Time	9	10
Successes	3	6
Clearly Defined Boundaries (DP1)	2	2
Defined Regulations & Rights	10	43
Geographical Boundary	10	13
Collective Choice Arrangements (DP3)	10	38
Community & Environment	8	18
Trust	4	5
User satisfaction	5	6
Conflict Resolution Mechanisms (DP6)	10	50
Congruence (DP2)	10	41
Digitalization	1	4
Financial situation	4	11
Graduated Sanctions (DP5)	10	35
Inner Capabilities (E2)	0	0

Collaboration	10	27
Communication external	10	13
Communication internal	8	8
Education	9	14
Knowledge development	10	14
Knowledge sharing	10	10
Members	8	10
Motivation	10	14
Principles	1	1
Rituals	6	6
Transparency	1	1
Junta Directiva	1	2
Liga	1	2
Maintenance	1	1
Minimal Recognition of Rights to Organize (DP7)	10	19
Monitoring (DP4)	10	41
Muni	1	2
Nested Enterprises (DP8)	10	29
Reflection	3	3
Responsibility	1	1
Role of Women	3	3
Safety	1	2
Share of women	2	3
Size of Organisation	3	4
Summer issues	1	1
Sustainability (E1)	1	1
Ecological Sustainability	3	4
Economic sustainability	1	1
Long-term thinking & development	6	10
Social Sustainability	3	3
Sustainability contribution	9	17
Sustainability Definition	9	9

Sustainability initiatives	4	4
Sustainability presence in ASADA	8	14
Tariff	1	1
Understaffed	2	2
Unpaid work	3	3

B4 Consent Form English and Spanish Version

Master Thesis Research

"The Role of Community-Based Organisations in facilitating collective and Sustainable Action for Local Water Management, in Hojancha, Costa Rica"

This interview is part of an ongoing research project called "The Role of Community-Based Organisations in facilitating collective and Sustainable Action for Local Water Management, in Hojancha, Costa Rica".

The project is funded by and carried out at Lund University, as part of the Master in Innovation and Global Sustainable Development.

The project aims at understanding how community-based organisation, here the ASADAs, facilitate collective and potentially sustainable action in water management in Hojancha, from the perspectives of the ASADAs and the community of Hojancha:

The project is led by Marie Luise Fiona Munzert and supervised by Rhiannon Pugh.

The project is supported by the Universidad Nacional de Costa Rica.

Interview Consent form – individual interviews

The interview will be tape recorded, and the interviewer will take notes. Both notes and recordings will remain confidential. Your personal identity will remain anonymous. No views will be directly attributed to you in any document that may be produced from the interviews. The name of your firm or institution may, however, be included in the report unless you explicitly request otherwise. We are aware that these interviews may include risks by discussing sensitive information. These risks will be mitigated by a strict protection of the data in a password protected software environment. Only the project leader, supervisor and the researchers in the project will have access to the notes. The information gathered from this study will be used to contribute to the project. It may be presented in the form of a report, a paper to a colloquium and/or a published scientific paper.

Consent

I hereby agree to participate in research regarding “The Role of Community-Based Organisations in facilitating collective and Sustainable Action for Local Water Management, in Hojancha, Costa Rica “ on the conditions above.

I understand that if I decide to participate in this study, my participation is free and voluntary and I have the right to withdraw my consent to take part or to stop my participation at any time without penalty or negative consequences.

……..

Signature of participant Date:……..

Name……

I hereby agree to the tape recording of my participation in the study

……..

Signature of participant Date:……..

If you have any questions about your rights as a study participant or are dissatisfied at any time with any aspect of the study, you may contact Marie Luise Fiona Munzert at this phone and this email.

+49 1632665733
mariemunzert@hotmail.de

Investigación de Tesis de Maestría

"El Rol de las Organizaciones Comunitarias en la Facilitación de la Acción Colectiva y Sostenible para la Gestión Local del Agua, en Hojancha, Costa Rica"

Esta entrevista forma parte de un proyecto de investigación titulado "El Rol de las Organizaciones Comunitarias en la Facilitación de la Acción Colectiva y Sostenible para la Gestión Local del Agua, en Hojancha, Costa Rica".

El proyecto está financiado y se lleva a cabo en la Universidad de Lund, como parte de la Maestería en Innovación y Desarrollo Sostenible Global.

El objetivo del proyecto es entender cómo las organizaciones comunitarias, en este caso las ASADAs, facilitan la acción colectiva y potencialmente sostenible en la gestión del agua en Hojancha, desde la perspectiva de las ASADAs y de la comunidad de Hojancha:

El proyecto está dirigido por Marie Luise Fiona Munzert y supervisado por Rhiannon Pugh.

El proyecto cuenta con el apoyo de la Universidad Nacional de Costa Rica.

Formulario de consentimiento para entrevistas individuales

La entrevista se grabará digitalmente y el entrevistador tomará notas. Tanto las notas como las grabaciones serán confidenciales. Somos conscientes de que estas entrevistas pueden entrañar riesgos al tratar información sensible. Estos riesgos se mitigarán mediante una estricta protección de los datos en un entorno informático protegido por contraseña. Sólo el investigador del proyecto tendrá acceso a las notas.
Su identidad personal permanecerá en el anonimato. No se le atribuirá directamente ninguna opinión en ningún documento que pueda elaborarse a partir de las entrevistas.
No obstante, el nombre de su empresa o institución podrá aparecer en el informe, a menos que usted indique explícitamente lo contrario.
La información recogida en este estudio se utilizará para contribuir al proyecto. Podrá presentarse en forma de informe, ponencia en un coloquio y/o artículo científico publicado.

Consentimiento

Por el presente acepto participar en la investigación sobre "El Rol de las Organizaciones Comunitarias en la Facilitación de la Acción Colectiva y Sostenible para la Gestión Local del Agua, en Hojancha, Costa Rica" en las condiciones arriba indicadas.

Entiendo que si decido participar en este estudio mi participación es libre y voluntaria y tengo el derecho de retirar mi consentimiento para participar o dejar de hacerlo en cualquier momento sin penalización ni consecuencias negativas.

……..

Firma del participante

Fecha:……..

Nombre y apellidos en mayúsculas:……

Acepto que se grabe la entrevista que me realizarán: ( ) Sí ( ) No

Si tiene alguna pregunta sobre sus derechos como participante en el estudio o no está satisfecho en algún momento con algún aspecto del estudio, puede ponerse en contacto con Marie Luise Fiona Munzert en este teléfono (+49 1632665733) y este correo electrónico

(mariemunzert@hotmail.de).También puede contactar con la supervisora Rhiannon Pugh en la Universidad de Lund en el correo electrónico rhiannon.pugh@circle.lu.se.

B5 Survey Questionnaire

Research Topic	Questions
Personal Information	**What is your gender?** - Women - Men - Other - Prefer not to answer **How old are you?** - below 18 - 18-25 - 25-30 - 30-40 - 40-50 - 50-60 - 60-70 - 70+ **Where do you currently live?** - Pita Rayada - Pilangosta - Hojancha - Monte Romo - Betania de Puerto Carrillo - San Isidro - Estrada - Huacas - San Miguel - San Rafel - Lajas - Santa Marta - Santa Lucia - El Socorro - Maravilla - Guapinol - Other: **What is your current occupation ?** - Agriculture and plantations - Trade and commerce - Food and drink - Construction and building - Education and training - Water, gas and electricity services - Health services - Public utilities

	- Forestry and timber - Transportation - I do home care work (home, children, elderly, etc.) - I work as a volunteer - I am studying - I am retired - I am unemployed - I work as a service worker - Other **What is your eduction level?** -primary school, incomplete - primary school - secondary school - CTP - higher technician or similar - baccalaureate - bachelor's degree - master's degree or higher - Other **Do you hold any voluntary roles?** - Yes, currently - No - No, but in the past I did
Clarity over Objectives and Benefits	**What are the main tasks of the ASADA?** - Continuous provision of water - Provision of water of high quality - Construction of acueductos and sewage tanks - Maintenance of acueductos and sewage tanks - Administration of acueductos and sewage tanks - Development of acueductos and sewage tanks - Assuring that acueductos and water systems comply with regulations - Assuring ecological stability of rivers and water basins - Other
Engagement	**How often do you have contact to the ASADA?** - never - 1x per year - 2-5x per year - 5-10x per year - +10 x per year **What were your reasons for doing so?** - a problem /issue - collaboration - to receive information - to share information - other: **Are you affected by decisions made by the ASADA?** - Yes - No - I don't know
Trust / Collaboration offen why	**Can you voice your opinion to the ASADA?** - Yes - No

	- Why: **Can you voice your needs to the ASADA?** - Yes - No - Why: **Do you feel like you can implement your ideas?** - Yes - No - Partly - Why: **Do you have trust in them to do their job effectively?** - Yes - Partially - No - Why:
Transparency	**Does the ASADA communicate information to you? (For example about water quality)** - Yes, often - Yes, sometimes - No, never **How do you receive information from the ASADA?** - Phone (Whatsapp group) - Flyer - Conversation - Reports - Meetings (weekly) - Meetings (monthly) - Meeting (yearly) - Other: **Are you satisfied with the amount of communication and information you receive from the ASADA?** - completely dissatisfied - somewhat satisfied - satisfied - absolutely satisfied
Satisfaction / Legitimacy	**How satisfied are you with the availability of tap water in your home? (Madrigal-Ballestero et al., 2013)** - 1: completely dissatisfied - 2: somewhat satisfied - 3: satisfied - 4: absolutely satisfied **How satisfied are you with the quality of tap water in your home? (Madrigal-Ballestero et al., 2013)** - 1: completely dissatisfied - 2: somewhat satisfied - 3: satisfied - 4: absolutely satisfied
Community	**How would you rate the feeling of community you have in your village?** - strong - medium - low

- none
- dont want to answer

Do you feel like the ASADA is a part of the community?
- Yes
- Partially
- No