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Water Governance in Cambodia: From Centralized Water Governance to Farmer Water User Community

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Received: 22 March 2017; Accepted: 29 August 2017; Published: 31 August 2017

Abstract: Cambodia has abundant water resources in the wet season and a scarcity of water in the dry season. These phenomena undermine the development in this country and pose a threat to long-term development. Hence, the governance of water becomes critically important for the current and future development of Cambodia. Thus, this study is undertaken to understand the current water governance practice, challenges and constraints that prevent Cambodia from managing water effectively, and identify opportunities to improve it. In doing this, the study examines the water governance in Cambodia from a large-scale water management system and three community-based water resource management systems and farmer water user communities (FWUCs) in three provinces around Cambodia. It concludes that the current water governance practice in Cambodia is still too weak and fragmented to address the water security issues affecting the country, and thus, reorganization of the current structure and system of the water governance framework would be required to address long-term water security issues.

Keywords: water governance; water security; water equity and efficiency; farmer water user communities; flooding; drought; livelihoods

1. Introduction

Cambodia has abundant freshwater resources. The Mekong River, and the Tonle Sap Lake are the main sources of freshwater resources for Cambodia. The Mekong River flows through Cambodia over 500 km from Laos's border to the Mekong Delta in South Vietnam, bringing a large volume of water flowing across its territories. The Tonle Sap Lake, the largest freshwater lake in Southeast Asia, takes and releases millions of cubic meters of water from and to the Mekong River [1]. About 75,000 million m^3 of surface water run off Cambodian land in the wet season each year, but only 1% of the total amount of water in the country—or 750 million m^3 [1]—is actually used by humans, and 95% of this is used for agriculture [2].

The over-abundance of water in the wet season causes frequent floods, damaging agriculture, leading to health problems and adversely impacting on the livelihoods of many Cambodian people [3]. Meanwhile, the most severe droughts to have occurred in the country thus far were in 2002, 2012, 2015 and 2016. In 2016, the government of Cambodia declared a state emergency for the first time in its history due to severe drought that affected its population and the development of the entire country. The subsequent droughts caused crop and agriculture damage, food shortages and the spread of disease [4,5]. Floods and droughts are a double edge sword; they have impacts on both humans and the environment. Floods accounted for 70% of rice production losses between 1998 and 2002, while droughts accounted for 20% of those losses [6]. The other 10% of losses was due to other causes such as pest and disease outbreaks [7].

The frequency and intensity of floods in Cambodia may increase in the future due to changing climatic conditions, with water resources affected by climate change in a number of ways. It is

predicted that by 2100, annual rainfall in Cambodia could increase by between 3% and 35% over current levels [8], but that there will be a reduction in the number of rainfall events, suggesting that the intensity of the rain will increase. This situation will be exacerbated by the deteriorating condition of watersheds, catchments and floodplains in terms of vegetation cover, as this will affect the runoff and replenishment of groundwater. In addition, wet seasons are predicted to become shorter. This all means that farmers who depend on rain-fed agriculture will be increasingly at risk of disasters, and especially droughts and floods, causing severe damage to rice harvests.

The governance of water becomes critically important for the current and future development of Cambodia. Failure to implement such governance would result in heavy annual losses financially and economically. The collapse of the Angkor Empire was associated with the failure to manage water by later Angkor rulers [9]. Recognizing this, various regimes including the current government have promoted water management as a key government priority, aiming at enhancing agriculture and boosting the national economy. However, the current water governance practice is suffering from a weak governance system, as water management falls within the remit of the Cambodian state, which has an important role to play in that regard, and large-scale irrigation schemes dominate the water management, but such schemes are expensive, plus they tend to suffer from a shortage of water during the dry season. Also, many of them do not function fully as only the main canal was built; the smaller canals used to distribute water were not built, due to financial constraints. These large-scale irrigation schemes were badly maintained and operated, due to the many stakeholders involved. Ministry of Water Resources and Meteorology (MoWRAM) is the main government agency responsible for water management in the country; however, though it is active in helping to build large-scale irrigation schemes, it does not maintain them. The maintenance and operation of such schemes falls to the local level, but local governments and communities, particularly the established farmers' water user communities, do not have the capacity, resources and procedures in place to handle these complexities. Thus, the maintenance and operation of the large-scale irrigation schemes remains inadequate. These are having adverse impacts on the national economy as well as the livelihoods of local people.

Thus, this study was undertaken to analyze challenges and constraints that prevent Cambodia's government and farmer water user communities (FWUCs) from managing water effectively, and identify opportunities to improve it. In doing so, first, this study reviews and employs the theoretical framework related to water governance to analyze water governance practices in Cambodia; second, the study examines water governance in Cambodia through analyzing three case studies of FWUCs in three selected study sites: (i) Kamping Puoy in Battambang Province, (ii) Stung Chreybak in Kampong Chhnang Province, and (iii) Seang Kveang in Prey Veng Province; and third, the study provides recommendations for practical inclusion in national and sub-national water management.

This study is critical to the understanding of water governance in Cambodia and the identification of opportunities to improve it. The study contributes to the knowledge of water governance through providing practical knowledge from water governance in Cambodia that water governance is not only challenged by scarcity or availability, but by institutional and legal arrangements, and stakeholder participations.

2. Theoretical Framework for Water Governance

Water is essential for life, the environment and development. Water resources may start within an open access regime but are often appropriated by a group and become a common property resource. When individuals or groups of individuals share water resources as a common property resource, people are connected in a socio-political, economic and ecological sense [10]. In a common pool, actions influence those sharing the resource regardless of the property regime under which the resource is held and its governance is distributed from this perspective [11].

At present, given the increased demand for water as a result of increasing development, population growth, and expanding economies, water management and governance is becoming

challenged [12,13]. Hufty [14] defines governance as the way in which society develops its own ways of making decisions and resolving conflict, and it is a process of interaction, and decision-making in which actors are involved in addressing a collective problem, leading to the creation, reinforcement, or reproduction of social norms and institutions. The Global Water Partnership defines water governance as the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society. Along this line, John Dore [13] defines water governance as the way in which society shares power with respect to discussion about how water resources are to be developed and used, and the distribution of benefits and involuntary risks from doing so. In his analysis, he argues about the importance of fairness, effectiveness and social justice in water governance.

In analyzing governance, Hufty [14] introduces the Governance Analytical Framework (GAF) to analyze the governance practice through five analytical tools: problems, social norms, actors, nodal points and process. He further elaborates that problems are sets of interrelated issues at stake; actors or stakeholders are involved in a collective action to address these problems, leading to the formulation of the social norms that guide, prescribe, and sanction collective and individual behavior through a process of complex interaction at a nodal point over time and space. In water governance literature, many scholars pinpoint three key approaches to water governance. First, as a cross-cutting issue, water governance is concerned with the design of policies and institutional arrangement, and its processes that seek to enhance efficiency, equity and effectiveness of water management and share it for users and uses to benefit society and its members [12]. It is also concerned with political, social and economic organizations and institutions and their relationships, which are important for water development and management [11,12,15]. However, according to Stein et al. [16], the legal and institutional frameworks discussed above tend to focus on the formal administrative structure, those being explicitly stated in specific policy documents and laws. They argue that these may have little to do with the everyday reality of natural resource managers and users, their behavior and social interaction. Furthermore, Stein et al. [16] introduce a social network approach to analyzing water governance, particularly the aspects of the social complexity underpinning water resources governance. Tortajada [12] mentions the holistic approach in the agenda of future water governance.

A second approach of water governance is concerned with the decision-making processes, the ensuing allocation of resources and services and the impacts of such decisions on access to resources and services of different players. In this line, Dore [13] introduces deliberative water governance in which actors are involved in constructive engagement and inclusive deliberation, using critical analysis and social learning to build the institutions and policies to manage and use water fairly, effectively and equitably. Furthermore, Dore et al. [17] introduce a framework for analyzing tranboundary water governance complexes in the Mekong Region, and argue that water governance is a social process of dialogue, negotiation and decision-making, in which there are many different actors dealing with a variety of issues influenced by their individual and shared context—actors engage in multiple arenas, depending on opportunity, necessity and choice; drivers are what influence and motivate actors; actors employ drivers to establish and legitimize their positions, inform debate and influence negotiations; decisions emerge from the arenas, and the impacts of decisions result in fairness and sustainability of water allocation [17,18]. In addition, Ratner et al. (2013) [19] look at the governance of the aquatic agricultural system (AAS) from three governance's dimensions: (i) Stakeholder representation—which actors are represented in decision-making and how? (ii) Distribution of authority—how is formal and informal authority distributed with regard to decisions over resource access, management, enforcement, dispute resolution, and benefit sharing and (iii) Mechanisms of accountability—how are power-holders held accountable for their decisions, and to whom? These form the basis of governance of resources [20].

The management and allocation of water is driven by two water dimensions: (i) water as a basic good, and (ii) water as an economic good. Access to water resources is essential for the livelihoods of the rural poor. Furthermore, access to water plays important roles in assuring the well-being of people and reducing crop failures during dry spells, and provides opportunities for farmers to grow

two or three rice crops a year. However, treating water as a public good and the subsequent logic of it being free to all does create a few problems. The first is the inability of state institutions to respond to the needs of their citizens. Perry et al. (1997) [21] argue that the state is, by its nature, slow to respond to people's needs, due to bureaucracy, rules and regulations. Secondly, treating water as a public good can lead to wasteful use, as it is free and wastage does not incur any cost [20,22,23]. Then, people have to pay to use water, and because people are usually interested in maximizing profit/minimizing cost, they will only use enough water to satisfy their immediate needs [21]. In addition, markets can respond to people's needs faster than the state [21].

Third, water governance is intimately linked to the physical infrastructure that has been constructed and operated for the regulation, abstraction, storage, transport and distribution of water. The design and functioning of water infrastructure has an impact on the ecological and social landscape in which it is situated, and vice versa, as the prevailing social systems and processes shape the physical infrastructure used for management of water. Understanding a particular water governance configuration thus requires the recognition of the interdependency of prevailing social, technological and ecological systems. What this interaction also highlights is the dynamic nature of governance arrangements and processes [11,20].

For over two decades, from the 1950s to the 1970s, the dominant paradigm for water management globally involved large-scale water projects. These schemes were promoted, as they were seen by many states and development experts as a way to achieve rapid economic growth, thus benefiting a large number of people in the agricultural sector and producing cheap electricity for industry [24]. However, large-scale irrigation schemes often suffered from inadequate operation and maintenance systems, leaving them unable to respond to the needs of local people. These schemes also came in for criticism from social activists and academics, who were concerned first about the projects' impacts on the environment, and also that the benefits of such projects were being measured solely in terms of financial imperatives. The construction of large-scale schemes, in general, does offer the potential for irrigating large areas under cultivation, for improving transportation and also for providing cheap electricity. However, large-scale schemes also tend to cause disruption to regional ecosystems, resulting in environmental destruction and affecting local residents.

Since the 1990s, however, as criticism of large-scale irrigation schemes has grown, so too has the presence of alternative development approaches. These new approaches have tended to focus on small-scale schemes. Unlike large-scale schemes, a small-scale approach is usually more decentralized, and so allows people to communicate their needs to local officials and service providers. Local community-based water management would seem to be an old idea whose time has come again, as such an approach is seen as more politically and socially acceptable these days [25–27].

This article takes the conceptual discussion above to analyze the water governance in Cambodia. It first looks at the water governance in Cambodia, focusing on the current practice, challenges and opportunities; second, it studies the decentralized water management practices through FWUCs by the government of Cambodia to identify the key challenges to water governance; third, it examines three case studies of FWUCs to understand practical water governance at community level; and finally, it identifies strategies for enhancing water governance.

3. Methods

Water governance has long been an issue in many parts of Cambodia. It is beyond the scope of this study to understand the challenges and opportunities for improving water governance across the entire country. Rather, the study focuses on areas where critical water management issues, particularly the problem of too much or too little water, are affecting the livelihood security of rural communities and risk impairing the functioning and sustainability of ecosystem services. Thus, two important regions—the Tonle Sap and the Mekong Delta—were selected for study. The Tonle Sap region is located in the center of Cambodia, covers six provinces and is home to about 4 million people. It is likened to the heart of Cambodia, with the Mekong River flowing in and out of the Tonle Sap Lake,

supporting fishery productivity and rice farming. The Mekong Delta is a fertile rice producing region, where water management is key for maintaining production. It covers 10 provinces including Phnom Penh and is home to about 6 million people [28].

Two provinces—Battambang and Kampong Chhnang—in the Tonle Sap region were selected for study. Battambang is one of the most productive rice growing areas in Cambodia. Irrigation and therefore water governance have come to play essential roles in sustaining rice cultivation in the province. To understand how water governance contributes to rice cultivation, the Kamping Puoy irrigation scheme, one of the largest in Battambang, located in the northwest near the Tonle Sap Lake, was selected for in-depth study. In Kampong Chhnang, the Stung Chreybak River is a tributary of the Tonle Sap Lake. This river flows into the Tonle Sap Lake and farmers and communities along its length rely on its water for rice farming and household consumption. Conflicts have occurred between upstream and downstream farmers. Water governance is considered one of the approaches to address such conflicts, sharing water resources and improving productivity of water for rice farming. Thus, Stung Chreyback was chosen as one of the study sites.

Prey Veng province in the Mekong Delta is characterized by the Cambodian government as vulnerable to flooding and drought, which have been affecting both wet- and dry-season rice farming for many years. Water governance is one of the strategies of national and provincial governments to address flood and drought in the province and secure rice farming for its large population. A better understanding of water governance in this province could provide important lessons learned and recommendations for how it can be improved in the long run. Seang Kveang irrigation scheme in Prey Veng province was one of the many schemes chosen for in-depth study. In addition, the selection of study sites for in-depth study into water management and governance was based on the availability of information and data on water management interventions, and the functioning of local farmer water user communities (FWUCs) (Figure 1).

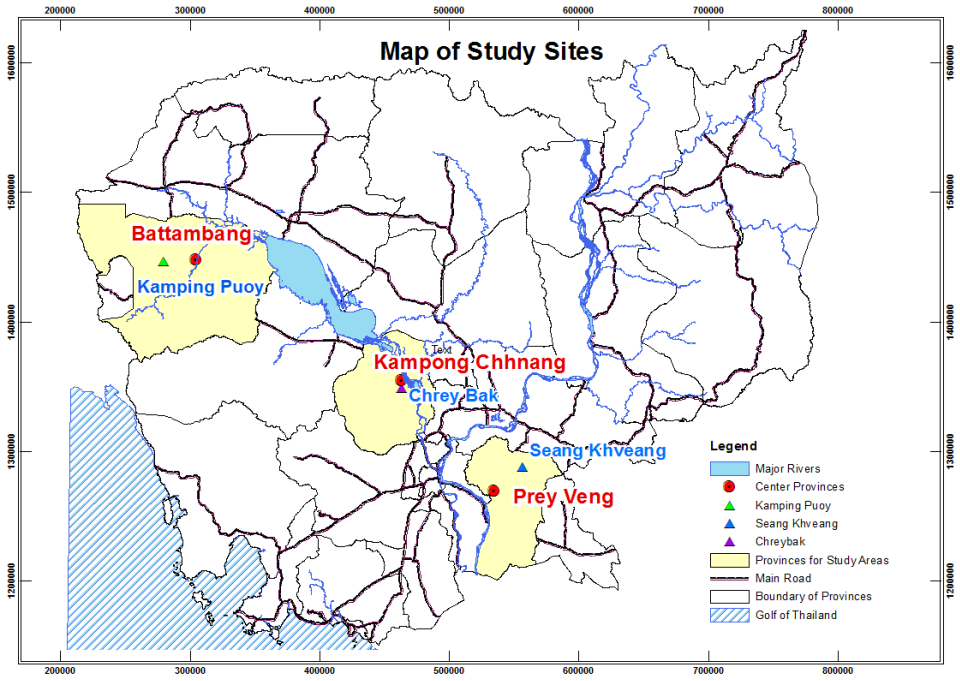

Figure 1. Map of study sites.

Primary and secondary data was gathered between July and September 2016. Secondary data was collected from various archive sources at national, provincial and local levels. The Ministry of Water Resources and Meteorology (MOWRAM) and the Cambodia Development Resource Institute (CDRI) were rich sources of documents, books and research papers. Data on population, cultivated

areas, irrigated areas and rice yields was collected from the provincial departments of Agriculture, and Water Resources and Meteorology, and the commune offices. Although useful data for tracing water management in the study sites is available, getting access to it took constant communication to build up trust before these agencies would share it.

Primary data was collected for the specific purposes of the study. In essence, the questions the researcher asked were tailored to elicit the needed data. The researcher gathered data from semi-structured interviews with stakeholders at the national and community levels, and through focus group discussions (FGDs) in three communities: Kamping Puoy in Battambang province, Stung Chreybak in Kampong Chhnang province, and Seang Kveang in Prey Veng province.

Key stakeholders were purposely selected for interview based on time and resource constraints, as well as on their involvement in water governance in the study sites, experience in water governance in Cambodia, and financial and technical support to communities. The United Nations Development Programme (UNDP) has been active in Cambodia, supporting Non-governmental Organization (NGOs) financially to work with communities in building farmer water user communities (FWUCs). The Asian Development Bank (ADB) has also been involved in financing water management in Cambodia and was therefore selected for interview. NGOs that have been working to support FWUCs were worth interviewing. In addition, representatives from the provincial departments of Agriculture, and Water Resources and Meteorology, as well as commune council members, were selected and interviewed. In total, the researcher interviewed 18 participants drawn from the UNDP, ADB (two officers), seven NGOs in Cambodia, national and local government agencies, and study communities. The interviews focused on the water management activities and programs run by each organization, the policies and legal framework in place to support such activities, the capacity of each organization to address water management issues, the level of participation among local communities and stakeholders, and the challenges and opportunities that exist to improving water management in the study areas.

Three focus group discussions (FGDs) were held, one in each study site, namely Kamping Puoy, Stung Chreybak and Seang Kveang. FGD participants included FWUC members, village chiefs and commune councilors. In Kamping Puoy, the FGD involved nine people—three FWUC members, three village chiefs and three commune councilors, representing three villages in three communes. In Stung Chreybak, the FGD was organized in a downstream community and brought together nine representatives from upstream and downstream areas to discuss the water management issues facing them. The FGD in Seang Kveang involved seven participants: two commune councilors, two village chiefs and three FWUC members. All three FGDs focused on the roles played by the FWUCs, as well as the management and use of water, the contributions made by FWUC members, the collection of water fees, any competition and conflicts that occur, and areas for improvement.

Both qualitative and quantitative analytical approaches were used to analyze the collected primary and secondary data. Since the sample size was small, the researcher used Excel to analyze quantitative data. The data was entered into Excel sheets and processed into percentages, figures and a table. It was used by the researcher to analyze the water governance in each study site. Percentage, fact and figure were supported by qualitative information. The qualitative information and data were analyzed based on the results of the FGDs, three case studies of FWUCs, the history of water governance in Cambodia and FWUCs, the legal and institutional frameworks, the performance and management of water and FWUCs, and the challenges and opportunities for improving water governance.

4. Results and Discussion

4.1. Water Governance in Cambodia: Past and Present

Cambodia has a diverse range of freshwater sources, including rivers, streams and lakes, and these contribute to abundant water resources. Of Cambodia's 181,035 km^2 of land, 86% (156,000 km^2) is drained by the Mekong-Tonle Sap system, and on average, the annual inflow of water into Cambodia

from the Mekong upstream is estimated to be 410 billion m^3 [2]. About 750 to 790 million m^3 of water (10% of the entire country's available water) is used in Cambodia each year [2], with agriculture the largest user, accounting for 56% of usage.

Management of water resources in Cambodia has long been centralized by the government and dominated by large-scale irrigation systems, evolved since the Angkor period (9th–14th centuries), the French Protectorate period (1863–1954), the Sihanouk period (1954–1970) and during Khmer Rouge rule (1975–1979), and has continued to dominate ever since [24,29,30]. The current Royal Government of Cambodia (RGC)'s 'Rectangular Strategy' has promoted large-scale water management through: (i) Enhancement of the agricultural sector, and (ii) Further rehabilitation and construction of the physical infrastructure [31].

About 2525 irrigation schemes were developed across major provinces in Cambodia [32]. These schemes are categorized into large-scale, medium-scale and small-scale schemes. Large-scale irrigation schemes can be broken down into three further categories based on the land area being irrigated. The first group of large-scale irrigation schemes irrigates more than 10,000 ha, and there are nine of these countrywide. The second group of large-scale schemes includes those which irrigate a land area of between 5000 and 10,000 ha, and there are 22 such schemes in Cambodia. Those schemes in the third group can irrigate between 2000 and 5000 ha, and there are 65 of these. The rest of the schemes fall within the medium- and small-scales. The medium-scale schemes can be broken down into two types: (i) those covering between 1000 and 2000 ha, and (ii) those covering just 500 to 1000 ha. The small-scale irrigation schemes range in size between 500 and 100 ha (Table 1). Of the irrigation schemes, 1574 do not function at all; 802 schemes function partly and only 149 schemes function well [32].

Table 1. Potential irrigation land areas in Cambodia.

Provinces	No. of Schemes	Cultivated Area (ha)	Potential Irrigated Area in the Wet Season (ha)	% of Total Cultivated Area	Potential Irrigated Area in the Dry Season (ha)	% of Total Cultivated Area
Kampong Thom	488	166,779	113,987	68.35	19,850	11.90
Banteay Meanchey	94	214,596	104,920	48.89	18,340	8.55
Battambang	132	246,494	165,991	67.34	19,278	7.82
Pursat	57	94,429	53,255	56.40	4800	5.08
Kampong Chhnang	101	124,019	35,454	28.59	15,195	12.25
Prey Veng	261	320,299	52,989	16.54	43,364	13.54
Siem Reap	250	190,740	105,389	55.25	14,679	7.70
Svay Rieng	28	161,261	28,440	17.64	33,642	20.86
Kampot	45	129,447	52,878	40.85	15,926	12.30
Kampong Speu	374	109,142	52,595	48.19	3477	3.19
Takeo	244	247,307	72,024	29.12	72,321	29.24
Kandal	108	103,715	12,310	11.87	26,329	25.39
Kampong Cham	343	218,796	51,311	23.45	33,966	15.52
Total	2525	2,327,024	901,543	38.74	321,167	13.80

Source: [32].

A range of ministries and agencies are involved in water resource management activities. The Ministry of Water Resources and Meteorology (MoWRAM) is the leading water sector agency; with overall responsibility for water management and conservation. The Water Law (2007) provides a legal and institutional mandate for the Ministry of Water Resources and Meteorology (MoWRAM) to manage water in Cambodia, and ensures accessibility for all people as well as quality and quantity, equitability, effectiveness, efficiency and sustainability [33]. Five strategic areas have been prioritized in order to achieve these priorities: (1) Water resources management, and the development and implementation of irrigation systems, (2) flood and drought management, (3) promoting the law regarding water provision and sustainability, and (4) water resources management and meteorological information.

Meanwhile, the Ministry of Industry, Mines, and Energy (MIME) focuses on providing clean drinking water, while the Ministry of Rural Development (MRD) focuses specifically on providing

clean water to rural areas, and the Ministry of Agriculture, Forestry and Fisheries (MAFF) focuses on providing water for agriculture [34]. The efficient management of the irrigation systems in place is supported by strengthening institutional capacity among the concerned ministries and agencies, and this is a top priority for the Royal Government of Cambodia (RGC). Many international donors, such as the World Bank, ADB, JICA, KOICA and Agence Française de Development (AFD) are involved in water resource management, providing financial and technical support to the ministries [26,27,31,35].

However, the governance of water in Cambodia has been challenged by weak coordination and overlapping roles of ministries related to water management and it is more concerned with economic growth than the environment, and its governance. Despite the integrated water resource management approach taken, insufficient cooperation takes place among the different ministries and even between different departments within a given ministry. Moreover, even though the MoWRAM is in overall charge of water management and conservation issues, intra-ministerial coordination is weak, meaning there is room for improvement in terms of its management capacity. Data related to water collected by individual ministries should be passed to and be accessible through the MoWRAM, with a master dataset openly available to all the ministries [34,36].

A common cause of operational problems in irrigation schemes is the way they are designed and/or constructed [18]. Some schemes date back to the Angkorian period [37], while many others were conceived under the Pol Pot regime during the latter half of the 1970s. Most schemes were not designed to cope in a context of increasing water scarcity in the dry season and with double-cropping becoming more common; most schemes were originally designed and built to provide wet-season supplementary irrigation only [38]. As a result, these schemes do not retain enough water during the wet season for use later in the dry season [27]. Flawed designs in relation to hydrological and geographical realities have also contributed to several existing schemes falling into disrepair, with failure already built into the design and/or occurring during construction.

At present, investment in large-scale irrigation schemes in the Cambodian water sector depends heavily on international donors such as the World Bank, the Asian Development Bank (ADB), the IMF and various UN agencies. Bilateral donors such as the European Union, France (through the AFD), Italy, Japan (through JICA) and Australia, South Korea (through KOICA), Kuwait, Qatar, China and India also make significant contributions to the water management sector in Cambodia [25]. This donor funding is often used to build "hard" infrastructure such as physical irrigation works, and to conduct extension programs. In Kampong Thom province, the ADB and Agence Française de Development (AFD) are the main donor agencies, providing financial support to the irrigation schemes featured in this study. For example, for the Stung Chinith irrigation scheme, the total project cost of USD 23.8 million was divided between stakeholders as follows: the ADB provided USD 16 million in loans, the AFD gave a USD 2.6 million grant, the Cambodian government provided USD 4.8 million and other beneficiaries gave about USD 0.4 million [16]. Since 2008, about 26 projects have been financed by donors across ten projects, with grants totaling USD 94.48 million and with loans given for 16 projects with a total budget of USD 1008.2 million.

Thus, water management in Cambodia is dominated by large-scale irrigation systems characterized by the use of a top-down and sectoral approach, requiring a high technical capacity, high costs and state-driven interventions. Such projects seldom involve public participation in the consultation, decision-making and design processes. As a consequence, many large-scale irrigation schemes do not operate in the dry season due to a shortage of water, while many small-scale irrigation systems, such as those suitable for small farmers, have not been built. Hence, the efficient use and governance of water resources continue to be a challenge to Cambodian farmers.

4.2. Decentralized Water Management—Farmers' Water User Community (FWUC)

In attempting to enhance the effectiveness of water management across the country, RGC has promoted the participation of local communities. Along this line, Cambodia has adopted a Participatory Water Management and Development (PWMD) approach to the planning, development

and management of water resources. Policy and instructional frameworks were developed to support the decentalized water management through which the government is developing responsibility for all water management activities, including the regulation of water access, the collection of fees and monitoring [25,39].

The government of Cambodia had developed the Water Law in 2005. Article 19 of the Water Law states that "All farmers using water from the irrigation system or part thereof may form a Farmers' Water User Community (FWUC)" [40]. The law and sub-decree give guidance on how the FWUCs should be organized. The FWUCs have to be registered in the Farmers Water User Community registry held by the provincial or municipal directorate of the MoWRAM. After having been registered, an FWUC is fully entitled to carry out activities in accordance with its statutes and is formally recognized [34].

FWUCs are established to serve the interests of farmers who have farming land and use water to irrigate their rice fields. They are part of a strategy designed to bring farmers together on the issues of sharing water and building the social capital needed to use water in a sustainable manner. The idea is that in this way the FWUCs help build collective action and solidarity.

Out of 2525 irrigation schemes, only 230 (6.3%) schemes across the country have an FWUC in place (Table 2), and of those 230, only four (2%) can be considered to be functioning well, though another 84 (36%) have the potential to do so. A well-functioning FWUC is one in which the FWUC committee or its leaders are active in the operation and maintenance of its schemes, and hold regular meetings among members during the year. In addition, irrigation fees are collected by the committee and/or the leaders on a regular basis. An FWUC that could function well is defined as one in which only some committee members and leaders are still active in terms of the operation and management of the relevant irrigation schemes.

Table 2. Farmer water user communities (FWUCs) in Cambodia.

Provinces	No. of Irrigation Schemes	Total No. of FWUCs	Irrigation Schemes without FWUC	FWUCs Functioning Well	FWUCs Could Function	FWUCs Do Not Function
Kampong Thom	488	39	449	1	9	29
Banteay Meanchey	94	28	71	1	2	25
Battambang	132	6	131		1	5
Pursat	57	9	50		5	4
Kampong Chhnang	101	18	95		6	12
Prey Veng	261	27	234		27	
Siem Reap	250	10	247		3	7
Svay Rieng	28	11	18		1	10
Kampot	45	6	40	1	2	3
Kampong Speu	374	22	368	1	5	16
Takeo	244	17	228		16	1
Kandal	108	6	104		4	2
Kampong Cham	343	31	331		3	28
Total	2525	230	2366		84	142

Source: [32].

The majority (62%) were found to be non-functioning (Table 2). The plan is that between 2014 and 2018, about 109 FWUCs involving 13,899 famer households will be established, covering 31,948 ha in the wet season and 17,587 ha in the dry season. An FWUC that does not function refers to one in which the leaders are not active [32].

However, the participation rate among farmers in the FWUCs is less than 50%. The reasons for such low participation rates include a lack of trust in the government among farmers, low participation rates among local governments, and a lack of finances [34]. A detailed action plan is needed to help convince farmers to participate in the FWUCs; however, landless people do not have an interest in becoming FWUC members, and in fact in many places landless people only fish, and farming activities often conflict with fishing. Nonetheless, there is limited information available about such conflicts.

4.3. Case Studies of FWUCs in Water Governance

Three case studies were conducted in three different communities that are engaged in water management in three ecological zones in Cambodia—one case study on the Tonle Sap Lake, the second case study on the Tonle Sap River, and the third case study on the Mekong Delta. The Stung Chrey Bak scheme in Kampong Chhnang Province represents the Tonle Sap River that could irrigate 10,367 ha of rice fields and it is classified into seven sub-irrigation schemes. These include the Trapaing Trabek irrigation scheme that irrigates 610 ha and the Taing Krasaing irrigation scheme that could irrigate 5620 ha [41]. However, the Kampong Pouy scheme, representing the Tonle Sap Lake, could irrigate 6600 ha, covering four communes: Takream, Chrey, O taki and Phnom Sampov in Battambang Province, while the Seang Kveang irrigation scheme could irrigate about 2160 ha of ricefields in Prey Veng Province, representing the Mekong Delta (see Table 3).

These case studies examine water governance at lower levels in Cambodia. They study how FWUC is organized, managed and functioned, and how water is managed and shared by community members (Table 3). The study utilizes the water governance framework to analyze the case studies, particularly the structures and processes of societies that share power, shape individual and collective actions; make decisions; and take actions through the application of responsibility, participation, information availability, transparency, custom and rule of law to use and manage water resources [42]. The study looks at these dimensions of water governance closely across three different ecological zones in Cambodia.

4.3.1. The Structure of Water Governance by FWUCs

The studied irrigation schemes were built during the Khmer Rouge periods (1975–1979). After the Khmer Rouge, these schemes were dysfunctional and unused, and large parts of the canal systems were damaged due to lack of management and maintenance. Due to security problems, many large irrigation schemes, particularly Stung Chrey Bak and Kamping Pouy were inaccessible. Nonetheless, some parts close to the towns, such as lower part of Stung Chreyback in Kampong Chhnang were secured and rehabilitation took place in 1985 and in Kamping Pouy in 1999. Furthermore, under the Rectangular Strategy of RGC, many irrigation canals and schemes were rehabilitated in the early 2000s, such as Stung Chrey Bak in 2001, Seang Kveang in 2011, and Kamping Pouy in 2014.

The rehabilitation and renovation of irrigation canals and systems has led to management and maintenance needs [43]. Water governance involves actors and structure, i.e., the arrangement of and relations between the parts or elements of institutions, markets and government. It also refers to frameworks including culture, law, agreements, materials and technical possibilities, the institutions, the market and the different levels of government within which these operate [11,13,14]. Along this line, the structure of water governance is developed, and part of this structure FWUC is established as a local level structure or a community-based water management organization to manage water in the irrigation schemes through a participatory approach [33]. FWUCs in Kamping Pouy, Seang Kveang and Stung Chreyback manage water and share it with farmers for farming activities, under the framework and support of MoWRAM (see Table 3). Meanwhile, at the provincial level, Provincial Department of Water Resources and Meteorology (PDoWRAM) provides direct technical support to FWUCs and is involved in the implementation and management of FWUCs within communities. At the national level, MoWRAM is a key central government agency, providing legal and technical support to FWUCs when established. FWUCs were established in accordance with the guidelines and frameworks provided by MoWRAM.

Table 3. Case studies of FWUCs in water management.

Case Studies	Seang Kveang	Kamping Pouy	Stung Chrey Bak
Province	Prey Veng	Battambang	Kampong Chhnang
No. villages/communes	5 villages/2 communes	25 villages/4 communes	15 villages
Year of building	During Khmer Rouge (1975–1979), and it has not been functional after that.	During the Khmer Rouge, but rehabilitated between 1999 and 2014.	It was built in 1976 during the Khmer Rouge.
Year of rehabilitation	FWUC was established in 2011, with the support of Community Resource Improvement for Development (CRID) and also Seang Kveang's commune councils.	The irrigation schemes was rehabilitated in 1999, and again in 2014. FWUC was established during these periods by MOWRAM.	Trapaing Trabek irrigation scheme was built in 2001, and Taing Krasaing was built in 1976 and renovated by AFSC in 1985, then by PRASAC in 2001. The FWUC was established in that year to manage water.
Irrigated areas (ha)	The irrigation schemes irrigate 2160 ha of ricefields.	The irrigation scheme covers 6600 hectares across four communes: Takream, Chrey, O taki and Phnom Sampov.	Seven irrigation schemes irrigating 10,367 ha. Trapaing Trabek irrigation scheme irrigates 610 ha. Taing Krasaing irrigation scheme irrigates 5620 ha.
Committee	The committee to manage FWUC was established and five permanent members, including two women were elected by villagers and facilitated by the commune councils and each village headman	The committee was established in 1999, and on 26 June 2014 was legally recognized by the RGC. There are four executive management members in the FWUC and 43 sub-groups representing four communes. There were around 115 female members.	With support from the PDoWRAM, an FWUC was established in 2001 to manage and operate this irrigation scheme.
Water fee	Water users who have paddy fields near the canal must pay 10,000 R/ha per crop. Those whose paddy fields are further away pay 5000 R/ha. The household furthest away pays only 3000 R/ha.	Between 2000 and 2002, members contributed 150 kg of rice per ha, but since 2002 members pay water fees of 40,000 Riel/ha. The water fees are then used to fund two key activities: 70% is used for operating and maintaining the scheme and 30% is used to support the FWUC's activities. The money given to the FWUC (30%) is further divided into two: 5% to support the FWUC committee/office and 25% to incentivize fee collection task force members to do their job effectively.	Water fee is collected by the committee, depending on the location of the ricefield.
Crop intensity	The irrigation scheme has provided more water to irrigate ricefields. Farmers could cultivate 2–3 rice crops a year.	The irrigation scheme has provided more water to irrigate ricefield. Farmers cultivate 2 crops a year	The irrigation scheme has provided more water to irrigate ricefields. Farmers cultivate 2–3 crops a year.
Yields	Before the canals were constructed, the average rice yield was 3–3.5 tons/ha, whereas now it is between 4–4.5 tons/ha.	The rice yield is about 3–4 tons/ha.	Rice yield has increased to 4–6 tons/ha.

At the community level, the by-law for each FWUC was developed as a community law to guide and regulate the water uses and its management in each irrigation scheme. The by-law is developed by members of FWUCs in consultation and guidance with MoWRAM, and facilitated by PDoWRAM. When completed, the by-law is approved and registered by MoWRAM. Without that, the FWUC is not recognized. Following the approval and recognition by MoWRAM, the FWUC is organized to manage water in the irrigation schemes. In doing so, the FWUC has to follow the rules and regulations set by MoWRAM and its by-laws. In addition, the FWUC has to report to MoWRAM and PDoWRAM. Thus, the FWUC is characterized as a centralized management system that functions as an arm of MoWRAM.

4.3.2. The Process of Water Governance in FWUCs

The schemes irrigate large land areas, and so, in many cases, they involve many villages, in which many villagers are members of FWUCs. Water governance in each of these schemes is a process of interaction or a series of actions or steps under the arranged structures with defined roles and responsibility based on policy, laws, agreements, materials and technical possibilities in order to achieve a particular end [11,13,41]. Furthermore, it is a process of dialogue, negotiation and decision-making, involving a wide range of actors, and between upstream and downstream communities. This process is facilitated by mechanisms or institutions such as MoWRAM/PDoWRAM that are at the centre of how community members cooperate to use waters and it involves water allocation, creation and management of water infrastructure and implementation of protection, monitoring and assessment of water quality and quantity [17,41].

Communities in the study areas have engaged in a long process of dialogue and negotiation over the access and uses of water. In Stung Chreybak, the conflicts between upstream and downstream communities led to the management of water failing over 10 years between 2000 and 2010, and it took a long process and great efforts to bring communities to communicate over the sharing of water, and negotiate the procedures to open up the water and release water downstream. The same happened in Kamping Pouy and Seang Kveang where communities surrounding the irrigation schemes competed for water, leading to poor maintenance and broken dikes, for instance in Kamping Pouy in 2010. This happened through the facilitation provided by PDoWRAM and local governments such as commune administrations and NGOs.

The dialogues and negotiations enable different downstream and upstream communities to work together to manage the river basins and schemes and share water. The establishment of FWUCs was the result of dialogues and negotiations. However, the dialogue and negotiation did not end there; it continues throughout the process of water governance until FWUC members receive water for farming. More importantly, the by-law development involves FWUC members from the discussion of articles in by-law through to the approval by MoWRAM. It took FWUC members from 2 to 3 years to complete it and it is done through an engagement, dialogue and negotiations.

The management of FWUC is guided by the community by-law that details the management system, the leadership, the decision-making and the sharing of benefits. In doing so, members of FWUCs elect their representatives to sit on the committee and to handle the management of water, the distribution of water, the sharing of the benefits and the maintenance of the schemes. Nonetheless, more than one village uses the water from each scheme and so, representatives from each village elect their representatives to sit on the committee. There are at least about 5–12 people who sit as committee members, and this comprises the chairman, the treasurer, and the members. The FWUC committee in Seang Kveang comprises five permanent members, including two women, elected by villagers and facilitated by the commune councils and each village headman. In Kamping Pouy, there are four executive management members in the FWUCs and 43 sub-groups representing four communes. There were around 115 female members, while Stung Chrey Bak has five committee members who work to lead the FWUCs. These Committees work to operate the irrigation schemes and allocate water to farmers to irrigate their farming fields.

Members of FWUCs from different villages, either upstream or downstream, near or far from the canals or water gates, negotiate their positions and make sure that FWUC committees distribute water fairly, equitably and timely. These negotiations require a strong facilitation process and powerful respected bodies to make fair decisions and the participation and agreement of all members. Members of FWUCs are involved in the process of negotiation and discussion over the close and open of the water gates. They also negotiate the times and schedules to open the water gates of the irrigation schemes when they cultivate rice, and to close it when there is too much water that could flood or spoil their ricefields, or when they harvest the rice. The negotiation between the downstream and upstream river communities such as in Stung Chreybak and Kimping Pouy improves the water sharing process between downstream and upstream communities, between farmers with farmlands close to and far from the reservoirs. The negotiation has reduced the conflicts between farmers, between villages and within villages such as the case of Seang Kveang and Stung Chreybak.

Members of FWUCs also negotiate the water fees and the times to pay the fee. FWUC committee members collect water fees from farmers, particularly after rice harvest. About 60% of FWUC members pay the water fees on time, while about 40% did not, depending on the yields and the returns from rice farming, and 80% of FWUC members pay the water fees, and 20% did not pay, as they argue that they farm in the wet seasons, and rely on rainfalls.

The water fee per hectare of rice field varies from scheme to scheme, but it is about 10,000–400,000 riel/ha, depending on the location of the farmer fields, upstream or downstream, close to or far from the schemes. In the Kamping Pouy scheme, the water fee is varied between past and present. Between 2000 and 2002, the water fee was paid in rice, estimated at about 150 kg per ha. However, since 2002, they changed it to cash, about 40,000 riel/ha (US$10/ha). The water fees are managed by the FWUC's Committee and then used to fund two key activities: (i) 70% is used for operating and maintaining the scheme and (ii) 30% is used to support the FWUC's activities. The money given to the FWUC (30%) is further divided into two: (a) 5% to support the FWUC committee/office and (b) 25% to incentivize fee collection task force members to do their job effectively. A bank account is set up to keep the funds collected from farmers, and the bank transaction has to receive the approval of the committees.

In Seang Kveang, the water fee is charged at the rate of 10,000 riel/ha/crop for the paddy fields near the canal. However, those whose paddy fields are further away pay 5000 riel/ha. The household furthest away pays only 3000 riel/ha. This is very similar to the Stung Chrey Bak, where those fields close to canals would pay around 10,000 riel/ha/crop; but those fields far apart would pay 6000 riel/ha/crop. Moreover, the water fee is not regularly paid, depending on the rice yields, and so, not all farmers who use the water paid the fee, contributing to a shortage of funds for canal rehabilitation and maintenance.

FWUCs also work with relevant stakeholders at the local and provincial levels and seek technical and financial support from these stakeholders aiming at contributing to the management of water in a given FWUC's areas. Many FWUCs receive financial, technical and management support from NGOs. NGOs, in most cases, receive funding from funding organizations to support FWUCs in carrying out their water management functions, for example, Seang Kveang FWUC received support from Community Resource Improvement for Development (CRID), Stung Chrey Bak from American Friend Service Committee (AFSC); and Kamping Pouy from ADB. Nonetheless, most NGOs do not possess the technical capacity with respect to water management, but rather are adept at community organization and development. In carrying out water governance activities at the community level, FWUCs work with PDoWRAM, and line agencies. Also, relationships with other key local players, such as commune councils, add a further layer of complexity and support (through merged memberships) FWUCs' level of authority [26].

However, FWUCs also lack formal conflict resolution mechanisms, and cannot take measures against non-compliant farmers such as water conflicts between upstream and downstream farmers, and non-paid water fees from farmers; but they rely on PDoWRAM and commune councils to handle

their conflicts. A failure to coordinate with line agencies means that FWUCs cannot enforce their rules on water allocation, and this causes farmers to become less interested in participating in the FWUCs' activities. Instead, they turn to the commune councils to resolve any water-use conflicts that occur. FWUCs' independence is further weakened by their dependence on local political actors, as most FWUC activities are implemented under the direction of the commune chief, who is normally a highly political actor. A lack of human resources and technical capacity within the FWUCs themselves is a major reason for this dependence on external actors [25]. Farmers often do not appreciate the importance of regularly maintaining modern irrigation schemes; their high maintenance costs mean that some farmers think that irrigation systems built during the Pol Pot period were better, as they were simple and easier to operate and maintain.

4.3.3. The Operation and Maintenance of the Infrastructure within FWUCs

The studied schemes experience abundant water resources in the wet season, but shortage of water in the dry season. The management of too much and too little water has been a key challenge in water-dependent communities such as in the stud areas in terms of flash floods in the wet season and drought in some parts of the schemes in the dry season. Thus, operation and maintenance of the schemes with the participation of FWUC members would address the issues of floods and droughts.

Each scheme has canals and reservoirs. The canal is branched into the main canals, the secondary canals and tertiary canals; however, the secondary and tertiary canals are not well-established and rehabilitated and so, water does not reach the further away ricefields, causing conflicts with farmers in the remote ricefields. In the study schemes, it is not recognized whether it is the secondary or tertiary canals, since it is not well-managed. Moreover, each study scheme has well-structured reservoirs with water gates constructed to store and to release water. The study found that, on the one hand, the canals and irrigation schemes have increased the water flows to a reservoir and storage; and further down to the ricefields. These systems help reduce the floods or flash floods in the areas and increased the water availability for the dry season uses. On the other hand, every farmer could access water in the schemes, and the establishment of FWUCs has enabled them to participate and manage water for their benefits. In addition, FWUCs have provided a framework and guidance to farmers to distribute and share water for agriculture. These benefits have improved access to water and there is water availability in the schemes.

The operation of the schemes is a key part of water governance. The community by-law details the operation, the roles and responsibilities of committees, members of FWUCs and users. However, the operation of the schemes has to comply with the policies of MoWRAM. The opening up of water gates, the release of water, and the closing of the water gates are key operation practices in water governance in the study schemes. Many villages that share the schemes encounter difficulties in reaching agreements on when to open up and close the water gates. In Seang Kveang, the opening up of water gates and the release of water downstream would cause drought upstream in the dry season, but the shutting up of water gates in the wet season would inundate the ricefields of upstream communities. In Stung Chreyback, the downstream communities in Trapaeng Trabek and Chrey Bak have to work out the schedules with Tang Krasang communities regarding when to open up the water gates, particularly in the dry season. Without that, their ricefields would be spoiled and damaged. In Kamping Pouy, the operation of the scheme faces critical challenges as it is a huge scheme involving many villages. Without technical and financial support from PDoWRAM and NGOs, the operation of opening up and shutting up of water gates would not be regular, thus affecting the rice farming of many villages downstream of Kamping Pouy reservoir. Hence, water governance is complex and it needs consensus between different groups—beneficiaries, technical agencies, local governments and other stakeholders. It needs to engage different actors in the discussion, negotiation, operation, planning and monitoring throughout the process.

Maintenance of irrigation schemes, the canals and reservoirs is a critical part of water governance. Without that, water governance is impossible. This maintenance requires the participation of all

stakeholders, including members of FWUCs, local governments, MoWRAM, PDoWRAM, NGOs and relevant stakeholders to protect, maintain and operate the schemes for the benefit of communities and government at all levels. The committee of the FWUC plays important roles in ensuring the scheme is well-managed and maintained. To achieve this, first, the committee is responsible for collecting the water fees from its members and managing them for the benefit of its members. Second, the FWUC committee oversees the uses of water and the management of irrigation, particularly, mobilizing labor to repair or rehabilitate the canals that are broken up, and so, water fees are used to support those activities. Third, FWUC committees and their members coordinate the construction and maintenance of roads alongside the canal, as well as water gates. Fourth, apart from the above, the committee members mobilize villagers for meetings to discuss the management issues and propose the plan of action.

In maintenance services, mobilizing members and delivering activities, committee members work on a voluntary basis. The elected FWUC committee members work for the interests of FWUC members without financial support. While the water governance of FWUCs is under way and functions as planned; many issues such as water distribution between upstream and downstream, maintenance and management of the canal and schemes, and the payment for water uses among members remain unresolved . Generally, the water governance has been challenged by the lack of focus on roles and responsibility, particularly with regards to distributing water equitably, effectively, and efficiently to members of FWUCs; however, challenges mostly concern mediation between farmers and PDoWRAM in administrative procedures and processes to comply with the MoWRAM procedure and frameworks.

Generally, in the operation of the study schemes, water gates are opened to release water from the schemes as and when FWUC members need it, rather than based on any particular plan or methodology for releasing water. However, when water is not released on time, tensions arise between farmers and FWUCs. This means that farmers end up competing among themselves over access to water to irrigate their fields. In addition, there are no clear procedures and methods in place on how to allocate water between those rice fields located close to and distant from the schemes. Furthermore, operation of the schemes tends to run into problems due to technical issues whose origins are related to the schemes' designs and construction. Thus, without improving and upgrading the rules, regulations, process and procedures regarding how FWUCs operate and maintain their schemes, these issues continue to act as a barrier to effective FWUC performance and well managed irrigation schemes.

4.3.4. Challenges and Opportunities for Water Governance via FWUCs

Even though water availability prevails in the studied schemes following the development of the irrigation system, water shortage is still an issue. The study found that little water remained in the schemes in the dry season, and so, the farmland was left uncultured for about 6 months in each year. At the same time, over the river system, for instance, Stung Chrey Bak, sub-irrigation schemes are built to tap water for different uses in different parts of the river system and so, water availability has been diverted to different parts across the river system, affecting the water distribution between upstream and downstream and causing conflicts among water user communities.

The research shows that in the dry season, the general degree of coordination in FWUCs in Kamping Pouy, Stung Chreyback and Seang Kveang, is poor both within and among irrigation schemes. At the scheme level, coordination issues manifest themselves in the relationships that exist between farmers, between farmers and FWUCs and within the FWUCs themselves. Also, the different water demand schedules that existed create problems when it comes to coordinating planting schedules, and this kind of problem is most pronounced in larger schemes such as the Kamping Pouy and Stung Chreybak schemes. The study found situations in which farmers do not want others to have access to water, so do not allow farmers whose land is a long way from the irrigation scheme to run a pipe through their land. Coordination within large schemes is even more problematic, as such schemes often involve many different villages and FWUCs. For example, the FWUC in Kamping Puoy is highly complex as it has 64 members divided into 15 groups, and each group covers about 400 households.

The Stung Chrey Bak scheme is also complex, as it irrigates 10,367 ha, benefits 2300 households and covers 15 villages. In the large schemes like these, FWUC members have to travel a long distance to meetings, and so attendance has tended to drop in the face of farmer apathy. In light of this finding, more research should be commissioned to help develop a framework that guides coordination within and among FWUCs.

The study found that these mechanisms and challenges have not helped improve the performance of FWUCs. Rather, they contribute to a low level of trust and a poor level of public service delivery of most FWUCs for most farmers and their neighboring upstream and downstream farmers. This situation has affected the performance of the FWUCs in key tasks, such as maintaining infrastructure, allocating water, and collecting irrigation service fees. The FWUCs' level of performance is also very inconsistent, as the following shows.

The use of hydrological knowledge and community participation to improve decision-making on water allocation indicates that a fragmented irrigation management situation has arisen due to a lack of coordination between FWUCs and the water user sector. The development of the irrigation sector has been single-sector oriented and ad-hoc. Many irrigation schemes were constructed during the 1980s and 1990s with assistance from international organizations, and the main purpose of irrigation infrastructure at that time was to increase food security and reduce poverty. However, these developments failed to establish any form of catchment management mechanism; the FWUCs and commune councilors were focused only on their own local schemes. The FWUCs for these schemes now plant their crops individually, without consulting each other, and as a result, the allocation of water is not properly planned or managed, with some dry season crops lost due to a shortage of water. Thus, developing a better level of understanding of the spatial and temporal aspects of water flows is likely to improve catchment planning.

The district authorities rarely communicate with FWUCs unless they are directly asked for help with water related conflicts. The PDoWRAMs help resolve conflicts by looking at water availability across schemes and trying to adjust flows, but with limited infrastructure, financial and technical support, PDoWRAM cannot assist FWUCs in any effective and timely way. As a result, many farmers have limited access to irrigation and the potential benefits of the schemes are lost. Improving coordination at the provincial level is therefore key to the effective development and management of water resources at the scheme level.

This study has found that in the early stages of FWUC creation, members' roles were clearly identified, but that due to problems with living conditions and the low level of coordination that exists among FWUC members and farmers, many FWUC members have given-up their roles. Village chiefs and commune leaders now lead most of the FWUCs, meaning that farmers and FWUC members are sometimes viewed as passive or even dependent stakeholders. In light of this, farmers and FWUCs hold relatively little power, despite having a legitimate and urgent interest in the outcome of irrigation scheme management activities. During periods of both wet and dry season rice cultivation, farmers report their water demands to the FWUC leaders, who then ask the FWUC committee to release water from the secondary canals into the tertiary canals. When there are water shortages in the secondary canals, the relevant FWUC should contact PDOWRAM, for it to release water from the main canal into the secondary canal.

5. Conclusions

Cambodia has abundant water resources in the wet season and a scarcity of water in the dry season. These phenomena undermine the development in this country and pose a threat to long-term development. Climate change and the construction of dams in the Mekong River Basin have the potential to further complicate the flood and drought phenomena, affecting Cambodia at large in the long run. Thus, effective water management is key to the development of Cambodia as it attempts to manage its floods and droughts, as this will contribute toward improving agricultural productivity across the country.

However, water management and its governance in Cambodia have been fragmented and disintegrated; various ministries are mandated to manage water related resources in different ways, but overlapping roles and responsibility over water, and conflicts of interest among ministries reduce the collective productivity of water for the country. Water management has long been suffering from a lack of long-term vision and complex institutional arrangement. On the one hand, water management is synonymous with irrigation management; as such, many large-scale irrigation schemes were built largely to regulate floods, not for irrigation, as farmers still rely on rainfall in the wet season, not water from irrigation schemes to water their farmlands; and most of the irrigation canals had no water in the dry season. On the other hand, water is essential for agriculture, and water management could contribute to improving agriculture development, but agriculture is suffering from a lack of water; the Ministry of Agriculture, Forestry and Fisheries (MAFF) has a mandate to promote agriculture but no mandate to manage water.

Water management in Cambodia has shifted toward a community-based system, and the adoption of FWUCs has been viewed as an alternative for water governance. Such an approach seems appropriate in Cambodia as FWUC is managed based on community needs, are owned by communities, and are simple to manage technically and economically. Nonetheless, the FWUC approach is a government driven movement that is deeply grounded in the Cambodian policy, sectoral approach and legal framework with the participation of local communities. Overall, it promotes decentralization and deconcentration, and enhances local participation in water governance. Indeed, it is only idealized theoretical governance policies at the policy level, whereby FWUCs have, to a large extent, become inefficient and dependent extensions of the line ministries, instead of independent and sustainable local governance bodies. Thus, the FWUC approach remains centralized and sectoral, in that its operations and functions are ineffective and inefficient.

The three case studies demonstrate that decentralized water governance through FWUC is suffering from political, financial, technical, managerial and participatory dimensions. The Cambodian government and donors have provided support for most of the FWUCs, and some FWUCs and irrigation schemes are even named after political figures. This has enabled the FWUCs and irrigation schemes to receive political, financial and technical support. While this seems like a good thing, it also discourages local people from taking ownership of the schemes and from contributing to their operation and maintenance. FWUCs also suffer from weak coordination among FWUCs, between FWUCs and farmers, and between FWUCs and local governments. Last but not least, they also suffer from water scarcity, and this leads to competition among farmers, who wish to release water for their own use regardless of the consequences for others. Power relations and politics of survival of water users shape the action and interaction of sharing water and benefits. Often, individual farmers compete and maximize water use for self-interests, but these depend on the power to negotiate and lobby.

Participation is weak, not only due to the projects' design and implementation, but also due to how irrigation schemes are run on a daily basis. First, farmers are not familiar with the concept of participation, and believe that it is not their responsibility to take part in managing the schemes. Second, farmers consider water a basic good that everyone has a right to, without any restrictions being placed on access. However, the current FWUC management system limits the participation of FWUC committee members as well as farmers, due to its centralized management structure in which MoWRAM plays a central role. Farmers and FWUC members could become more active if the schemes' operations, including water distribution procedures and fee collection activities, were decentralized and simplified. This more autonomous FWUC water management structure might trigger higher local participation levels than is the case under the current government managed structure.

FWUCs face difficulties when attempting to collect water fees. The farmers claim that Cambodians have never had to pay for the water needed to grow rice, and that they should receive a sufficient amount of water to do so just from rainfall, without having to pay for water from such schemes. As a result, among FWUCs, there is a general inability to collect the water fees required to cover the full operational and maintenance costs of the systems. The management process of the fees collection

is also a challenge given the limited capacity of FWUC members, and the lack of transparency and accountability within the FWUC system. In this regard, FWUCs remain dependent on the commune support fund (approximately seven million riel for 2008/2009) and also emergency funds from PDoWRAM, other agencies as well as NGOs and donors in order to support maintenance and the operation of the schemes. The government recognizes that it is necessary for MoWRAM, through PDoWRAM, to provide more assistance to FWUCs (financially, technically and for collecting fees), and that the sharing of operational and maintenance responsibilities between MoWRAM and the FWUCs is not fully clarified. It is also acknowledged that MoWRAM's irrigation scheme maintenance budget is not sufficient for the tasks required. Improving water governance within the FWUC schemes will require effective action in all these areas, and the building of capacity within communities, particularly when it comes to collecting water fees from farmers and the utilization of these funds to maintain and operate the schemes for the benefit of all members.

At present, FWUCs are not empowered or able to influence a wide enough spectrum of production. At the same time, the FWUC model does not work for every irrigation scheme; it requires a context-specific approach to be taken. In fact, the need for a variety of institutional models to be adopted may be driven by the need for more flexible approaches to be taken toward irrigation, especially where the reservoir and canal systems are inefficient and unsustainable. An alternative institutional mechanism currently attracting the attention of both the government sector and donors is the agricultural cooperative (AC), which is a mechanism used to encourage integrated self-development in the agricultural sector. ACs appear to be a direct government response to the weaknesses inherent in the FWUC approach. Another major advantage of ACs appears to be the economies of scale available through collective action. ACs are able to source inputs at cheaper prices, as they can place bulk orders directly with manufacturers, then negotiate prices on behalf of their members. In theory at least, the logic behind ACs and their organizational structures is appealing, as they have the potential to overcome some of the key weaknesses inherent to FWUCs.

The case studies illustrate that water governance through the FWUC approach could improve water accessibility and availability. However, issues of sometimes too much water in one community and too little water in another community still prevail in all three case studies, dependent on the location and geography of the schemes. Coordination, dialogues, negotiation, planning and monitoring would improve the practices of water governance and build the capacity of stakeholders to overcome these challenges in the future.

Acknowledgments: Author gratefully acknowledges the comments from reviewers, and supports from staff and students of Royal University of Phnom Penh, Cambodia, in data collection.

Conflicts of Interest: The author declares no conflict of interest.

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