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Gender and Water Governance: Women's Role in Irrigation Management and Development in the Context of Climate Change

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Responsibility for the ideas, facts and opinions presented in this research paper rests solely with the authors. Their opinions and interpretations do not necessarily reflect the views of the Cambodia Development Resource Institute.

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ACRONYMS

CDRI	Cambodia Development Resource Institute
FGD	Focus Group Discussion
FWUC	Farmer Water User Community
IWRM	Integrated Water Resource Management
KII	Key Informant Interview
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOE	Ministry of Environment
MOWA	Ministry of Women's Affairs
MOWRAM	Ministry of Water Resources and Meteorology
NGOs	Non-government organisations
NSDP	National Strategic Development Plan
PDAFF	Provincial Department of Agriculture, Forestry and Fisheries
PDWA	Provincial Department of Women's Affairs
PIMD	Participatory Irrigation Management and Development
UNDP	United Nations Development Programme
WCC	Women and Childcare Committee
WCCC	Women and Child Consultative Committee

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EXECUTIVE SUMMARY

Addressing gender issues is essential in promoting and advancing the role and economic, social, political, legal and cultural status of women. The need to address this concern has been increasingly acknowledged by the government of Cambodia since it would help to improve and sustain not only family economy but also national development and economic growth (UN Women 1995) (RGC 2010). In its third five-year strategic plan, Neary Rattanak III, the Ministry of Women's Affairs (MOWA) sought to ensure gender-responsive national policies, legislation and reform programmes, support the economic empowerment of women, develop the capacity of women and address the main barriers to women's access to their right to fully participate in, and benefit from, economic and social development (MOWA 2011b).

Cambodian farmers mainly depend on agriculture for their livelihoods. However, during the last one and a half decades, Cambodia has experienced frequent floods, windstorms and droughts that have severely damaged agriculture as well as property and human life. Significant rice production has been lost to drought, which has mainly occurred in the mid-wet season almost every year in the major rice-producing provinces. Flooding has also become a real challenge for farmers, especially the rural poor. The 2011 flooding had a severe impact on human life and assets, infrastructure and crops (ADB 2011).

The government is strongly committed to addressing climate change impacts (MOE 2006). As part of this, it is managing water resources following the integrated water resource management (IWRM) principle (MOWRAM 2007a).

Under IWRM and participatory irrigation management and development (PIMD) policies, women have gradually participated more in village and community water management. However, due to limited capacity and socio-cultural and physical constraints, only a few have been able to fully join farmer water user communities (FWUCs) in water and irrigation management as well as in disaster risk reduction activities.

This study aims to establish women's roles and constraints in irrigation and agricultural development and management in the context of the changing climate, analyse their priority needs and raise awareness of women's major challenges in water resource management and climate change adaptation. This will enable agencies and groups working on gender issues to take appropriate action and give support. It also seeks to generate realistic recommendations for reducing or eliminating barriers to Cambodian women's greater engagement in sustainable water resource management, environmental protection and climate change resilience.

The research involved a desk review, focus group discussions (FGDs) and key informant interviews (KIIs) to gather information on water governance, agriculture, gender roles in irrigation management and development, socio-economic and livelihood improvement and related issues. The study drew upon the results of FGDs, KIIs and provincial workshops in late 2010 in the three provinces in which women were asked to present their critical challenges in water and irrigation management and the appropriate measures to solve those challenges. The collected data were summarised in a matrix format following the gender analytical frameworks employed in the study: the Harvard Analytical Framework or Gender Roles Analysis Framework, the Community-based Risk Screening Tool–Adaptation & Livelihoods, the Socio-Economic and Gender Analysis and the Longwe Framework (or Empowerment Framework). This was done to identify gender differences and inequalities, including access to and control over resources among men and women, responsibilities and roles in society or the community, practical and strategic gender needs, constraints and benefits.

The study found that people generally want to have more women in management and development roles in local communities and in public work (such as FWUCs or commune councils) because women understand their issues and can solve some critical issues (water use conflict, money or irrigation service fee collection and management, women's issues and needs) better than men in a fast and peaceful manner. At commune level, women have opportunities and chances equal to those of men. Rural women have notably participated in meetings or training on women's rights, saving groups and agriculture. They are actively involved in their communities. Furthermore, they are well aware of their rights in society and are able to settle complicated issues of their families or communities.

In FWUCs, men and women play very important roles in the development or rehabilitation, operation and maintenance of irrigation systems. Compared with the past, women have become more active, committed and able to put forward their views. However, gender imbalance in FWUCs still exists, since women have many household chores to perform. Because of this, only a few women have the time to join FWUCs and village and commune development activities, particularly in water and irrigation management or in disaster risk reduction. At the same time, even though they are committed, women still lack capacities, experience and skills in this sector. These barriers have affected the willingness of the women to join in public affairs.

It is noticeable that men and women have different roles, challenges and abilities. Compared with men, the number of women in FWUCs (and also in commune councils) is low. Among 43 members of FWUCs in the study areas, only nine are female (21 percent). Most of the important positions in FWUCs, such as chair and first and second vice-chair, are dominated by men. While women mostly hold positions as treasurers and accountants in the committee, men tend to take overall management control, including water allocation, irrigation system operation and maintenance and water use conflict resolution, as well as in rice planting. Men also provide technical input and final (household and community) decision-making. Unequal numbers, roles and power have pushed women into a weakened position.

Rural farmers have faced frequent and severe natural disasters and climate impacts, particularly floods, windstorms, high temperatures, vector-borne diseases and droughts, in the last one and a half decades. Interviewees observed that the climate is becoming more abnormal from one year to the next. The temperature is rising, and farmers experience increasing numbers of pests (mainly from February to March) like worms, grasshoppers, small caterpillars and brown leaf-hoppers that can destroy many hectares of rice in just one night. High temperatures also increase the incidence of sickness in children and reduce crop growth and yield. Droughts are increasingly frequent, and droughts or dry spells have become longer in the last 10 years. Livelihood resources have been damaged or are unavailable. During droughts and water shortages, the families most affected are poor and/or female-headed, because they lack both equipment (pumps, hand tractors) and labour. A further change can be noted in rainstorms that are longer or shorter than the norm, or that are delayed. Sometimes rice fields are quickly inundated and damaged by heavy rain. For example, the floods that occurred in 2009 and 2011 severely damaged agriculture, the environment, infrastructure, human settlements and even human life.

Given these challenges, significant land and water resources are required. These include funds for building or maintaining irrigation systems and flood protection dams, technical support from relevant provincial departments, FWUCs, commune councils and other social groups. All of these are crucially important for both male and female farmers to improve agricultural production, to generate income, adapt to climate change and to generally build resilience. However, women have less access to and control over those resources than men.

It is clear that the vulnerability to climate change among men and women is different. This relates to their capacities, the resources available to them, their experience and their levels of responsibility. Women have potential roles in provincial, district, commune and village climate change adaptation and disaster management mechanisms. They work in volunteer groups, in women's help groups, on women and childcare committees and on women and child consultative committees to assist women and children when disasters occur.

Rural people need to have equal rights and access to and control over those resources, as well as the opportunity to participate in public decision making. Although legal frameworks and mechanisms have been developed for gender equality and for empowering and inspiring women's commitment and participation, the capacities of women, social and cultural norms and internal rules and regulations in rural areas are still challenges to be overcome.

FWUCs, commune councils and men and women from relevant institutions are very open-minded about women's participation in the community, the commune and public work in general. However, as mentioned above, women's experiences in water and water governance or in climate change adaptation activities remain limited compared with those of men. Women tend to be hindered by the demands of housework, and this reduces the time and opportunities they have to participate in public affairs. As a result, FWUCs have tended to be dominated by men: women are mostly found in more passive positions and have to seek support from men on water allocation, irrigation system construction and maintenance, water use conflict resolution and disaster risk reduction activities.

Therefore, more needs to be done to promote gender sensitivity and gender empowerment in water governance, agriculture and climate change adaptation.

Recommendations

Below are some key options to diminish challenges. They also stimulate discussion on the empowerment of women and the mainstreaming of gender sensitivity and the role of women within water management, agriculture and climate change adaptation that will boost the mandate and responsibility of FWUCs without diminishing the important local role and authority of men.

Recommendation 1: Minimise women's challenges in water, agriculture and climate change adaptation

A deficiency of suitable capacity, skill and experience, and limited opportunities and time for working in these sectors, remain challenges for women's participation in water and agriculture development and climate change adaptation. To minimise those challenges, the following measures should be undertaken:

- strengthen the capacity of women through FWUCs and other local social groups and motivate men and women to work towards gender equality;
- review and reform existing rules (community internal rules, election criteria and by-laws) and regulations that may hinder the participation of women or their representatives;
- ensure that new policies and development programmes or projects take into account gender sensitivity and promote the active participation of women at all levels;
- establish and facilitate women's help groups to support gender mainstreaming and reduce gender constraints;

- enhance women's economic, social, political, legal and cultural status and promote gender awareness-raising for women and men in communities, villages and communes;
- encourage men to allocate time (by taking on some of their household jobs) for women to work (or to participate) in the community or public affairs.

Recommendation 2: Improve water governance, irrigation system expansion and extension services

Women's livelihoods are more susceptible than men's to climate shocks because their farming activities rely mainly on water. The irrigation systems and agricultural extension services that use, or relate to, modern technologies that help farmers to cope with climate change, are not available to the small-scale farming activities in which women are involved. Thus, key areas to be taken into account include:

- strengthening water governance by addressing its economic, social, gender, environmental and political dimensions to ensure that water resources and irrigation systems are managed in a transparent, participatory, equitable and accountable manner;
- supporting and reinforcing FWUCs following IWRM and PIMD principles and community-based adaptation frameworks;
- handing over appropriate responsibilities to women in FWUCs such as planning and decision-making in water management and development and disaster risk reduction activities;
- expanding irrigation systems to secure water availability, to reduce water stress and user conflict arising from water scarcity and to control flood water. In addition, awareness raising about irrigation management, agricultural development and climate change adaptation should be started with women at household level;
- widening the provision of agricultural extension services to farmers and increasing field demonstrations and local short training courses;
- encouraging women to become involved in agricultural extension services and in women's help groups and field demonstrations;
- improving women's engagement and strengthening gender equality mainstreaming.

Recommendation 3: Improve gender mainstreaming in water governance and adaptation to climate change

Under government directives, various state, private sector and civil society institutions are to incorporate gender equality through their sectoral implementation plans. Women's livelihoods are even more vulnerable when there is a discrepancy in gender equity in social, cultural and political institutions. Thus, some important measures include:

- establishing appropriate policy and guidelines that enable women and men (girls and boys) to have equal opportunities in resource allocation and management, and to share their views and concerns in decision making;
- enhancing gender considerations across sectors in order to give women the education, skills and capacity needed to participate in an equal manner with men;
- promoting and integrating local knowledge with scientific research into climate change adaptation strategy and actions;

- providing equal opportunities for men and women to control their livelihood resources, to have their voices heard and their challenges removed. Particular attention should be given to the development of a comprehensive gender equality strategy that will ensure that men and women have equal social, economic, decision-making and political opportunities;
- promoting the participation of men, women and social groups in water and agricultural development initiatives and climate change adaptation programmes and projects, and establishing mechanisms that enable them to benefit equally from these;
- enhancing collaboration among state, private and civil society organisations to review and reform existing unequal structures in FWUCs and other local social groups. Practical efforts should be formulated and people motivated to strengthen or create more gender equity in social, economic and livelihood development and climate change response.

Recommendation 4: Promote women's participation and empowerment in water governance and climate change adaptation

Population growth, human development activities and climate-related hazards threaten the resources on which rural women depend. Improving women's rights and ensuring their access to those resources are therefore significant. Important activities include:

- providing equal and suitable opportunities for farmers, FWUCs and other social groups and committee members to participate and exercise their rights and obligations in natural resources utilisation, management and development (in leadership and decision-making roles), and to have equal access to and control over common property resources;
- increasing women's access to professional skills and on-the-job training (based on practical and strategic needs) and capacity development programmes in agricultural production and diversification; irrigation management, operation and maintenance; gender equality; disaster management; and climate change adaptation;
- motivating competent women to share experiences, skills and information that would empower and enhance the knowledge and capacity of other women;
- supporting farmer associations, cooperatives and other forms of local collective action to solve gender and women's issues;
- reviewing gender strategy and integrating the principles of gender equality and women's empowerment into all sectors;
- reviewing and monitoring ongoing water and irrigation development and climate change adaptation programmes and projects to ensure that pro-poor and gender issues have been taken into account.

1

INTRODUCTION

Addressing gender issues is essential in promoting and advancing the role and status of women, a concern that is increasingly acknowledged by the government (RGC 2010). Its Rectangular Strategy for Growth, Employment, Equity and Efficiency, Phase II recognises women as the backbone of the economy and society (MOWA 2011a). The government has put much effort into enhancing and increasing the role of women in local, sub-national and national society. In its third five-year strategic plan, Neary Rattanak III, the Ministry of Women's Affairs sought to ensure gender responsive national policies, legislation and reform programmes, to support the economic empowerment of women, to develop the capacity of women and to address the main barriers to women exercising their right to participate fully and benefit from economic and social development (MOWA 2011b). MOWA is currently preparing its Neary Rattanak IV (Five-Year Strategic Plan 20014-18), in which climate change and green economic development are related to the promotion of women's status in economics as well as in climate change adaptation (MOWA 2013).

During the last one and a half decades Cambodia has experienced frequent floods, windstorms and droughts that have severely damaged agriculture as well as property and human life. Significant rice production has been lost to drought, mainly in the mid-wet season almost every year in the major rice producing provinces.[1] Floods have also become a real challenge for Cambodian farmers, especially the poor. The 2011 floods were larger than those in 1996 and 2000 in terms of loss of life and impacts on infrastructure and crops (ADB 2011). Higher temperatures have also adversely affected the quality and quantity of crops in many provinces. The droughts in 1997-98 caused farmers great hardship and pushed many into poverty. In addition, farmers have noted that the prolonged dry spells that commonly occur in the middle of the wet season have damaged their rice crops increasingly severely. Moreover, changes in seasonal weather patterns (irregular rainfall and temperatures) have exerted a significant impact on the cropping calendar and consequently on farmers' confidence in planting and managing production (Nang 2012).

The government is strongly committed to addressing climate change impacts (MOE 2006). The government's technical working group on agriculture and water highlights natural disasters as one of nine major factors that pose threats to Cambodia's agriculture and water sectors (TWGWA 2007). At the same time, the government is managing its water resources following integrated water resource management (IWRM) principles to ensure effective water resource management (MOWRAM 2007a). IWRM and participatory irrigation management and development (PIMD) principles are being introduced in recognition of the need for greater participation of men and women to improve irrigation systems, rice production and the population's livelihoods and to cope with climate change.

Cambodia is a water-rich country. In common with their male counterparts, women farmers have a long history in the management and development of agriculture and irrigation, such as in building canals, water reservoirs and even gigantic irrigation systems throughout the country (Kumar *et al*. 2000; Ross & Savada 1998; Khmer View 2013; Nang 2013). IWRM and PIMD policies are also recognised as holistic approaches to water management, ensuring the coordinated development of water, land and related resources and optimising economic and social welfare without compromising sustainability. Under these initiatives, women have

[1] Prey Veng, Takeo, Kompong Cham, Kompong Thom, Battambang, Banteay Meanchey and Siem Reap.

gradually increased their participation in village and community water management. However, due to limited capacity and sociocultural and physical constraints, only a few are able to join fully with FWUCs in water and irrigation management as well as in disaster risk reduction.

This study aims to establish women's roles and constraints in irrigation and agricultural development and management in the context of a changing climate, to analyse their priority needs and raise awareness about women's major challenges in water resource management and climate change adaptation so that relevant agencies and groups working on gender issues can take appropriate action. The study also explores women's roles in IWRM, PIMD and climate change adaptation to generate realistic recommendations for eliminating barriers to women's greater engagement in sustainable water resource management, environmental protection and climate change resilience. It will also contribute to gender mainstreaming, help to improve women's livelihoods and minimise climate change vulnerability.

2

RESEARCH QUESTIONS

The research seeks to answer the following questions:

- what are male and female farmers' and different sectors' perspectives on women's involvement in water governance and climate change adaptation?
- what are the main constraints on farmers' (especially women's) roles in agriculture, irrigation management and climate change adaptation?
- what resources and practical measures are needed to remove women's constraints and strengthen their roles in water management, agriculture, livelihood improvement and climate change adaptation? How can farmers (especially women) gain equitable access to these resources and measures?

3

OBJECTIVES AND SCOPE

The main objectives of the research are:

- to describe the perspectives of farmers and different sectors on women's participation in water governance and climate change adaptation;
- to identify the roles, needs and constraints of men and women in engaging in the application of IWRM and PIMD principles and climate change adaptation policy;
- to seek appropriate measures to support men and women in addressing their identified constraints and to mitigate their livelihoods' vulnerability to climate change.

4

METHODOLOGY

4.1. Data Collection and Analysis

The research involved desk review, focus group discussions and key informant interviews. In addition, the study drew upon the results of FGDs, KIIs and provincial workshops in late 2010 in the three targeted provinces. During those activities, women were invited to identify their key constraints and challenges in water utilisation, irrigation management and development.

New FGDs were conducted in 10 selected irrigation schemes: three in Kompong Thom, three in Pursat and four in Kompong Chhnang. Each FGD consisted of five to seven persons (two women farmers, two or three FWUC committee members and two commune councillors). Each was organised as a mixed group of men and women based on their specific characteristics. Age, education, social class and experiences of the women were also taken into account.

Similarly, KIIs were held with stakeholders such as FWUC leaders, farmers, village leaders and commune council members (in selected irrigation schemes), and provincial departments[2] (in provincial towns) to gather information about their perceptions of gender roles and their constraints in irrigation management and development. Ten FWUC committees (from 10 irrigation schemes) in the three provinces were contacted to seek information about how gender equity is achieved in decision making in water resource management and climate change adaptation. The KIIs were also designed to shed light on resources, climate change impacts and vulnerability and coping strategies of local communities. Informants were asked to rate the degree of climate change impacts (low, medium and severe) affecting their livelihoods, agriculture, water and food security, and to identify suitable measures to adapt. Also reviewed and discussed were influence and power relationships among men and women within the household and the community, and gender needs to solve those constraints and to assist in mainstreaming gender equality in water governance and climate change adaptation.

Data gathered from provinces, communities and households were summarised in a matrix format of the gender analytical frameworks employed in the study to identify gender differences and inequalities, including access to and control over resources among men and women, social or community responsibilities and roles, practical and strategic gender needs, constraints and benefits.

[2] Women's Affairs, Water Resources and Meteorology and Agriculture, Forestry and Fisheries.

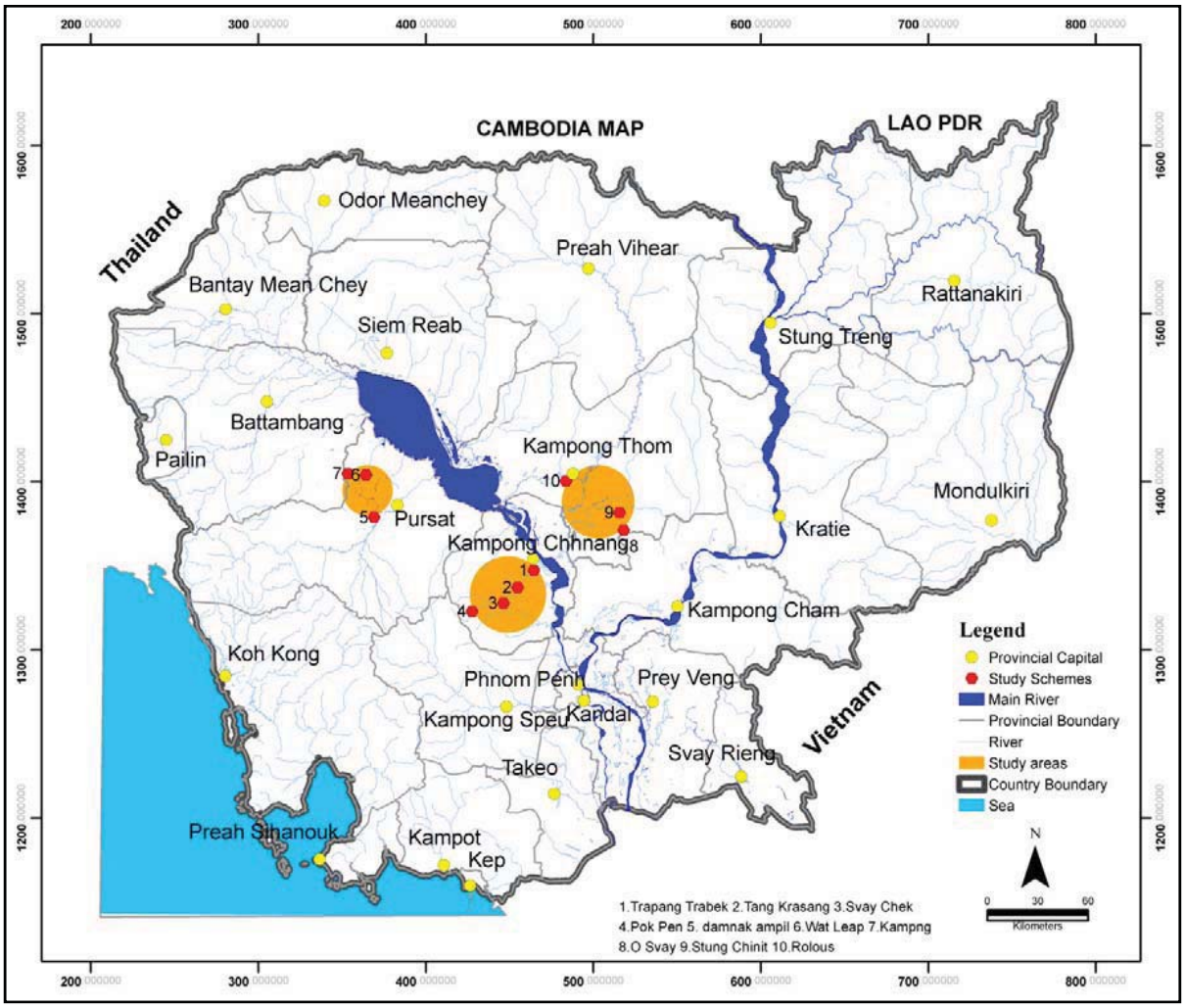
Table 1. Summary of Study Methods, Locations and Data Collected

Methods	Number	Locations	Data Collected
KII	11	• Kompong Chhnang (4) • Kompong Thom (4) • Pursat (3) provinces	• Water (and other natural resources) governance and irrigation management and development • Water scarcity, allocation and water use conflict management • Agricultural strategy and activities • Gender-related issues (gender division of labour, gender mainstreaming and women's empowerment) • Economic, social, cultural and environmental issues • Natural disasters and climate change impacts • Climate change adaptation and disaster risk reduction strategy.
FGD	10	• Kompong Chhnang: Pok Pen, Svay Chek, Tang Krasang and Trapeang Trabaek schemes • Kompong Thom: O Svay, Stung Chinit and Rolous schemes • Pursat: Damnak Ampil, Wat Leap and Kampang schemes	• FWUC establishment, operation and community development plan • Water governance and irrigation management and development • Water scarcity, allocation and water use conflict management • Local administration and public participation (particularly of women) • Gender division of labour within the household and the community, gender mainstreaming and women's empowerment • Agricultural activities and access to credit, market, extension services and training • Economic, social, cultural and environmental issues • Income generation and livelihood resources • Access and control over resources and services • Livelihood diversification and improvement • Natural disasters and climate change impacts • Climate change adaptation strategy and disaster risk reduction measures

4.2. Study Sites Selection

The research was conducted in 10 irrigation schemes across Kompong Chhnang, Pursat and Kompong Thom (Figure 1). Selection of study sites was based on their governing structure under IWRM and PIMD frameworks, relative upstream and downstream locations, diversity in scale and configuration of the different schemes and their frequency of natural disasters, particularly floods, drought and pest infestations.

Figure 1. Map of Study Sites



Source: (Author 2014)

The ten study sites are: Trapeang Trabaek, Tang Krasang, Svay Chek and Pok Pen (in Kompong Chhnang); Wat Leap, Kampang and Damnak Ampil (in Pursat); and O Svay, Stung Chinit and Rolous (in Kompong Thom).

4.3. Some Definitions

Gender Analysis is defined by the Human Development Programme as "a systematic way of looking at the different needs, interests, priorities and experiences of males and females and the different impacts of laws, policies, programmes, customs, practices and development on them. It is a specific type of social analysis that requires the collection of data 'disaggregated' by sex (broken down for males and females) and of detailed gender-sensitive information about the population in question. Incorporating a gender perspective into any type of social issue or development project involves conducting and applying a gender analysis throughout all stages and aspects of work" (HDP 2009).

Gender equality is defined as "a stage of human social development in which the rights, responsibilities and opportunities of individuals are equal, regardless of whether they are born male or female" (Augusto & Saadia 2005).

Impact of climate change refers to "the consequences of climate change on natural and human systems" (McCarthy *et al*. 2001: 989).

Vulnerability is defined as "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. It is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, the sensitivity and adaptive capacity of that system" (Parry *et al*. 2007).

Resources refer to the things or means that can be used to cope with a difficult situation. They can be: physical resources such as land, livestock, fertilisers and mechanical equipment; human resources, like farm labour; social resources such as education, women help groups; and institutional resources, e.g. extension services (FAO *et al*. 2012).

Empowerment is a concept "about people—both women and men—taking control over their lives: setting their own agendas, gaining skills, building self-confidence, solving problems and developing self-reliance" (UNESCO 2006).

5

REVIEWING GENDER, WATER AND IMPACTS OF CLIMATE CHANGE

5.1. Gender, Water and Climate Change Impacts

5.1.1. Gender

"Gender" is defined by the United Nations Environment Programme as: "the social roles and relations between women and men. This includes the different responsibilities of women and men in a given culture or location. Unlike the sex of men or women, which is biologically determined, the gender roles of women and men are socially constructed and such roles can change over time and vary according to geographic location and social context" (UNEP 2006: 18).

The World Bank (2011) confirms that men and women perform significant roles in their society and community and have different responsibilities in social and economic activities, access to resources and decision-making authority. Indeed, the allocation of specific gender roles is an international tendency, evident at many levels of society, regardless of race, class, age and ethnicity. Within their respective roles, men and women are involved in mainly three types of work: productive work (work that has economic value); reproductive work (work that does not directly contribute to the production of tradable products); and community work (work that relates to collective organisation for the social and cultural development of communities (FAO 1995). In many cases, men's and women's roles and responsibilities are different. Compared with the past, men are increasingly involved in reproductive work (the care of children, and family health, along with water and fuel collection) that were previously mostly performed by women (*ibid.*). Similarly, women are now more involved in productive and community work. However, their efforts and needs are frequently overlooked and less valued than those of men. To understand comprehensively men's and women's vulnerabilities, constraints, needs, adaptive capacities and opportunities, gender analysis thoroughly examines and assesses the different needs, interests, priorities and experiences of males and females and the different impacts of laws, policies, programmes, customs, practices and development on men and women throughout all stages and aspects of work (HDP 2009; Rebekka 2010).

Within the context of climate change and water governance, four main gender analytical frameworks were applied in order to examine the division of labour between men and women in both productive and reproductive activities, access to and control over resources and benefits and other key issues. These included cultural and socio-economic factors that shape these dimensions. The four frameworks are:

1) The Harvard Analytical Framework or Gender Roles Analysis Framework, which is designed to generate information at the grass roots and employs an analysis matrix to identify gender differences and inequalities, including mismatches of roles and responsibilities among men and women in the community;

2) The Community-based Risk Screening Tool–Adaptation & Livelihoods, which has been applied in this paper to examine systematically and identify the relationships between men and women farmers' livelihoods and climate change impacts, community adaptive capacity and strategies and mechanisms to improve local livelihoods and local capacity to mitigate the impacts of climate change;

3) Socio-Economic and Gender Analysis, which offers an understanding of the specific needs (practical and strategic), priorities and constraints of men and women in food security and agriculture. It is also utilised to examine the measures needed to respond to, or cope with, emergency situations (particularly climate-related hazards);

4) The Longwe Framework (or empowerment framework) to discuss women's empowerment, women's participation (for example in professional training, irrigation system management, and social groups) and control over resources and women's ability to argue for change in their critical condition and position in society (e.g. water governance, water use conflict and water scarcity management, community/commune development plans, women's networks, and women and children consultative committees).

5.1.2. Water and Water Consumption

In most agrarian countries, water is regarded as "life". Water is an indispensable resource for human and natural systems. Water functions as both a provisioning service[3] (irrigation water for food production and hydro dams for energy production) and a supporting service (for environment and biodiversity protection, watershed/catchment and river basin management, etc.) (MEA 2005; Frances 2005; Gomez & Ravnborg 2011). This resource has a key role in poverty alleviation, economic development, food security and ecosystem conservation. Due to water's vital role in sustaining human livelihoods and ecological health, the sound utilisation and management of this resource is critical.

The global demand for water for domestic, industrial and agricultural purposes is rapidly increasing (Engelman & LeRoy 1993, cited in Acreman 2004) with population growth. By using the UN Medium Population Projections of 1998, Population Action International reveals that, by 2025, more than 2.8 billion people in 48 countries (of which 40 are in Africa) will face water stress or scarcity (UNEP 2008). Some studies have further projected that, by 2050, the number of countries facing water stress or scarcity could rise to 54, with a combined population of 4 billion people—about 40 percent of the projected global population of 9.4 billion (Gardner-Outlaw & Engleman 1997; UNFPA 1997, cited in Don and Henrylito 2011). This would also create water use competition on a national or even international scale.

The above challenges seem to require a more holistic management framework that ensures sustainable water consumption without jeopardising its physical, economic, social and environmental role, known as integrated water resource management (Frances 2005; Bates *et al*. 2008). Under the IWRM framework, the role of women has become increasingly accepted particularly in the provision, management and development of water and irrigation.

5.1.3. Impacts of Climate Change on Water and Humans

The rise in global temperatures and increased weather extremes, including floods, droughts, storms and sea-level rise, are predicted to affect water quality and worsen water pollution (Bates *et al*. 2008; UC 2009). Water shortage and food insecurity will increasingly threaten human health and livelihoods, particularly among vulnerable groups. The negative impacts of climate change on water systems and built structures such as irrigation systems, canals and drainage systems, hydropower, dams and dikes are expected to prevail over the benefits (Bates *et al*. 2008).

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[3] A provisioning service is any type of benefit to people that can be extracted from nature. See also: http://www.nwf.org/Wildlife/Wildlife-Conservation/Ecosystem-Services.aspx (accessed 23 December 2013)

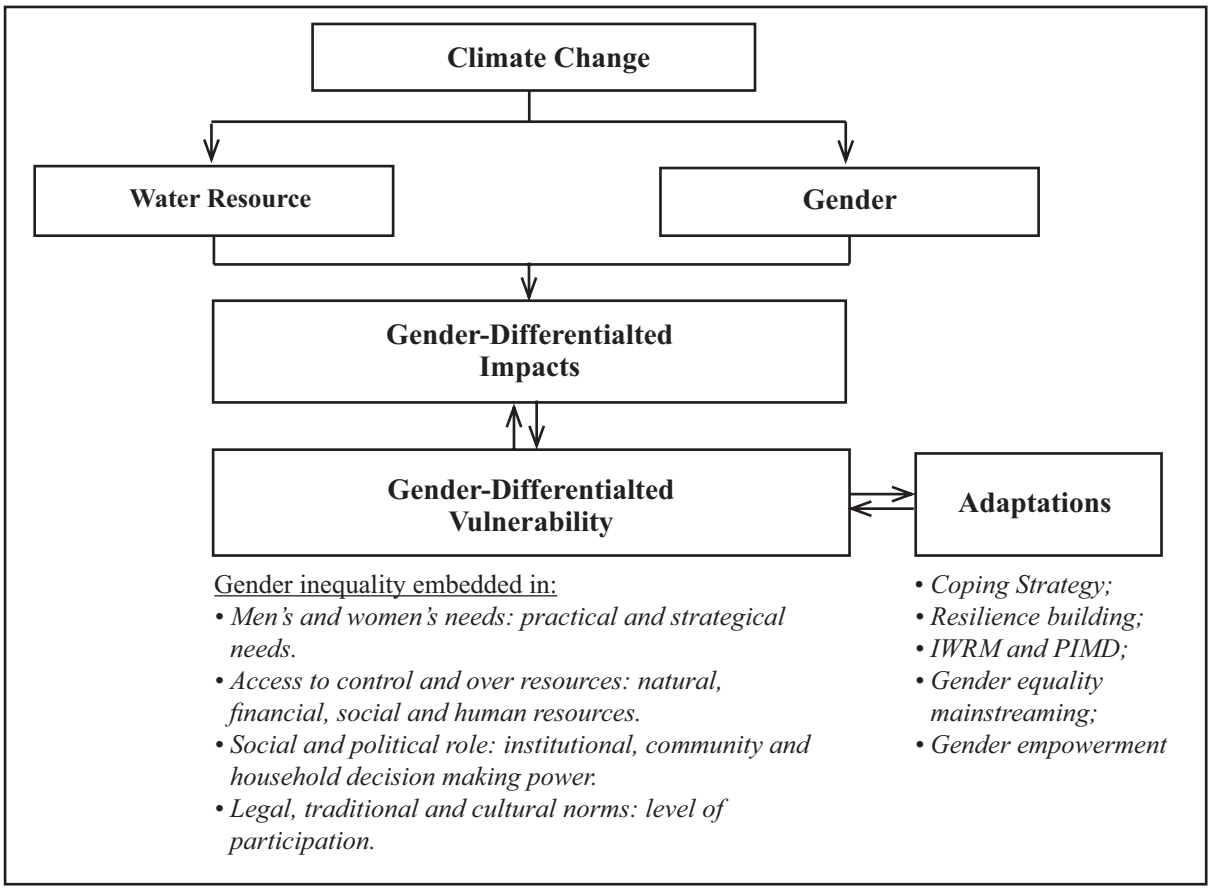
Climate change effects on humans have been both direct and indirect (UC 2009). For example, the impacts of climate change on food security have increased the vulnerability of poor farmers (Bates *et al*. 2008) and have created a heavy burden for women, discussed below.

The extent of vulnerability depends on a system's sensitivity and its adaptive capacity. Women and children are more vulnerable than men to climate change impacts, not least because their bodies are weaker. A case study conducted by the Women's Environmental Network (WEN 2010) revealed that female-headed households and orphans find it difficult to cope with climate change because they are physically weaker and more prone to diseases than men. Notably, in 2011, floods affected 8 million people across south-east Asia; 38 out of 43 deaths in Vietnam, half of the 247 mortalities in Cambodia and 52 out of 320 in Thailand were children (Asian Scientist 2011).

During and after floods, children cannot go to school, and most women have to spend more time taking care of children and producing goods for the household, with consequently less time for earning income. Households (particularly female-headed households) that depend mainly on natural resources for their daily livelihoods could be more vulnerable and become more impoverished (Frances 2005).

At the other extreme, drought is considered as severe a climate hazard as flood (Timothy *et al*. 2013). In periods of drought, farmers have to reduce water consumption considerably in agriculture and in domestic use.

Figure 2. Impacts of Climate Change on Water and Gender



Source: (Adapted from Babugura, 2010)

5.2. Gender Differentials and Gender Needs in the Context of Climate Change

5.2.1. Gender Differentials

As discussed above, men and women are affected differently by climate change. Even so, the level of vulnerability both experience relates to their ability to cope with, recover from or adapt to climate variability (Babugura 2010). Additionally, vulnerability to climate change relates to the level of exposure to it and the degree of sensitivity.

Given the gender-differentiated impacts and vulnerabilities, men and women will have different needs, priorities and responses to climate change. In climate change, the basic needs of men and women include safety and health care, housing and shelter (particular in areas prone to floods), food security, water and sanitation (Gotelind 2011). The Food and Agriculture Organisation classifies needs as practical (e.g. access to water, electricity, housing, health care, employment and other income-generating services) and strategic needs (long-term needs challenging gender divisions of labour, and power and control) (FAO *et al*. 2012).

5.2.2. Resources Needed

Access to resources can also depend on legal rights, social relations, tradition and cultural norms and the regulations of a specific location (Frances 2005). Women and men in rural areas are both more vulnerable to climate change impacts than their counterparts in urban areas, and their abilities to protect themselves depend heavily on the available resources (FAO 2012). However, access to and control over resources, and particularly re-establishing access and control in the face of climate change, differ between men and women (World Bank 2009; UNDP 2003; UNDP 2010). For example, men and women use water differently. Their perceptions, priorities and responsibilities in respect of water resources are differentiated.

This unequal access to and control over resources leads to vulnerability and poverty (EC 2007): specifically, unequal power relations and access to resources, and imbalance in roles and responsibilities and in legal, traditional and cultural norms, can make women more vulnerable than men to the effects of climate change (Frances 2005). Thus righting this balance is critically important.

Consequently, gender equality policies have been established and mainstreamed by various countries to ensure that men and women have equal access to and control over common property resources, finances, information, education, institutions and communities. This is seen as a means to achieve an overall enhancement in food production, livelihood resilience and the sustainable use of resources (EC 2007). Mechanisms that allow women to participate equally in decision making have thus been regularly considered (Parpart *et al*. 2000).

5.3. Water Governance, Gender Empowerment and Climate Change Adaptation

5.3.1. Water Governance

Water governance is a key discussion topic in society, state and development and is particularly being globally applied in the management of the water sector (Cleaver & Franks 2005). Water governance includes the full spectrum of influences on water management. It involves a wide range of public, private and community actors or stakeholders and encourages systematic participation in the planning, operation and management of irrigation projects (Nang *et al*. 2011). Good water governance creates cooperation and coordination among stakeholders in managing water resources and irrigation systems collectively and sustainably.

Good water governance has emerged in the principles of integrated water resources management and participatory irrigation management and development. IWRM and PIDM are accepted by many countries as the pathway to sustainable use of water resources (UNDP 2013). By incorporating equity, efficiency and socio-economic and environmental issues in the management of water resources, these principles lead to sustainable use and equitable sharing of community water resources among men and women. Under these principles, the differences and relationships between women and men have been analysed, and the needs and interests of both incorporated in a manner that aims to reduce gender inequalities.

IWRM and PIMD require the effective and active participation of the men and women concerned and recognise that women can play a central role in water allocation, management and protection (Hamdy *et al*. 2004). Men and women have different views and interests in the use, benefits, management and development of water resources (UNDP 2005). As a result, the integration of men's and women's knowledge from all sectors is attempted as a means to manage water and irrigation and to shape appropriate adaptive mechanisms and actions. The active involvement of both women and men is deemed to help to reduce the adverse effects of climate change and ensure the sustainable development and management of water resources.

5.3.2. Gender Mainstreaming and Women's Empowerment

Gender mainstreaming (or mainstreaming a gender perspective) has been internationally regarded as a main strategy for reducing inequalities between women and men (UNESCO 2000). The United Nations Economic and Social Council defines "mainstreaming a gender perspective" as a process of evaluating the implications for both men and women of any planned action (UNDP 2006).

Gender inequality has been found in decision making from local and community level upward. Women frequently face difficulties in access to decision making. As a result, their specific needs are to some extent overlooked. In the water sector, women remain under-represented, while men dominate in both management and training (UN-WATER 2005). This can create tremendous challenges for women in coping with climate change impacts (see also UN Women Watch 2012). Gender mainstreaming and women's empowerment are thus vitally important to minimise or reduce these challenges and bring about gender equality (Augusto & Saadia 2005).

Under frequent and unexpected climate extremes, sound and sustainable water resource management that strengthens hydrological systems and farmers' capacity for longer term climate risk reduction and climate change adaptation is critically important (Sadoff & Muller 2009). The IPCC (2007) has revealed that sustainable development can reduce vulnerability to climate change and must take into account the development of adaptive capacity and local resilience. IWRM could be an appropriate tool for addressing climatic challenges (Bates *et al*. 2008; Sadoff & Muller 2009). Mainstreaming gender in IWRM would increase the willingness of farmers, the community, civil society, development partners and academia to support gender approaches that integrate the needs and interests of both men and women, promote equal participation and enhance water management (UNDP & GWA 2006).

Women's empowerment and gender mainstreaming policy depend mainly on how well they represent and integrate men's and women's interests in strategic planning and in national, sub-national and local operation (from the very beginning to monitoring and evaluation).

The key elements of women's empowerment have been mooted as social (e.g. women would gain a positive self-image when they were selected by villagers to work on community committees including those attached to FWUCs, women's help groups, money saving groups,

etc: and women would be able to develop their capacity by attending professional training that gave them advice on, for instance, farming techniques, money saving, marketing, agriculture diversification, and so on.). Other element of women's empowerment are economical (the right to spend benefits and income, and enjoy equality of access to, and control over, resources), political (the right to participate in the democratic processes, water governance, community and commune development plans, women's networks, women and children committees) and physical (access to health care and to clean water, and to live with dignity, safety and security) (Longwe 1991, cited in March et al. 1999; Oxaal & Baden 1997; Augusto & Saadia 2005; Muylwijk 2006). It is important for women to empower themselves and not to depend on external agencies or institutions (Oxaal & Baden 1997).

Women, particularly those living in rural areas, rely daily on natural resources. Thus, giving them equal access to natural resources, as well as credit and education, is crucial for their living standards. Awareness raising has an essential function in eradicating gender inequality and in strengthening women's capacity to overcome the gaps that hinder their growth (Oxaal & Baden 1997). The United Nations Division for the Advancement of Women (2005) also suggests that the development of women's capacity and social networks, and gender-sensitive policies, programmes and mechanisms play very important roles in enhancing women's participation and local, national, regional and international leadership. In addition, women should be inspired to participate in political institutions and policy making, formal or informal women's organisations and networks and knowledge networks. These include academic and research groups that explore and disseminate appropriate ways to integrate gender equality issues into policy institutions and political debates (Longwe 1991, cited in March *et al*. 1999; UNDAW2005).

The equal participation of women and men in community decision making is a key element in the democratisation of water governance. Under IWRM and PIMD principles, water management is democratic, transparent and accountable, thereby responding to the needs of the people (Roux 2005; Nang *et al*. 2011). This implies that men and women have equal responsibility in water resource management, planning and operation, and equal access to and control over water resources. In this way, their specific needs and concerns are taken into account and addressed (UN-WATER 2005). Women will take decisions equally alongside men if women and men are working collectively, and through this, women will be empowered to gain increased representation. Given that climate change risk mitigations and adaptation are gender responsive, women's participation in decision making in water management and climate change-related policies and programmes must be encouraged (CEDAW 2009).

6

GENDER AND WATER GOVERNANCE IN A CLIMATE CHANGE CONTEXT IN CAMBODIA

Based on the empirical findings, this section reviews and assesses farmers' perceptions about gender roles in water governance, and women's constraints in water governance, agricultural and climate change adaptation to identify suitable options to reconcile water management, climate change adaptation policy and gender empowerment issues.

6.1. Views on Women's Participation

The participation of women in water governance and public work is strongly supported by both men and women. All FWUC members, commune councillors, farmers and officials from related provincial departments expressed the opinion that they want to have more women working in FWUCs, communes, departments and development activities because they know that women understand their issues and know how to solve them much better than men. These issues include irrigation service fee collecting, money saving, encouraging villagers to maintain canals/dams, and so on.

Women are now well aware of their rights, and sometimes they can settle water use conflicts faster and easier than men. During the interviews, farmers reported that women are currently cleverer, more active and more vocal than previously. Some women, who have been involved in meetings and training activities supported by departments and NGOs on women's rights, savings groups or agriculture, have shared many ideas during public village or commune meetings. The FWUC in the Kampang scheme (Pursat province) reported: "Since 1993 [after the presence of the United Nations Transitional Authority in Cambodia during 1992-93], women in our commune started to participate in village and commune and community affairs" (interview, August 2012). Similarly, the commune leader in Kompong Thma (Kompong Thom province) added: "As compared with the past five to 10 years, women are now better educated and more empowered" (interview, August 2012). Staff from the provincial Department of Water Resources (PDWRAM) in Pursat noted: "Women are better aware of their roles in agriculture as well as in the management of water. They have changed their attitude from asking the men to be responsible for water allocation, to doing the work by themselves or assisting men" (interview, August 2012).

However, the numbers of women in farmer water user communities, communes and provincial departments are reported to be still low. Various factors hinder women from fully participating in public affairs and in water and irrigation management. For example, women have much housework in addition to running home businesses and farming. Lack of public trust due to the slow reaction of FWUCs against negative activities such as closing or opening water gates without permission from FWUCs and refusing to pay irrigation service fees is among key factors that make women unwilling to join FWUCs. For example, in the Wat Leap scheme (Pursat), some farmers illegally damaged Kleang Teuk Dam to divert water downstream and the FWUC was unable to stop this. This created a negative image that slowed women's efforts or willingness to participate in water management. Another noticeable factor is that managing water resources and irrigation is hard work that needs strong commitment and physical strength. In addition, women's limited capacities (some FWUCs referred to this as women's experience or skill) in the water sector are a potential obstacle to involvement. These capacities need not only strong commitment but also long involvement in related issues such as water and irrigation management, agriculture, infrastructure, development, gender, disaster

risk management and reduction and climate change adaptation. The Kork Banteay FWUC (Kompong Chhnang province) gives an example: "Generally, we [FWUC] would like to have more women in the management of water since it would improve both water allocation and water use conflict resolution. However, women should have strong capacity and commitment in such work. If they do not have these things, they will become useless for the community. For example, last year (2011), among 92 voters and 32 candidates, two women candidates were elected. One woman was elected as the chair of the FWUC committee, but she rejected this position and instead wanted to be treasurer or accountant. The voters asked her reason for this rejection, and she replied that she has not enough experience or capacity in managing water so she would rather work as an accountant" (interview, August 2012).

Local elections provide opportunities for moving women toward leadership roles. However, it is noteworthy that, particularly because of the number of women candidates in the nomination list, access for women is limited although they are generally welcomed in their respective areas. Farmers and the Wat Leap FWUC gave another example of a commune council election in Me Teuk commune: "Many women were nominated as commune council candidates, but, in the end, they were not elected since they were nearly at the bottom of the parties' candidate lists. Nine commune councillors would perhaps be elected (out of a total of 18 candidates or nine from each of the two parties). The women candidates were listed as the last numbers, so they could not be elected. In general, the highest number for women was 6, 7 or 8." This case is not different from the listing of women candidates in the election of FWUCs. If that situation is improved, the participation of women will increase.

6.2. Gender Roles and Constraints

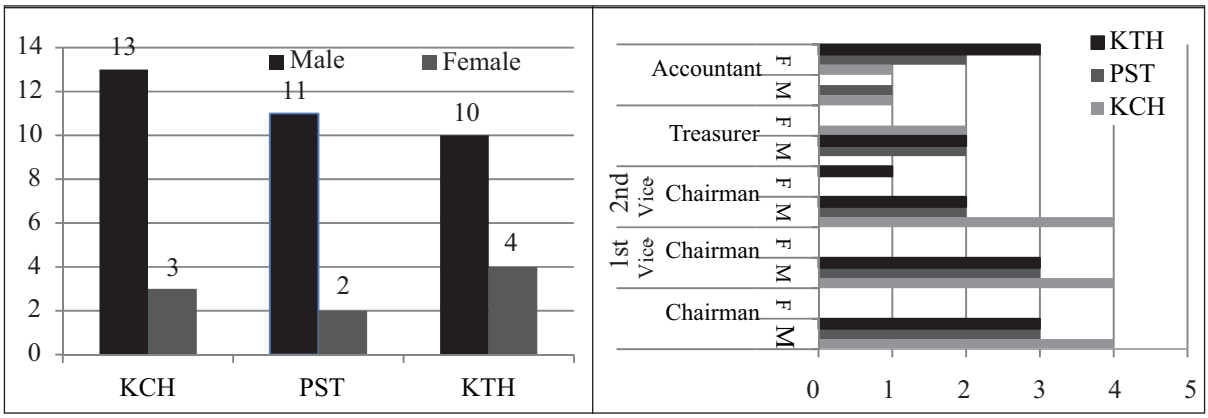
6.2.1. Gender Roles and Constraints in water governance and agriculture

Various small, medium and large irrigation systems have been constructed on the main streams of the catchments around the Tonle Sap Lake as water supply for agriculture, disaster risk reduction and climate change adaptation strategies. Cambodia accepted IWRM and PIMD as the core strategies to promote water governance and participation of relevant institutions and persons in the management of water and irrigation schemes. Under this principle, a FWUC is a kind of community-based organisation in which each community member (men and women) has paddy land inside the scheme, although they may be living in different villages, communes or districts. The FWUC holds the primary authority to manage, repair and improve irrigation systems and guide the development of new ones.

In all the study sites of the three provinces, the roles of men and women in FWUCs are important. Men and women have different roles and challenges in the committee, and the number of women is generally low.

As shown in Figure 3, among the 43 members of FWUCs committees, only nine are female (21 percent). Women are rarely elected to decision-making positions of water management committees. Most of the important positions in FWUCs, such as chair and first and second vice-chair, are held by men, except in the Stung Chinit scheme of Kompong Thom province, where the second vice-chair is a woman. Women mostly hold positions as treasurers and accountants in the committees, while men tend to take overall management roles including water allocation, system operation and maintenance and conflict resolution. Men also provide technical input and make final decisions. These unequal numbers and uneven power relationships have pushed women into passive roles in which they are not directly involved in irrigation water management.

Figure 3. Gender Roles in Farmer Water User Communities



KCH: Kompong Chhnang, PST: Pursat, KTH: Kompong Thom

In securing water for farming, men and women have been involved in managing water (see Table 2), operating and maintaining irrigation systems, sharing and disseminating information relating to water and farming, collecting and managing irrigation service fees, providing consultation on water allocation for community members and villagers and participating in irrigation and agricultural development, management and planning.

The empirical data show that in farming, women are mainly involved in selecting seed, planting, harvesting, threshing, selling products and holding money, while men are commonly responsible for land preparation, ploughing, applying fertiliser and transporting products. Men keep only a small amount of money for smoking or drinking and let their wives handle the rest.

Since farmers have increased cropping from once to twice per year, the demand for water has also increased. Water user competition within and across schemes (upstream-downstream water user groups) has occurred frequently during cropping seasons. Women have increasingly assisted men in conflict management because sometimes men cannot settle these quarrels peacefully. For example, the FWUCs in Kompong Chhnang (Kork Banteay) and Pursat (Kampang) reported that during water shortages or water competition, so far, only men went to ask for water from the upper schemes [Tang Krasang or Damnak Ampil]. But men have sometimes been faced with strong challenges from women in those schemes who did not allow the opening of water gates or canals to release water for them. In the case of women in Damnak Ampil, sometimes they criticised men who came from the Kampang scheme because those men had released water downstream without their approval. So now, to reduce water use conflict during water scarcity, men in the Kork Banteay and Kampang schemes like to go with women to negotiate with FWUCs in the upper irrigation schemes." This shows that women's roles in water management (and agriculture) are as essential as men's.

The empirical data also indicate that men tend to focus more than women do on productive work such as growing crops, managing and allocating water, operating and maintaining irrigation systems, irrigation and infrastructure development, fishing or selling their labour. Interestingly, in addition to earning cash from small businesses and conducting various productive roles with men in the community, women are also involved in reproductive (unpaid) work like providing food, fuel, water and child care (see Table 2). As a result, some women are overloaded with work.

Table 2. Gender Roles in Agriculture and Water or Irrigation Management

Activities	Females			Males		
	Not involved	Less involved	More involved	Not involved	Less involved	More involved
Selecting rice seeds and varieties			√		√	
Ploughing		√				√
Planting			√		√	
Collaborating with farmers upstream to release water downstream		√				√
Solving water conflicts		√				√
Applying natural fertiliser		√				√
Applying chemical fertiliser		√				√
Harvesting			√		√	
Threshing			√		√	
Transportation		√				√
Selling products			√		√	
Holding money			√		√	
Others						
Meetings/training			√		√	
Cutting a 30 cm gap in the bund to get water[4]		√				√
Cutting canal to catch fish	√					√
Cutting canal to transport agricultural products		√				√
Paid labour			√			√
Migration			√			√

Women are better trained than they were previously and have a good understanding of their rights and needs. They are better able to put forward their views in meetings and are more active in their duties. Some women have a thorough understanding about gender equality through training provided by institutions, projects and NGOs. Women have become more thoughtful and empowered than in past decades. The leader of Kompong Thma commune emphasised: "Women are now better informed and educated and have a good understanding of their obligations, social conditions and the progress of all sectors of present society …"

The number of women participating in village meetings and public work is reported to be high. However, women have more work at home than men; that is why their presence in commune, district and provincial meetings is reported to be low. During meeting with officials

[4] Farmers (men) cut a 30 cm gap in the bund to get water onto their fields, but then water flow erodes the bund, creating a much larger gap, at times up to 3 metres wide.

from provincial departments (Agriculture, Forestry and Fisheries, Water Resources and Meteorology, Environment and Women's Affairs), it was learned that, in general, more women than men attend village meetings (women account for 70 percent of attendees). But in commune meetings, women account for only 30 percent of attendees. In village and commune meetings, women have been given the right to make decisions on all matters raised in the meeting if their husbands are far from home (for instance, if they have migrated to seek jobs).

6.2.2. Climate Change Impacts

Farmers in all the provinces studied noted that they are facing more natural disasters and climate-related impacts, particularly floods, windstorms, high temperatures, vector-borne diseases and droughts (see Table 3). In Kampang, Wat Leap and some parts of the Damnak Ampil schemes, droughts were prolonged from one to three months in 2012 (i.e. there was no rain from May to August). Rice crops were damaged, and rivers and streams and grass (for feeding animals) dried out. Farmers in the Kampang scheme said: "In the past five to 10 years, at this time [August] the stream used to be full of water, but this year [2012], there is no water at all in the main stream [Svay Don Keo]. There are no fish (or very few) in the stream because the water is so low."

Similarly, farmers interviewed in Pursat, Kompong Chhnang and Kompong Thom reported that sometimes it seemed that rain was imminent (dark clouds and strong wind, or cold and strong wind), but lately rain had not materialised at all. Drought caused extreme problems for people living outside or far from irrigation schemes because the water in canals or drainage systems was insufficient. Farmers needed to spend a lot on pumping water for their fields. Some farmers (particularly poor ones) did not have pumps or long water pipes, and, as a result, their paddy was damaged. The most vulnerable were the poor and women-headed families or widows.

FWUCs reported that many vulnerable and poor households lacked both equipment (pumps, hand tractors) and labour when facing floods, droughts, pests and diseases. So FWUCs frequently request their neighbours or the volunteer group in the village to support them during these difficult times, regardless of whether their fields are inside or outside the irrigation systems.

Field observation shows that the intensity of climate change impacts on men and women is almost equal (see Table 3). However, the adaptive capacity of men seems to be better than that of women—in particular in adapting to higher temperatures.

Table 3. Climate Extremes and Their Impacts on Men and Women

Climate extremes	Level of impact		Adaptive measures
	Female	Male	
Flood	S	S	• Rehabilitate irrigation systems and build flood protection dams • Plant resilient crops • Prepare paddy to store water after flood • Prepare seeds, fertilisers, labour, land and water to grow crops right after flooding • Improve water governance and irrigation system management • Build safe locations and flood warning systems • Establish volunteer groups to help women and disabled people during floods • Seek support from government, NGOs, private companies, development partners • Buy or hire pumps or water pipes to use during and after flood • Migrate to seek jobs in provincial towns, cities or neighbouring countries.
Drought	S	S	• Expand the irrigation system • Plant resilient crops • Improve water governance and irrigation system management • Seek new or more water supply sources and reservoirs • Seek support from government, NGOs, private companies, development partners • Rent paddy land close to water sources • Buy or hire pumps or water pipes to use when facing water scarcity • Migrate to seek jobs in provincial towns, cities or neighbouring countries.
High temperature	S	M	• Improve health care (particular for women and children) • Plant more trees in the village
Vector-borne disease (people)	S	S	• Improve health care (particularly for women and children) • Increase access to health care and hygiene services
Vector-borne disease (livestock)	S	S	• Coordinate with local authorities and report to relevant agencies to combat diseases • Vaccination and other livestock protection services
Pests	S	S	• Coordinate with local authorities and report to relevant agencies to take action again pests

L= Low, M=Medium, S=Severe

6.2.2.1. Flood Frequency and Impacts

Floods are a natural catastrophe for farmers in the study sites. In the O Svay scheme in Kompong Thom, farmers noted that some parts of the villages, rice fields and home gardens were inundated and damaged during the 2011 flood, which lasted seven to 10 days. Both men and women suffered severely. Cows and pigs were evacuated to higher places like big dams and the banks of canals. However, many pigs and chickens drowned. In a similar case, the FWUC in the Trapeang Trabaek irrigation scheme, Kork Banteay commune, noted: "Floods occur more frequently than in the past. For example, farmers in this scheme encountered big floods twice in 2012: the first one was the Tonle Sap flood and the second was the flash flood caused by the heavy rain upstream. Both wet and dry season rice, water gates, canals and some

dams were damaged. Farmers lacked food and had to replant after the floods; otherwise they would have had no food to eat."

Floods (followed by windstorms and prolonged drought) are seen as big climate issues by rural farmers, including those living in the Kampang and Wat Leap schemes. In 2011, flooding destroyed all wet season rice in the Kampang scheme. Farmers reported: "Our areas faced big floods in 2000 and 2001. But they were smaller than the ones that took place in 2009 and 2011." Flood protection dams and spillways have been built to protect farmers and crops. Farmers in the Wat Leap scheme renovated a big dam, built in the Pol Pot regime, 1975-79, to prevent flooding. But it was not big enough to cope with the flood that occurred in 2012. In the Rolous scheme, Kompong Thom, a new spillway was also built by MOWRAM.

Beside the increased frequency of floods, farmers who had lived in the Rolous scheme, O Kanthor commune of Kompong Thom, for more than 40 years mentioned that the amount and frequency of rain had changed remarkably, i.e. rain duration was sometimes shorter, longer or delayed (late). They emphasised that normally the rain fell from April to November each year, but in the past few years there had been little or no rain during April to August. For example, this year [2012], there had been no rain from April to August.

In most schemes and communes studied, farmers noted that storms were becoming more frequent and stronger. The FWUC and people in the Rolous scheme reported that every time the schemes were flooded, there were also strong winds (in 2000, 2001, 2009 and 2011). A severe case of flood and windstorm was recorded by a farmer in the Wat Leap scheme in 2011: "It was a strong windstorm that occurred in the commune. Three children in one family died during the flood. Two were drowned in the river. Another one who had travelled by boat across the village was also drowned after his boat was hit by the strong wind and capsized." In the villages of O Svay and Trapeang Trabaek, many big trees were blown down by strong winds in 2012. These occurrences were causing great concern to the people there.

6.2.2.2. Dry Spells and Their Impacts

Dry spells or drought in the middle of the wet season is a major concern that can lead to water use conflict. In Pursat province, droughts happen frequently. Prolonged drought or dry spells (in March-April and July-August) have severely damaged rice crops. In 2012, about 30-40 percent of the rice crop (according to FWUCs the total dry season rice in 2012 was about 500 ha) in the Wat Leap scheme, and about 60 percent of the rice crop (the total dry season rice is 1570-1600 ha) in the Kampang scheme were damaged by dry spells that took place from May to August. Farmers said that the remaining crop in the two schemes provided a yield of only 1-3 tonnes/ha (normally, if there is no drought, the yield will be about 4-6 tonnes/ha).

Pursat PDWRAM reported: "In the wet season of 2012, the rain was unpredictable [lack of rainfall] during May to June. Farmers in many communes of Bakan district faced water shortages. PDWRAM released water from many reservoirs such as those in Stung Svay Don Keo, O Tnous Tachap and Stung Boeung Kna to save farmers' rice crops. The rice fields that were close to main canals (less than 400 m) could access water. However, those located far from main canals faced water deficiency (particularly during May and August 2012)." FWUCs in the Wat Leap and Kampang schemes said: "Due to uncertainty about rainfall, at present there are few farmers who are planting wet season rice [April/May-July/Aug] in the Wat Leap and Kampang schemes. Many farmers are afraid of water shortages and prolonged drought that will cause them to lose seeds, time and fertilisers." People in Stung Chinit (Kompong Thom) and the Pok Pen scheme (Kompong Chhnang) also raised concerns: "The weather is now changed compared with the last 10 years. In the cold season, it is not cool but instead is sometimes very

hot. And some areas that used to have heavy and regular rainfall are now facing a complete lack of, or irregular, rainfall." These observations suggest that uncertainty about the weather makes farmers' livelihoods less secure.

Prolonged drought challenges provincial and district authorities, PDWRAMs, FWUCs, village and commune leaders to find suitable ways to ensure the equal sharing of water in two respects: between FWUCs in upper and lower schemes and between water user groups (FWUGs) within a scheme. In most cases, FWUCs and FWUGs located downstream or farmers whose fields are far from canals cannot get enough water to save their crops during droughts because farmers who live upstream do not release water. This puts pressure on farmer water users downstream, particularly the poor, and some become even poorer. It was also observed that, during water shortages, women and female-headed households faced severe difficulties since they lack the human and financial resources to cope.

6.2.2.3. High Temperatures and Pest Infestations and Diseases

The temperature is rising from year to year and causing great challenges. FWUCs and farmers observed that the temperature in 2012 was higher than in the previous year. One old farmer in the Wat Leap scheme said, "The temperature is too high, and my family could not stay even under the house". As mentioned, men have more options than women in protecting themselves from high temperatures, although they are still affected. Furthermore, when the weather is hot, the animals (cows and buffaloes) suffer in that they have no grass to eat, and some die. When the temperature rises, farmers experience more pest infestations (mainly in February-March) like worms, grasshoppers, small caterpillars and brown leaf-hoppers, which can destroy many hectares of rice in just one night. At the same time, high temperatures have reduced crop growth rates (crops have become smaller or thinner) and yields.

Farmers also face vector-borne diseases such as fever, diarrhoea and dengue. FWUCs in the Rolous and O Svay schemes reported that some farmers in the community have faced food shortages as a result of drought and disease. Livestock have no grass to eat and also get diseases. Some people fall into greater debt because they need to borrow money from the bank or businessmen [for food, seeds, fertiliser] but they are not able to pay the interest (especially female-headed households or widows). Women in the Wat Leap scheme revealed that in 2012, some young children had developed high temperatures and caught dengue fever. In two cases, they died.

Before, during and after climatic hazards, staff from province and district departments of Agriculture, Forestry and Fisheries come to the village to help famers with problems caused by pests. District and commune veterinarians come to vaccinate livestock in the village or commune after people report those issues to the village or commune chief. The commune and village women and children care committees (WCC) work closely with staff from PDWA and the provincial Department of Health and the village volunteer groups to provide support with health care and sanitation.

6.2.3. Gender Roles and Constraints in Climate Change Adaptation

Gender mainstreaming and women's empowerment have been introduced and applied in every sub-national sector because of their importance (interview with an official from the provincial Department of Women's Affairs on 13 August 2012 in Kampong Thom province). The PDWA plays a very important role in this work. Currently, sub-national gender mainstreaming is applied well, and women are more aware of this subject. Many competent women have been elected as committee leaders or commune councillors. During key informant interviews in

Kompong Thom, PDWA officials reported: "Now women's participation has been taken into account in every development project. Currently, there is no committee that has no women members."

From one community to the next, women's involvement is increasingly observed in any public work, project, FWUC or commune, as well as in adaptation to, and mitigation of, climate-related disasters. Village volunteer groups (consisting of men and women) and women's help groups have been created to assist vulnerable and marginalised groups and women and to ensure that women's rights, benefits and difficulties are well addressed. In commune/sangkat and village Women and Children Care Committees (WCCs), which focus on women's rights and child protection, and in district and provincial Women and Child Consultative Committees (WCCCs), women are working enthusiastically. WCCs are set up and led by the commune. The commune leader is the chairperson, and all village chiefs are members. The second deputy leader of the commune is the vice-chair, and one commune councillor who is responsible for women's and children's care in the commune is a permanent member of the committee. Various awareness-building and public activities, focusing on such things as water management, village and commune investment plans, agricultural development and climate issues, are implemented through this committee. WCC members join the WCCC meeting once a month. Issues that cannot be solved by commune or district are reported to the provincial council and administration committee for further action.

Year after year, women in these committees try to support each other, and at present are performing well and thus encouraging other women to work equally with men locally. They have persisted with the work assigned to them (either household or public work) and do their best to fulfil the requirements. For example, in Kompong Thma and O Kanthor communes, women from every village have actively participated in the volunteer groups[5] or village support groups[6] to help people in the commune during natural disasters, particularly floods and droughts. This reflects that, at grassroots level, women's role is vital in improving livelihoods and food security and adapting to climate change.

However, the time available to women, their capacity and experience and encouragement, recognition and support from men in water governance and climate change adaptation are still limited. In this respect, PDWA and PDWRAM officials in Kompong Thom mentioned: "Women want to participate in all public work. However, due to their capacity, experience and housework, only a few women can actively take part. Some women are still afraid of the responsibilities that come with being elected as committee leader." This indicates that cultural barriers and perceptions mean that men are still regarded as the ones who should play the important roles in public and household activities, although this has been reduced. The effect of this perception varies from one community to another, but does hinder women from participating in public work.

6.3. Resources Needed and Adaptive Measures

The empirical data indicate that human, natural, physical, financial and social resources are key (Table 4) for local farmers in all study areas to secure their livelihoods as well as to adapt to climate change.

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5 These are supported by the provincial Red Cross and work closely with provincial and district disaster management committees to help people during natural disasters.

6 These are created in each village consisting of two men and one woman. In some villages, all members are men. The village leader is the chair of this group.

Table 4. Resources Needed, Priorities and Constraint

Type	Resources needed	Priorities	Constraints
Natural resources	• Water, land, lakes, rivers, forest, fish and rain water	• Agriculture and daily use • Improving management and governance	• Changing climate • Geography • Irrigation systems • Good management and governance
Physical resources	• Spillways, dams, canals and drainage systems • Pumping stations, pumps • Roads , water gates and bridges	• Expanding irrigation systems • Transportation • Strengthening land and water management	• Limited funds (construction, operation and maintenance) • Good management and governance
Financial resources	• Household funds • Banks • Irrigation service fees • Rice banks • Savings groups • Markets	• Daily and nutrition • Health and physical energy • Improving irrigation, infrastructure and agricultural products	• Repaying loans • Collecting and managing irrigation service fees • Uncontrollable and unstable market prices for agriculture products
Human resources	• PDWRAM, PDAFF, PDOE, PDOWA and others • Local authorities and villagers	• Agricultural technology, water governance and climate change adaptation • Seedlings and farming techniques • Processing and conservation of agricultural products • Education and gender mainstreaming • Improvement of gender empowerment, knowledge and capacity • Increasing women's incomes, livelihoods and participation	• Ability to deliver agricultural education, extension services, research and demonstration • Farmers' attitudes in rice seed selection and farming • Education, perception and actual farmer practices
Social resources	• FWUCs • Local authorities and villagers • Red Cross and provincial • Committee for Disaster Management • WCCs, WCCCs, women's help groups, volunteers • Savings groups • NGOs	• Providing support and trust in women's participation • Enhancing women's empowerment, awareness and capacity • Improving women's rights and access to and control over resources and decision making	• Lack of practical mechanisms for gender mainstreaming and empowerment • Knowledge and skill of local stakeholders • Education and cultural barriers • Participation, opportunity and women's commitment

Men and women have equal rights and access to those resources. In particular, natural and physical resources (land, water and irrigation systems) need to be better used and managed (taking into account the disabled, women, children and marginalised). Financial resources are needed for rehabilitation, construction, development, operation and maintenance of irrigation systems, reservoirs, flood protection dams and rural infrastructure. Human resources are required not only for technical advice on management of common property resources, agricultural development, gender mainstreaming, gender empowerment and climate change, but also for monitoring and enhancing women's participation, awareness, capacity and resilience building. Provincial departments and authorities play important roles in improving women's rights, access to and control over resources, and their rights to participate in public decision making, disaster risk reduction and climate change adaptation.

Women's networks are reactive mechanisms that can support local women in a timely and effective manner. For example, PDWAs rely on their own networks (women's help groups) to support women in villages or communes affected by climate disasters since the response from PDWA or its district network is sometimes slow or remote (interviews with officials from PDWA on 13 August 2012, Kompong Thom). Commune or village women's help groups can support village women at any time; they are fast and capable of engaging or training local women.

During natural disasters, local authorities and provincial departments join with the Committee for Disaster Management to help people at their respective levels. The chairperson of the sub-national Disaster Management Committee is the provincial governor (the deputy governor is the vice-chair) and all provincial department directors are members. When floods or droughts occur, the provincial departments cooperate with the provincial Red Cross and the Disaster Management Committee to save people in their sectors. The provincial health department and NGOs are also involved in disaster response. The provincial Disaster Management Committee is in charge of practical responses to disaster, including the identification of safe locations for evacuation. The Provincial Department of Agriculture, Forestry and Fisheries provide seeds, fertiliser, training and field demonstrations to help farmers to recover. Men, women and marginalised groups who have suffered from disasters have equal rights to these services.

Although local men and women enjoy equal rights regarding resources and to participate in public decision making, it is reported that women have difficulties in taking advantage of these. For example, due to their geographical location and the lack of irrigation systems, some farmers do not have sufficient access to water for their fields, and some face floods and drought more than others, even when they are members of the same FWUC. In some schemes studied, poor rural women and female-headed households whose rice fields were far from main canals were among the most vulnerable and were unable to cope with natural disasters. Generally, they own small paddy plots and lack both human and financial resources for farming, particularly during floods and droughts. Even access to credit from private sector companies and banks or micro-finance institutions, although much better than in the past, still does not solve problems: farmers are reluctant to adopt this solution because they worry about their ability to repay loans. At the same time, unexpected climate and weather conditions and unstable market prices of agricultural products add to their anxiety: if their crops fail, they will not be able to repay loans. In 2012, some farmers in the Kampang and Wat Leap schemes did not cultivate at all because they were afraid that irregular rainfall would damage their crops

The relevant institutions have made great efforts to help and inform people about the measures to protect them or to cope with disasters. For example, PDWRAMs are in charge of ensuring water allocation and governance, and PDAFFs are key in delivering agricultural education and extension services, research and demonstrations for farmers. Even so, many farmers find

it hard to change their attitudes and practices following PDWRAM and PDAFF instructions and guidelines, and this results in water use conflict and crop loss. Furthermore, although there are mechanisms for gender mainstreaming and women's empowerment (some undertaken by government institutions, local social groups and NGOs) that inspire women's commitment and participation, farmers' knowledge (especially that of women) and social and cultural norms in rural areas still hinder farmers from fully accepting and applying gender mainstreaming and women's empowerment.[7] In many cases, even though more women than before participate in public meetings, training or in holding family or community funds, the final decisions still fall to men.

[7] During the interviews in some areas, farmers expressed views which showed that such social and cultural norms are still embedded: women should listen to, or obey, their husbands or leaders and should not talk much in public meetings; women should take care of work at home.

7

DISCUSSION

The demand for women's involvement and empowerment through socio-economic and political equity and the rights to access and control fundamental resources has gradually increased. Knowing that water is vitally important for agriculture and that 66.5 percent of Cambodian farmers are women, MOWRAM emphasises the participation of women in the operation and management of irrigation systems in order to ensure that women and vulnerable groups have the water they need to improve their socio-economic situation and their health (MOWRAM 2007b). Thus, in its gender mainstreaming strategy 2007-10, MOWRAM paid particular attention to establishing women's networks and gender mainstreaming action committees to promote women's capacity and to provide as many opportunities as possible for the equitable participation of women and men in national, provincial and local decision making. The above findings, however, suggest that traditional attitudes and gender stereotypes remain as pressures on women to remain subordinate to men in every aspect of their daily lives (see also MOWA 2008). For example, in all the areas studied, even though women are interested in engaging with FWUCs, they are still reluctant to take leadership or decision-making roles.

Cambodia has gradually improved the use of water resources to boost the economy and people's livelihoods and general welfare in a participatory and inclusive manner (MOWRAM 2007a). Good water governance creates cooperation and coordination among farmers, local authorities, NGOs and government in managing water resources and irrigation systems. The findings suggest that the participation of women in FWUCs is significant, but the number of women in decision-making roles remains very low. Thus, the men in key roles in the committees should have strong knowledge and a good understanding of gender equality and women's empowerment in the management and operation of water allocation.

The improvement of water governance is crucial to respond to an expansion in irrigation while at the same time enhancing equitable access to irrigation water and promoting women's role in household and community decision making. With support from men in the community, women need to commit to active participation to build their experience in water and irrigation management and development. This will not only help to minimise their constraints and provide them with the resources they require but also strengthen their capacity to work equally with men in water and agriculture and bounce back from climate change impacts.

Cambodia has made great efforts to promote and ensure the rights of women to participate in national development on an equal basis with men (CDC 2004). The gender mainstreaming framework has been integrated into major national policy and strategy, including the National Strategic Development Plan 2006-2010 (RGC 2006), Mid-Term Review of NSDP (RGC 2008b) and the NSDP Update 2009-2013 (RGC 2010a), the Law on Administrative Management of the Capital, Province, Municipality, District and Khan (RGC 2008a), the Five-Year Strategic Plan Neary Rattanak III (MOWA 2011b) and the National Programme for Sub-National Democratic Development 2010-2019 (RGC 2010b).

The government has a strong commitment to provide men and women with equal economic benefits as well as access to public services, health care and social protection, employment and education. Gender needs and concerns have been closely examined and taken into account in policies and programme design, implementation, monitoring and evaluation. MOWA, the leading institution in the reduction of gender-based disparities, has recently collaborated with the MOE and established the Climate Change Working Group or Gender Climate Change Committee to facilitate gender mainstreaming action committees, which are mainstreaming

gender and climate change issues into policies and programmes in the line ministries and national, sub-national and local government. Through this mechanism, the constraints on women are expected to be removed, and women will have more opportunities to enjoy the benefits of development. Furthermore, with the collaboration of MOWA and the United Nations Development Programme, MOE has also established the Gender Working Group with responsibility to improve gender status, mainstream gender equality in all development programmes, raise gender awareness at all levels of the environment sector and increase opportunities for rural women to manage natural resources and environmental services (MOE 2010). MAFF has set objectives to increase gender awareness, integrate gender analysis and sex disaggregation into agricultural planning, increase the number of competent women in leadership positions and increase the opportunities for rural women to manage resources and agricultural services (MAFF 2006). Although various tangible and intangible challenges still exist, gender mainstreaming and women's empowerment have become a focus and are being addressed and integrated within key development sectors.

8

CONCLUSION AND RECOMMENDATIONS

8.1. Conclusion

Effective and continuous involvement of women in water and irrigation management and development, agriculture, village and community development and climate change adaptation has become crucially important. Aware of this, stakeholders from different sectors and levels have become very open towards women's participation in community, commune and public work. Men and women are encouraged to take part in community planning and decision making because they have built their knowledge in water, agriculture and disaster risk reduction and obtained precious understanding that can help to establish proper natural resources governance as well as climate change adaptation and mitigation practices.

The government has progressively mainstreamed gender policy in water governance and agricultural development to ensure better water allocation, crop production, drought and flood protection and farmer livelihood resilience. The co-management roles of men and women in local communities have been promoted to ensure sustainable management of common property resources and inclusive development. Local knowledge and scientific findings on climate change adaptation have been integrated in national climate change adaptation strategy and policy. Also, the collaboration among provincial departments, local authorities and communities and civil society plays a very important role in improving women's right, access to and control over resources needed to mitigate climate disasters.

However, women currently still have less experience than men in water and irrigation management. Their participation in commune affairs is also hampered by the demands of both reproductive and productive roles. Female-headed households whose fields are far from canals face severe challenges during droughts. In addition, there are still hindrances in gender mainstreaming and gender equality implementation. Men dominate most important positions in the FWUC committee. Unequal numbers and power relations, in turn, undermine women's interest. Women's access to and control over resources to adapt to climate change are moderately less than those of men. Due to this, women's voice in decisions on irrigation system development, drought and flood protection dam construction and commune development projects can be overlooked and their constraints remain unsolved.

As climate and weather variability is becoming more pronounced from year to year, farmers face more climate-related impacts, particularly floods and droughts. Better water governance, irrigation expansion and local support are crucial to cope with climate change and build livelihood resilience. Since gender equality, women's empowerment and climate change adaptation are closely related, all need to be taken into account and well understood by all involved. This will ensure better climate change adaptation, sustainable water and agriculture development and inclusive economic growth, and ensure that the rights, responsibilities, opportunities and benefits of men and women are equitable and well protected.

8.2. Recommendations

Below are some key options to diminish challenges. They also stimulate discussion on the empowerment of women and the mainstreaming of gender sensitivity and the role of women within water management, agriculture and climate change adaptation that will boost the mandate and responsibility of FWUCs without diminishing the important local role and authority of men.

Recommendation 1: Minimise women's challenges in water, agriculture and climate change adaptation

A deficiency of suitable capacity, skill and experience, and limited opportunities and time for working in these sectors, remain challenges for women's participation in water and agriculture development and climate change adaptation. To minimise those challenges, the following measures should be undertaken:

- strengthen the capacity of women through FWUCs and other local social groups and motivate men and women to work towards gender equality;
- review and reform existing rules (community internal rules, election criteria and by-laws) and regulations that may hinder the participation of women or their representatives;
- ensure that new policies and development programmes or projects take into account gender sensitivity and promote the active participation of women at all levels;
- establish and facilitate women's help groups to support gender mainstreaming and reduce gender constraints;
- enhance women's economic, social, political, legal and cultural status and promote gender awareness-raising for women and men in communities, villages and communes;
- encourage men to allocate time (by taking on some of their household jobs) for women to work (or to participate) in the community or public affairs.

Recommendation 2: Improve water governance, irrigation system expansion and extension services

Women's livelihoods are more susceptible than men's to climate shocks because their farming activities rely mainly on water. The irrigation systems and agricultural extension services that use or relate to modern technologies that help farmers to cope with climate change, are not available to the small-scale farming activities in which women are involved. Thus, key areas to be taken into account include:

- strengthening water governance by addressing its economic, social, gender, environmental and political dimensions to ensure that water resources and irrigation systems are managed in a transparent, participatory, equitable and accountable manner;
- supporting and reinforcing FWUCs following IWRM and PIMD principles and community-based adaptation frameworks;
- handing over appropriate responsibilities to women in FWUCs such as planning and decision-making in water management and development and disaster risk reduction activities;
- expanding irrigation systems to secure water availability, to reduce water stress and user conflict arising from water scarcity and to control flood water. In addition, awareness raising about irrigation management, agricultural development and climate change adaptation should be started with women at household level;
- widening the provision of agricultural extension services to farmers and increasing field demonstrations and local short training courses;

- encouraging women to become involved in agricultural extension services and in women's help groups and field demonstrations;
- improving women's engagement and strengthening gender equality mainstreaming.

Recommendation 3: Improve gender mainstreaming in water governance and adaptation to climate change

Under government directives, various state, private sector and civil society institutions are to incorporate gender equality through their sectoral implementation plans. Women's livelihoods are even more vulnerable when there is a discrepancy in gender equity in social, cultural and political institutions. Thus, some important measures include:

- establishing appropriate policy and guidelines that enable women and men (girls and boys) to have equal opportunities in resource allocation and management, and to share their views and concerns in decision making;
- enhancing gender considerations across sectors in order to give women the education, skills and capacity needed to participate in an equal manner with men;
- promoting and integrating local knowledge with scientific research into climate change adaptation strategy and actions;
- providing equal opportunities for men and women to control their livelihood resources, to have their voices heard and their challenges removed. Particular attention should be given to the development of a comprehensive gender equality strategy that will ensure that men and women have equal social, economic, decision-making and political opportunities;
- promoting the participation of men, women and social groups in water and agricultural development initiatives and climate change adaptation programmes and projects, and establishing mechanisms that enable them to benefit equally from these;
- enhancing collaboration among state, private and civil society organisations to review and reform existing unequal structures in FWUCs and other local social groups. Practical efforts should be formulated and people motivated to strengthen or create more gender equity in social, economic and livelihood development and climate change response.

Recommendation 4: Promote women's participation and empowerment in water governance and climate change adaptation

Population growth, human development activities and climate-related hazards threaten the resources on which rural women depend. Improving women's rights and ensuring their access to those resources are therefore significant. Important activities include:

- providing equal and suitable opportunities for farmers, FWUCs and other social groups and committee members to participate and exercise their rights and obligations in natural resources utilisation, management and development (in leadership and decision-making roles), and to have equal access to and control over common property resources;
- increasing access for women to professional skills and on-the-job training (based on practical and strategic needs) and capacity development programmes in agricultural production and diversification; irrigation management, operation and maintenance; gender equality; disaster management; and climate change adaptation;

- motivating competent women to share experiences, skills and information that would empower and enhance the knowledge and capacity of other women;
- supporting farmer associations, cooperatives and other forms of local collective action to solve gender and women's issues;
- reviewing gender strategy and integrating the principles of gender equality and the empowerment of women into all sectors;
- reviewing and monitoring ongoing water and irrigation development and climate change adaptation programmes and projects to ensure that pro-poor and gender issues have been taken into account.

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