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Pilot testing of potential adaptation and mitigation measures

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Analysis of gender-differentiated climate change impacts, vulnerability and adaptation of smallholders in Soc Trang and Tra Vinh provinces in the Mekong River Delta (MRD)

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Summary

The objective of this study is to better understand socio-economic and gender-differentiated impacts and perceptions of climate change in rice farms in Southern Viet Nam. Focus group discussions and a household survey of both male and female farmers in 160 households were conducted in four villages of Soc Trang and Tra Vinh provinces. These coastal provinces are located at the mouth of the Mekong delta in southern Viet Nam, an area highly at risk of climate variability and climate change causing exacerbating problems of saline intrusion and drought episodes. The survey found that the farm households heavily relied on rice for their livelihood, and that rice contributed to 79 % of the farmer's total income. In the last 10 years, 95 % of the Soc Trang households and 89 % of the Tra Vinh province had experienced damage to their livelihoods due to salinity and/or drought. The residents in Soc Trang and Tra Vinh province are mostly Khmer ethnic, followed by *Kinh* (Vietnamese) people. Most of the households are rice farmers, having their own lands. Husbands are generally the household heads and the landowners, and they little education, but in general more educated than women. Both male and female farmers perceived the existence of climate change and variability and recognized its adverse impacts on crop production, animal husbandry, and fishing, as well as other household activities. Low crop yields, and even occasionally total crop losses were rated as the major impacts, leading to increased debt and food insecurity. Farmers coping strategies included change of rice varieties; leave land fallow during severe drought; change of the cropping pattern; more cash crops; and off-farm work. Women not only did the same tasks as men in farming traditionally but also contributed to seed preparation, replanting, hand weeding, removing off types, drying and sacking. Womens' workload inn recent years increased more than that of men due to climate variation. It was found that male farmers are more likely than female farmers to adopt technologies that can reduce vulnerability to climate change. These technologies included the use of stress-tolerant crop varieties; planting of early, medium or late varieties to avoid crop loss to variations in presence of drought/salinity; pest and disease management techniques; and development and use of crop varieties resistant to pests and diseases. Both female and male farmers had equal access to credit and money loans in the periods of extreme weather events. Moreover, female farmers tend to spend less money, and they stored food to cover basic needs, while male farmers are used to seek wage labor or migrate. The respondents, especially women, reported a lack of adequate extension and technical information about how to cope with agriculture under climate variability. Thus, in situations of salinity and drought, rice farmers reverted to traditional practices with low rice yield outputs, and the Benefit-Cost Ratio (BCR) varied from 1.2 to 1.6 only. Given the important role of women in rice production , rural extension should not ignore women farmers in the development of the extension programs related to agriculture adaptation and climate change. Moreover, mitigation measures should address the needs of both men and women, and ethnic people living in the areas affected by climate change. Any new adaptation measures have to be simple, help in reducing GHGs, low cost and easily adaptable, since majority of farmers are small or marginal landholders with little education and low investment capacity and the government does not have adequate resources.

Keywords: Climate change, gender, vulnerability and adaptation.

1. Introduction

Vietnam will see substantial changes in the rural areas, in its efforts to achieve the set national development goals in the coming years. Addressing the needs of 75 % of the population living in rural areas who also constitute 90 % of the poor - is perhaps the most difficult challenge the country has to address in the next 2-3 decades. A majority of the farmers are small scale, with average farm sizes of 0.8 hectare that currently provide only part-time work for most farm families and are highly vulnerable to changes taking place within social, economic and climatic conditions. Climate change and variability associated natural hazards such as flooding, storms and droughts have been a continuous threat to the life and property of Vietnamese society in the past. With its 3,260 km coastline and highly varied geography, Vietnam is highly vulnerable to climate change (Das Gupta et.al 2007; Das Gupta et.al 2010).

The country is divided into three regions: North, Central, and South, and the annual mean temperature in the different regions ranges from 8 to 29 °C. The monthly mean of the coldest month is about 13-20 °C in the North and 20-28 °C in the South. Vietnam has a tropical monsoon climate with frequent tropical cyclones affecting the Northern and Central regions, and less frequently in southern areas. Annual rainfall ranges from 600 mm to 5,000 mm, with as much as 70-80 % of rainfall concentrated in the rainy season (August to November). The seasonal distribution of rainfall is closely related to the monsoons. In some years, rainfall intensity can be high, producing a rapid run-off and serious flooding. Because of its low coastal topography, Vietnam is exposed to high winds and storm surges brought by tropical cyclones.

Rising temperatures, variability in the seasonality of rainfall and sea level rise are the three main concerns for Vietnam, despite the uncertainty in climate projections. In general, the trends show increasing wetter wet seasons and prolonged drier dry periods (Johnston et.al 2010). Studies have found that the annual average temperatures have increased between 0.5 to 0.7 °C per decade, according to a report by ISPONRE (2009). Simulations of future climate change in Vietnam show that temperatures will increase further by 0.3 to 2.5 °C by the year 2070 that will have a significant impact on food production (Asian Disaster Preparedness Center, 2003). Shifts in temperature will also lead to more incidence of pest and disease and subsequent reduction of yields if not managed properly (Johnston 2010). Scarcity of water resources and droughts are becoming a more common phenomenon in the country albeit still lower in priority than the critical annual flooding problems. During the mid-dry season (March-April), the maximum water demand, mostly for irrigating rice fields, coincides with minimum discharges from the river. Sea level rise and salinity will have grave implications for Vietnam, with its extensive coastline, leading to saline intrusion and loss of productive land (Asian Disaster Preparedness Center, 2003). Damage to rice production by loss of rice land based on scenarios of climate change for Vietnam is severe (MARD, 2009). The Vietnam Institute of Water Resources Planning reported that salinity intensity (as high as 4%) will increase along the coastline reaching upto 40 km inland from sea borders , affecting at least 300,000 ha of rice area and about 20 million inhabitants, thereby, resulting in a loss of 10 % of GDP (National Institute for Planning and Projection,

Report 2003). The World Bank has classified Vietnam as one among five Asian countries that will face food insecurity.

Poverty in Viet Nam is more common among farmers, households with low education and large families, and minority communities. Poor people are more vulnerable to environmental variability. The gender-poverty links indicate that 70 percent of the poor in the world are women and their vulnerability is articulated by race, ethnicity, and age (Parikh 2007). Farmers and women in Vietnam will need to adjust to climate change (with rising sea levels and changed weather patterns) and accordingly adapt with layers of resiliency in their farming practices and investment decisions (The IPCC Fourth Assessment Report, 2007). However, any new adaptation measures have to be simple, help in reducing GHGs, low cost and easily adaptable, since majority of farmers are small or marginal landholders with little education and low investment capacity and the government does not have adequate resources. Viet Nam has made considerable progress on gender equality, nevertheless important gender differences still exist upon deeper examination of data (World Bank 2011). This report aims to analyze gender-differentiated climate change impacts, perceptions, vulnerability and adaptation of farming households in Soc Trang and Tra Vinh provinces located in the Mekong River Delta (MRD) of Vietnam.

2. Methodology

2.1 Study area

2.1.1 The Mekong Delta

The Mekong Delta is the most important rice production area in Viet Nam with a total land area of 40.554 km^2 (equivalence of 4.055 million ha), of which rice area in 2012 occupied 1.7 million ha. Its rice production was 24.6 million tons, where 6.8 million milled rice was exported (84 % of the total national rice export), and the average rice yield in the Mekong Delta was 6.7 ton/ha (Ministry of Agriculture and Rural Development, 2013). The Mekong Delta focuses on extension to help farmers in adoption of new technologies to improve rice production. According to Nguyen Van Thang, et al. (2010), if the sea level raises by 0.25 m, the submerged area will be 5,428 km^2 (14 % of the area and will affect 9.6 % of population). If the sea level raises by 0.5 m, the submerged area will be 12,873 km^2, occupying 32 % of the area and affecting 22 % of the population. If the sea level raises by 1 m, the submerged area will be 26,856 km^2 (occupies 67 % of the area and affects 55 % of the population). The unusual phenomenon of seawater raise and saltwater intrusion recently have affected the rice production in the Mekong Delta.

This study was conducted in Tra Vinh and Soc Trang, two coastal provinces in the Mekong Delta having estuaries leading to the sea. Drought and salinity problems often happen in the provinces and cause large damage to rice production. According to Soc Trang Irrigation Department (2013), the agricultural area affected with salinity intrusion in Spring –Summer season in 2013 was 6,322 ha, of which rice area affected was 6,105 ha (occupied 96.6 % of the total area). Nearly, 53 % of

the total rice area was affected by 70-100% crop losses. The salinity intrusion and prolonged droughts have caused challenges in rice productivity and food security in the Mekong delta.

2.1.2 Soc Trang province

Soc Trang province (Figure 1) is spread over 331,176 ha has nine districts. The population is 1,304,965 and about 50% is female. Kinh people occupy 65%, Chinese 5% and Khmer ethnic about 30%. The total agricultural area is 276,958 ha (83.6 % of total area), of which rice covers more than half of the agriculture area (146, 970 ha). Rice producing farmers constitute 84 % of the population in the province and the poverty rate is 17%. Soc Trang province has different soil types: sandy soil (2.7%), alluvial soil (2.0 %), clay soil (0.3%), salinesoil (52.9 % area) and acid sulphate soil (23.6%). Salinity is mainly a problem in Vinh Chau, Long Phu, and Tran De districts (Master Plan of Soc Trang Province, 2013). The mean temperature in Soc Trang province is 26.8 °C. The rainfall is more than 1,800 mm/year. Soc Trang is affected by high tidal flow from the East Sea.

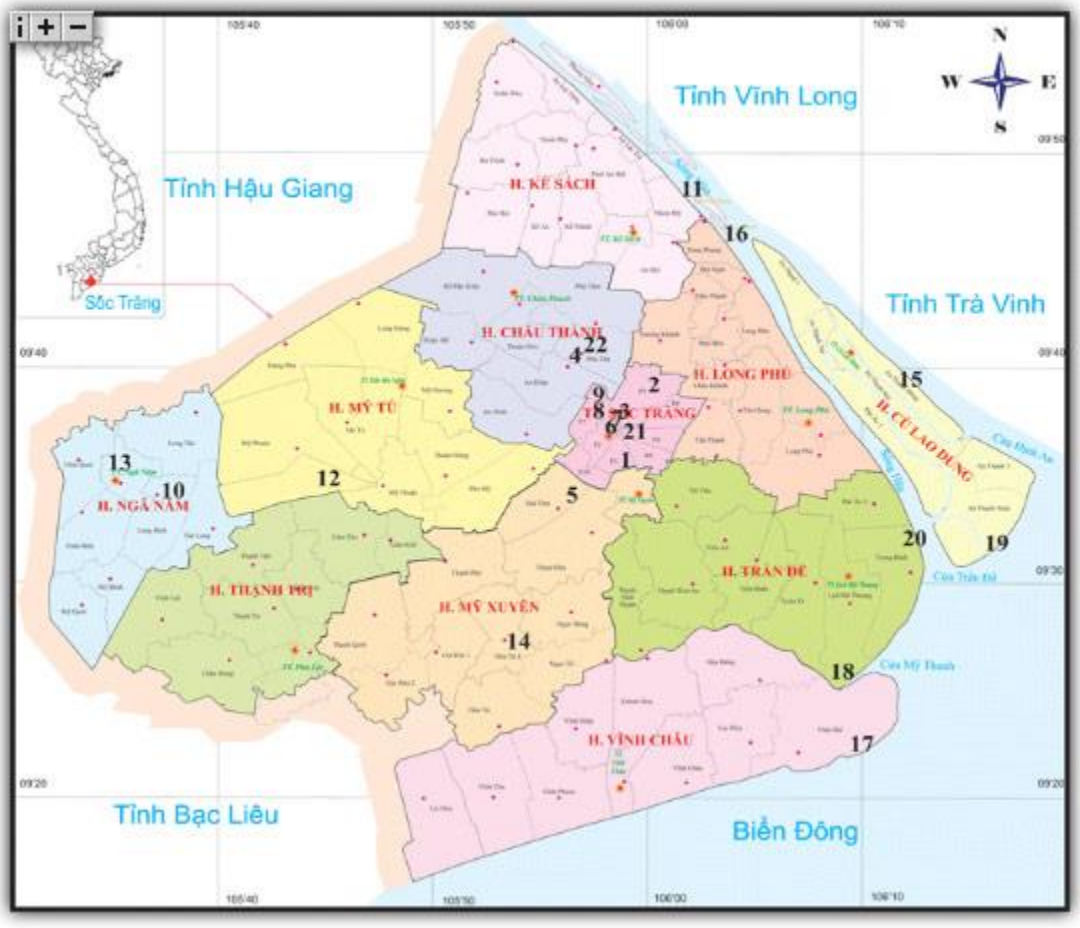

Figure 1 Map of Soc Trang province

In recent years, Soc Trang has been affected by unusual floods of larger areas and seawater level increases with 0.56 cm/year. The temperature has increased by 0.1 ^{o}C the last 30 years, and the dry season is longer and hotter. The wind is stronger and typhoon has appeared more often and more intensive since 1997. Saltwater intrusion is more severe and happens more than before, and erosion is recently more severe at the seashore (Master plan of Soc Trang province, 2013).

Soc Trang province has different farming systems, dominated by triple rice system and shrimp–rice system. In the coastal area, planting rice season starts at the onset of rice season because of the partially dependency on rainwater. There are three rice crop seasons in the coastal area:

Winter - spring: December to March

Summer - autumn: April to August

Autumn – winter: September- to December

In 2012, the rice area of Soc Trang province was 147,127 ha with an average yield of 6.2 tons/year. The area affected by salinity was 6,322 ha in 2013 (Department of Agriculture in Soc Trang province, 2013). Drought and shortage of fresh water happen more severely due to climate change with prolonged months of sunny and hot weather. Moreover, the construction of dams in the upstream cause shortage of water. Tan Hung commune of Long Phu district and Lieu Tu commune of Tran De district located at the coastal area of Soc Trang, were selected as they represent typical areas affected by salinity and drought. The total area of Tan Hung commune is 3,227 ha with 2,906 ha agricultural land. The rice area is 2,400 ha. Its population is 12,042 (50.3% female). The total number of household is 3,061 with 1,575 agricultural households. Among these, 1,575 are rice-farming households, and the poverty rate is 20.2 %. The total area of Lieu Tu commune is 5,056 ha with 2,850 ha agricultural land, all used for rice production. The population is 14,720 (49.9% female). Agricultural households constitute 1,580 out of total household of 3,305. The poverty rate is 23.4 %. See **Feil! Fant ikke referansekilden.** for more information about Soc Trang and the study sites in this province[1].

2.1.3 Tra Vinh province

Tra Vinh province (Figure 2) is located in the coastal area of the Mekong Delta with a total area of 234,115 ha, of which 185,868 ha is devoted to agriculture out of 90,000 ha to rice production.

[1] The appendices are found in a separate document.

The population of the province is 1,015,300 (of which 50.7 % are female). Kinh, Chinese and Khmer are the main ethnic groups. There are about 260,589 households, of which 55.3 % are agricultural households. Of these 47.9 % are rice farming households. The province has a 65 km long seashore, one city and seven districts. The poverty rate of Tra Vinh province is 16.4%. Tra Vinh has an average temperature between 26- 27^0C and humidity between 83 – 85%. The mean rainfall is 1,500 mm, which is lower than the mean of rainfall in the Mekong delta. Erratic rain occurs from June to November at the onset and end of raining season. Therefore, Tra Vinh is not much affected by flood, but rather by salinity and drought due to sea tidal flow in the East Sea. The tidal flow brings saltwater into the rice fields, and changes water quality due to increase in salinity levels and thus affect rice production. Climate change impacts the sea level rise, which in turn increases the severity of salinity intrusion inland.

The most common cropping systems in Tra Vinh province are:

1) Triple rice system three rice crop season :
   - Winter Spring season: (dry season) from November/December to March/April
   - Summer- Autumn season: (1^{st} wet season) from May/June to August/September
   - Autumn –Winter season: (2^{nd} wet season) from August/September to November/December
2) Double rice system:
   - Summer- Autumn season: from May/June to August/September
   - Monsoon rice (or Autumn –Winter season) from August/September to November/December
   - Fallow: from December to April
3) Rice-Rice – Upland crop system::
   - Rice in Summer- Autumn season: from May/June to August/September
   - Rice in Autumn –Winter season from August/September to November/December
   - Upland crop in Winter Spring season from December to April. The upland crops are peanut, corn, etc.
4) Rice-shrimp system:
   - Rice in Autumn –Winter season from August to November
   - Shrimp is from February to May

The rice area comprises 90,000 ha and the total rice production is 1.15 million tons per year. Fallow periods are from December to January and June to July. Most farmers make their living by rice farming, and other farm activities are:

- 14,500 ha of coconut trees that produce 130 million tons/year.
- 6,500 ha of sugarcane and 100 ton/ha, mostly in Tra Cu and Tieu Can districts.
- 4,500 ha of peanut and 19,200 tons/year, mostly in Cau Ngang and Duyen Hai district.
- 5,700 ha of corn and 28,000 tons/year, mostly in Tra Cu and Cau Ngang districts.

- 19,200 ha of fruit tree (mango, pomelo, orange, mandarin orange, longan, rambutan, durian, mangosteen) and 198,000 tons.
- Pigs (420,000), cows (160,000), cattle (2,000), goats (8,000) and poultry (5,300,000)

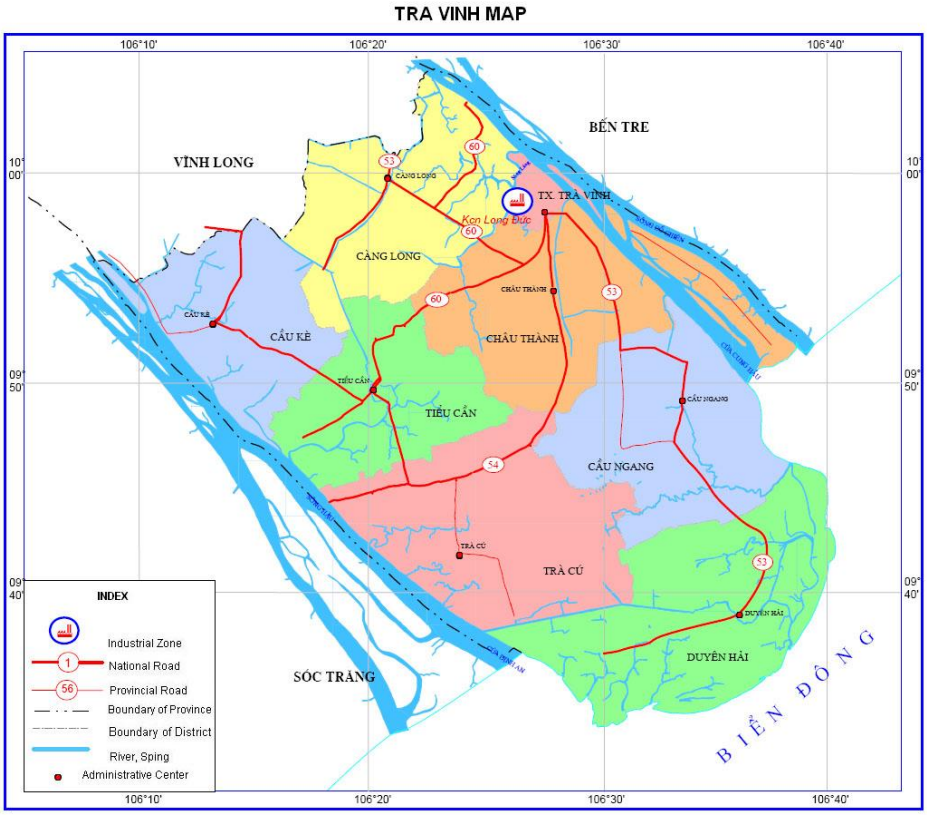

Figure 2 Map of Tra Vinh province

See **Feil! Fant ikke referansekilden.** for more information about Tra Vinh and the study sites in this province.

2.2 Salinity intrusion

Salinity intrusion takes place when sea water level is raising and flooding into the inland, narrowing the cultivated area and homestead. If salinity intrusion takes place simultaneously with fresh water shortage, people's life and crop cultivation are affected. Salinity intrusion in the provinces located in the coastal area is influenced by low fresh water flow from the upper stream and high tides from the seawater at estuaries (Le Sam, 2006). Salinity has two opposite characteristics, 1) it causes limitation in crop cultivation and 2) it forms bracket fresh water that is favourable in cultivation of bracket shrimp and other aquaculture with high yield (Le Sam, 2006). Salinity intrusion goes deeper inland in the dry season and causes damage to the crops, increases the level of salinity and acidity in the soil, lack of fresh water for living and for agriculture. Thus, salinity intrusion causes a reduction in farmers' income and has an effect on farmers' livelihoods

(Nguyen Thanh Binh et al., 2012). A study by Lam Huon (2010) reported that salinity intrusion has affected agriculture production and people's life in Soc Trang province in the following way:

- Salinity intrusion reaching 50 – 60 km inland, especially in the dry months affects people in the entire province. However, farmers' access to the information on negative impacts of salinity intrusion is limited. Nearly 42% of the farmers did not have information on the impacts of salinity intrusion on agricultural production.
- Salinity intrusion has reduced rice yield up to 62.39%, and shrimp yield up to 62.86%.
- The negative impacts of salinity intrusion includes: increase of soil salinity and acidity, difficulty in agricultural production, low yield, lack of fresh water for production and household use, especially in dry months, leading to increase the input cost in production.
- Salinity intrusion has reduced household income; there were 60.22% of the households facing income reduction and difficulty in life.

According to Le Canh Dung (2008), there was a conflict about water quality for both rice and shrimp cultivation in the same community and among communities. Mono-shrimp culture faces several risks of diseases and the environment, at the same time mono-shrimp culture affects soil quality. Salinity and drought reduce rice yield, however, yield reduction can be improved if the rice is cultivated more often. Nguyen Viet Hau (2010) reported that the livelihoods of the households in salinity areas are strongly influenced by salinity intrusion and the state policy. In areas with early salinity intrusion and high salinity levels, farmers prefer shrimp culture to rice cultivation. In the areas with late salinity intrusion and low salinity levels, supported by rational irrigation system, farmers prefer rice cultivation.

Le Sam (2007) reported that the salinity levels in the coastal areas of the Mekong Delta varied irregularly and it depended on the water flows of tides. The flow at the estuaries are also affected by winds, typhoon and seawater flow. In December, the wind directions are opposite to the flow of the Mekong river and thus it pushes seawater deeper into the inland (Le Anh Tuan, 2008). Saline intrusion can increase the growth of forestry of the coastal area together with brackish water shrimp, crabs and fish as well as birds. However, if salinity was 0.1 g/l the rice yield was reduced by 4%, if salinity was 1.0 g/l the rice yield was reduced by 12%, and if salinity increased over 2 g/l the rice seedlings did not survive. In addition, salinity intrusion limited the use of fresh water for domestic use and crop production. Besides, saline water erodes the water pumps and agricultural machines used in agricultural production. Duong Trung Thinh (2011) also reported that salinity intrusion reduced household income, especially the poor groups due to lack of capital, lack of tools for production and small farmland. They lack means to cope with climate change and extreme weather events including floods, typhoons and storm surges. According to Le Xuan Bao (2010), the Ministry of Natural resources and Environment (MONRE) estimated that by 2050, the salinity intrusion will be so severe that it will not be possible to cultivate crops if the present trend continues. Salinity intrusion may reach 100 km inland according to MONRE estimates.

The above research shows that drought and salinity intrusion seriously affect rice production and farmers' livelihoods in the Mekong Delta, and more so in Soc Trang and Tra Vinh provinces. In the tables below more information on rice production and salinity/ and drought incidence and impacts in the Long Phu and Tran De districts of Soc Trang province is provided

Table 1 Area, rice production, yield, area affected by salinity in Soc Trang province

Item	Soc Trang province							Long Phu district		
	2007	2008	2009	2010	2011	2012	2013	2010	2011	2012
Total natural land area (ha)		331,176	331,176	331,164	331,164	331,165		26,382	26,382	26,382
Rice area (ha)		**144,156**	**144,156**	**146,586**	**146,743**	**147,127**		15530	15530	15530
Rice production (tons/year)	1,602,535	1,743,500	1,780,400	1,966,580	2,090,640	2,251,746	2,219,893	267,362	274,800	298,645
Average rice yield (tons/ha)		5.41	5.32	5.62	5.99	6.15	5.94	5.95	6.36	6.41
Area affected by salinity (ha)							6,321.90			

Source: Report from department of agriculture of Soc Trang and Long Phu (2013)

The next table shows the damaged area due to salinity and drought in Tran De district in Soc Trang province.

Table 2 Damage area due to salinity and drought in Tran De district in Summer-Autumn crop season 2013

Name of commune	Damage area (ha)	Rice		Upland crop	
		30- 70%	70- total loss	30- 70%	70- total loss
TT Lich Hoi Thuong	97.5	59.15	30.44	3.93	3.98
Dai An 2	319.13	61.35	190.5	65.69	1.59
Trung Binh	10		10		
Lich Hoi Thuong	70.33		70.3		
Lieu Tu	403.225	12.1	375.51		15.615
Vien Binh	123.6	52.7	47.3		23.6
Vien An	4		4		
Tai Van	582.88	86.55	496.33		
Total	1610.665	271.85	1224.38	69.62	44.785

(Source: Report from Tran De district in 2013, internal circulated document)

2.3 Data collection and gender analysis

In total, 160 rice-farming households were selected randomly in four villages in three districts of Soc Trang and Tra Vinh provinces. In every household, the principal male and female members were interviewed separately using structured questionnaires, in total 320 interviews (160 households) were conducted (Table 3). Characteristics of the household and rice production were collected from the household head, while questions related to climate change perceptions and coping strategies were asked to male and female farmers separately. In addition, focus group discussions, with male and female farmers, were conducted to better understand the contextual issues. To ensure data validity and reliability, the interviewers were trained on how to collect quantitative and qualitative data before heading to the field.

Table 3 Overview of respondents interviewed in Soc Trang and Tra Vinh province

Province	Soc Trang province		Tra Vinh Province	
District	Long Phu	Tran De	Tra Cu	
Commune	Tan Hung	Lieu Tu	Don Chau	Don Xuan
Village	Tan Qui	Bung Buoi	Ta Rom	Ba Giam
No. of households	40	40	40	40
Total no. of respondents (50 % female)	80	80	80	80

This study uses gender analysis to document and interpret how men and women farmers are impacted by climate variability, and perceive and respond to climate change. Gender analysis aims to shed light on the different roles of women and men so as to comprehend what they do, what resources they have, and what their needs and priorities are (FAO 2015). Gender is one of many important socio-cultural aspects that habitually is included in climate change vulnerability assessments but it is rarely included in adaptation research and planning (Lambrou & Nelson 2010). Nevertheless, gender-disaggregated approach is crucial to better understand the levels of vulnerability, and coping mechanisms of different social groups and effectiveness of measures (Parikh 2007). Gender-disaggregated qualitative and quantitative data were collected to capture the voices of both men and women. The data was mainly analysed with descriptive statistics (mean, percentage and frequency), and Wilcoxon tests was used to test significant gendered-differences in the likelihood of adopting technology interventions to reduce vulnerability to climate variability.

3. Socio-economic characteristics of the farmers

3.1 Household characteristics

Average household size in the provinces is 4.7, with 2.6 earners and 1.9 dependents. About half of the household members are female, 85% are headed by males, 11 % by the parents and only 5% of the households are headed by the female farmer. Average age of male respondent is 48 and

female respondent is 46. The education level of the male farmers is higher than female farmers education, but still at a low level, from grade 3 to grade 6 only. Low levels of education is especially prevalent in poor areas such as Tra Cu district (Tra Vinh province) and Long Phu and Tran De district (Soc Trang province), where ethnic people reside and cannot afford higher education. Male farmers have, on average, been involved 12 years longer in rice farming than female counterparts. Annex 3 to 5 give more details on the household characteristics. Rice is the main source of income and contributes to 79 % of the total household income, and other income comprises of salary, livestock and off-farm labor (Table 4).

Table 4 Household income (VND/year)

Sources of income	Soc Trang (n=80)	%	Tra Vinh (n=80)	%	All (N=160)	%
Rice	186,696,644	82	77,656,346	72	132,176,495	79
Non-Rice crop	248,750	a	660,000	1	454,375	a
Off-farm labour	6,294,250	3	6,704,250	6	6,499,250	4
Animal	16,813,750	7	5,183,875	5	10,998,813	7
Salary	13,355,000	6	13,341,950	12	13,348,475	8
Remittances	911,813	a	588,625	1	750,219	a
Others	4,344,375	2	3,695,000	3	4,019,688	2
Total household income	228,664,582	100	107,830,046	100	168,247,314	100

Note: a < 1%

More than half of the houses are semi-permanent, and one-fourth are temporary houses. The rate of permanent houses are small (20%). Most of the houses are located in the areas affected with salinity and drought, near to river, canal and sea in the study sites of Soc Trang and Tra Vinh (**Feil! Fant ikke referansekilden.**). Most of the households have inherited or both inherited and bought land, only few had received land from the government. More than half of the husbands in this study own farmland (**Feil! Fant ikke referansekilden.**). Around one-fourth of the households have land ownership jointly by husband and wife, the rest was owned by old parents or others (Table 5 Land ownership).

Table 5 Land ownership

Land owner	Soc Trang (n=80)		Tra Vinh (n=80)		All (N=160)	
	Count	%	Count	%	Count	%
Husband	46	58	47	59	93	58
Wife	6	8	2	3	8	5
Both	22	28	14	18	36	23
Parents and others	6	8	17	21	23	14
Total	80	100	80	100	160	100

About one-third of the female farmers or female household members owned other types of assets than farmland. These assets included: pig and chicken, cell phone, cart (to sell vegetable, meat, fish), house right certificate, cash, motorbike in Soc Trang site, and cow, pig, cell phone,

motorbike, cash, small store, small food shop and house in Tra Vinh site (**Feil! Fant ikke referansekilden.** and 9).

3.2 Farming characteristics

A majority of the farmers (41 %) have only one land parcel and about 29% farmers had two parcels located in different places. Only 21% of the farmers surveyed had three land parcels about 9% had had more than three parcels. Farmers owned the majority of the land. Farmers in Soc Trang province have on average more than twice as big farmland than farmers in Tra Vinh province. Most of the land is located in salinity and drought prone zones, near to the river, canals and sea, and were supplied with water from river, canals and rains. In Soc Trang province, the triple rice system is dominant, followed by the double rice system. The other cropping patterns in Soc Trang province are rice-rice-corn and rice only. In Tra Vinh province, more than half of the land parcels apply triple rice system, followed by double rice system. Similar in Soc Trang province, rice-rice-corn and rice only are very common. See **Feil! Fant ikke referansekilden.** and 11.

In Winter-Spring and Summer-Autumn crop seasons, in a year, non-certified seeds were used more often than certified seeds both in Soc Trang and Tra Vinh provinces. In Autumn-Winter crop season, more certified seeds were used than non-certified seeds in Soc Trang province, the opposite was the case of Tra Vinh province. Most of the seeds were collected from previous crop season and from other farmers. In a way, this is better for farmers who cannot afford to buys seeds, provided the seeds are of good quality. More than one-third of the farmers used seeds from commercial seed producers. Direct seeding by manually broadcasting was mostly applied in almost all of the land parcels. Farmers used high seed rates (nearly 200 kg seeds/ha) in all crop seasons. In salinity areas, the rice yield in dry season (Winter-Spring crop season) was in general low due to both salinity and the lack of fresh water. Yield varied from 4.05 t/ha in Soc Trang province to 5.26 t/ha in Tra Vinh province. In Summer-Autumn crop season, yield more than 5 t/ha, and in Autumn-Winter crop season, the yield was highest due to availability of fresh water from rains and river. **Feil! Fant ikke referansekilden.** shows seed use and rice yield in the different crop seasons.

Most of the farmers sell rice to middlemen that pick up rice by boats passing through rice fields and canals. However, there is a rice policy that based on the input cost of each season in order for farmers to obtain at least 30% profit from rice production. Despite this, the rice price fluctuates and is mostly determined by traders and middlemen. There is a need to check the exploitation of farmers by intermediaries and providing storage facilities to farmers (See **Feil! Fant ikke referansekilden.**).

All farmers in Soc Trang and a majority of the farmers in Tra Vinh site sell rice after harvest to pay hired labour, and pesticide and fertilizer bought on credit. More than one-third of the farmers in Soc Trang and more than half of the farmers in Tra Vinh site keep part of the rice produced for home consumption. In Soc Trang province, the majority of the farmers do not keep rice for seeds.

About one-fourth of the farmers keep rice as seeds for the next crop season. Most of the rice was sold after harvest (92-95% of total production). Only 3% of rice was kept for home consumption in Soc Trang province meanwhile this is 7% in Tra Vinh province. The percentage of rice kept for seed varies from 1% in Tra Vinh site to 2% in Soc Trang site. See **Feil! Fant ikke referansekilden.**. Farmers apply granular fertilizer from 3 to 5 times/crop season. Seed is an important input and farmers should be trained to produce and keep good quality seed for the following season. This will become more important to address salinity and drought issues in the Mekong delta.

In Tra Vinh, the most common application is 3 times/crop season while it is 4 times/crop season in Soc Trang. Aside from granular fertilizer, farmers also use foliar fertilizer in rice production. Nearly half of the farmers in Soc Trang site used foliar fertilizer from 1 to 4 times per crop season. One-fourth of the farmers used foliar fertilizer from 1-3 times per crop season (See **Feil! Fant ikke referansekilden.** for more data and details). Regarding pesticide use, farmers applied herbicide twice /crop season, insecticide 2-3 times/crop season, fungicide 3 times, rodenticide 1-2 times and molluscide once /crop season (**Feil! Fant ikke referansekilden.**). All farmers in Soc Trang province use surface water for irrigation. Most of the farmers in Tra Vinh site also use surface water for irrigation in rice production, and only 5% of them use rainwater (Table 6).

Table 6 Type of irrigation

Type of irrigation	Soc Trang (n=80)		Tra Vinh (n=80)		All (N=160)	
	Count	%	Count	%	Count	%
Surface water	80	100	76	95	156	98
Rain water	-	-	4	5	4	3
Total	80	100	80	100	160	100

There is no difference in the irrigation pattern of the two study sites. Farmers pump water one time before sowing and land preparation. From sowing to flowering, farmers irrigate three times. From flowering to harvesting, farmers irrigate one time. Total number of irrigation per crop season in Soc Trang is four times and in Tra Vinh province is five times. Average number of days interval between two irrigations are 11 to 12 days. Average depth of water from soil surface for each irrigation is 8-9 cm. See **Feil! Fant ikke referansekilden.**. Most of the farmers do land preparation by rotovator or tractors, and harvest rice by combine harvesters, and few farmers harvest rice manually because of lodged rice. Similarly, most of the farmers do irrigation by pumping machines and a few irrigate manually (See Annex 18).

4. Vulnerability and gender-differentiated impacts

4.1 Perceptions on climate change

All male and female farmers acknowledged the change in climate during the past 30 years (from 1980 to current). This change was particularly notable for temperature, rainfall, salinity and availability of water. Around half of male and female farmers in Soc Trang and more female than male farmers in Tra Vinh expressed that the temperature had increased (

Table 7). The majority of male and female farmers (74 %) expressed that it is hotter during hot months and colder during cold months as compared with before. About one-third of the farmers said that the air temperature has decreased when it rains many days during wet season.

Table 7 Gender-differentiated perceptions on the change in temperature (*)

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male (n=80)		Female (n=80)		Male (n=80)		Female (n=80)		Male (N=160)		Female (N=160)	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Increase	54	39	49	28	35	34	43	71	45	73	46	
Decrease	19	20	25	32	41	34	43	47	30	54	34	
Hotter during hot months	85	68	85	51	65	51	64	119	75	119	74	
Colder during cold months	75	62	78	56	71	56	70	116	73	118	74	

(*) Multiple responses

More than half of the male and female farmers responded that the rainfall decreased compared to earlier years, contributing to increased salinity and drought, causing difficulty in rice production. More farmers in Soc Trang perceived that rainfall is higher in some years, as compared to respondents in Tra Vinh. Both male and female farmers expressed there is unexpected drought in their localities due to late and low rainfall. The most noteworthy change is low rainfall, followed by unexpected drought.

Table 8 Gender-differentiated perceptions on the change in rainfall in Soc Trang and Tra Vinh (*)

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male (n=80)		Female (n=80)		Male (n=80)		Female (n=80)		Male (n=160)		Female (n=160)	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Decrease/ Low rainfall	43	54	47	59	44	56	53	66	87	55	100	63
Increase/ High rainfall	33	41	33	41	25	32	23	29	58	36	56	35

Early rainfall	27	34	23	29	24	30	21	26	51	32	44	28
Late rainfall	31	39	27	34	29	37	22	28	60	38	49	31
Unexpected flood	5	6	6	8	4	5	2	3	9	6	8	5
Unexpected drought	39	49	35	44	42	53	38	48	81	51	73	46
Unusual rainfall	13	16	6	8	18	23	8	10	31	19	14	9

The farmers were asked to assess change in salinity. Overall, 59 % of the farmers reported an increase, 32 % a decrease and 22 % did not notice any change. The majority of the farmers in Soc Trang perceived an increase in salinity in their fields compared to the situation 10 years earlier. In Tra Vinh, almost half of the farmers perceived an increase in salinity and less than half observed a decrease of salinity. This depended on the location of their rice field. In localities closer to canals or rivers, water was used to reduce salinity by flushing out excess salts in the field before sowing rice.

Table 9 Gender-differentiated perceptions on the change in salinity in Soc Trang and Tra Vinh (*)

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male (n=80)		Female (n=80)		Male (n=80)		Female (n=80)		Male (N=160)		Female (N=160)	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Increase	61	76	57	71	37	47	37	46	98	62	94	59
Decrease	20	25	19	24	39	49	32	40	59	37	51	32
None	19	24	17	21	14	18	18	23	33	21	35	22

(*) Multiple responses

In the Soc Trang sites, more male than female farmers perceived that water availability has decreased in recent years. In Tra Vinh sites, more male than female farmers perceived that water availability has been increased. In addition, both male and female farmers recognized water pollution (Table 10).

Table 10 Gender-differentiated perceptions on the change in water availability in Soc Trang and Tra Vinh (*)

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (n=160)			
	Male (n=80)		Female (n=80)		Male (n=80)		Female (n=80)		Male (n=160)		Female (n=160)	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Increase	28	35	33	41	40	51	25	31	68	43	58	36
Decrease	40	50	35	44	26	33	18	23	66	42	53	33
Water pollution	3	4	2	3	1	1	2	3	4	3	4	3
None	20	25	21	26	23	29	41	51	43	27	62	39

(*) Multiple responses

The analysis in this sections shows that female and male farmers perceive climate change similarly.

4.2 Impact of climate variability on agriculture and houses

Climate change has severely affected agricultural production in the study sites. In Soc Trang, 95 % of the farmers and in Tra Vinh 89 % of the farmers have experienced damage due to salinity and/or drought in the last 10 years. In 34 % of the cases, the level of damage was reported to be severe, 39 % serious and 27 % mild (

Table 11).

Table 11 Farmer's experiencing damage from salinity/drought in the last 10 years

Item	Soc Trang (n=80)	Tra Vinh (n=80)	All (N=160)
Damage from salinity/drought last 10 years (%)			
Yes	95	89	92
No	5	11	8
Total	100	100	100
Level of damage (%)			
Severe	33	35	34
Serious	36	42	39
Mild	32	23	27
Total	100	100	100

Both male and female farmers expressed that the most important impact of climate variability on agriculture is low crop yields. In some cases, it even caused total crop losses, leading to increased debt and food insecurity. Severe weather change made also damage to houses and other properties, increased salt water level and organic toxicity in the field, and the acidity in the upper soil layer. See next table.

Table 12 Gender-differentiated perceptions of key impacts of climate change on agriculture and housing (*)

Item	Soc Trang		Tra Vinh		All (N=160)	
	Male (n=80)	Female (n=80)	Male (n=80)	Female (n=80)	Male (N=160)	Female(N=160)
Low yields (%)	96	91	89	84	93	88
Food insecurity (%)	15	14	13	10	14	12
Increase indebtedness (%)	55	45	48	45	51	45
Crop loss (%)	44	40	36	30	40	35
Damage to house and other property (%)	1	3	1	3	1	3
Others (a)	6	4	3	1	4	3

(*) Multiple responses

(a) Others: Organic toxic in rice field, pig and chicken died, increase salt water level in the field, and increase the acidity in the upper layer on soil.

4.3 Impact of climate variability on health

Around 90% of the farmers in the study sites said that the health status of the family members worsen in years with severe weather change such as erratic rains, too hot, strong winds and low tropical pressure. The most common family health problems during these occasions includes flu, cold and cough. Small children, followed by wife and aged persons, are the family members most affected by health problems during severe climate change. Other health problems are skin problems, inflammation of nasal cavity, sore eyes, running nose, sore throat, low blood pressure, vomit, backache, headache, body pain, blood bleeding at nose, difficulty in breathing, petechial fever, swollen hands and feet when it is cold. See Annex 19-22.

5. Adaptation to climate change in the study areas

5.1 Division of labour

Climate change and extreme weather events lead to changes in the division of labour amongst household members to a certain extent. It was found that women contributed more labour in seed preparation, replanting, hand weeding, drying and sacking, than men in both the Soc Trang and Tra Vinh. In Tra Vinh, women contributed more labour than men in fertilizer application, while in Soc Trang province the situation was found to be opposite. Men were more involved than women in land preparation, irrigation, drainage, cleaning/repair of dikes/making filed internal ditches, seed sowing, pesticide apply, mechanical harvesting, hauling, mechanical threshing, and transportation, though, women also contributed their labour in these activities (Table 13).

Table 13 Percentage of male and female labour contribution to activities in rice production during extreme weather

	Soc Trang (n=80)		Tra Vinh (n=80)		All (N=160)	
Activity	Men	Women	Men	Women	Men	Women
Land preparation	88	12	96	4	93	7
Irrigation	88	12	99	1	95	5
Drainage	84	16	100	-	98	2
Cleaning/repair of dikes/making field internal ditches	87	13	82	18	86	14
Seed preparation	34	**66**	27	**73**	31	**69**
Sowing/planting	60	40	67	33	63	37
Replanting	32	**68**	18	**82**	24	**76**
Hand weeding	9	**91**	27	**73**	18	**82**
Application of fertilizer	67	33	42	**58**	59	41
Application of pesticide	76	24	74	26	75	25
Harvesting	85	15	98	2	91	9
Hauling/gathering	100	-	100	-	100	-
Threshing	100	-	-	-	100	-
Transporting	96	4	53	47	61	39
Drying, sacking	37	**63**	18	**82**	21	**79**
Total	**53**	**47**	**43**	**57**	**48**	**52**

Farmers use higher seed rates than recommended in both provinces and had similar use of fertilizer, pesticide and labour during extreme weather. See next table.

Table 14 Farm inputs and labour in rice production, Summer Autumn, 2013

Item	Soc Trang (n=80)	Tra Vinh (n=80)	All (N=160)
Seed (kg/ha)	193.4	192.6	193.0
N fertilizer (kg/ha)	114	103	108
P fertilizer (kg/ha)	37	29	33
K fertilizer (kg/ha)	24	22	23
Total commercial granular fertilizer (kg/ha)	434	379	407
Total commercial pesticide (kg/ha)	6	5	5
Hired labour (person days/ha)	20.4	19.5	19.9
Family labour (person days/ha)	20.4	19.5	19.9
Total labour (person days/ha)	41	39	40

The rice yield in wet season varied from 5.1 to 5.4 t/ha in salinity areas. Rice income in Tra Vinh site was lower than in Soc Trang site due to relatively lower yield but higher cost of pesticide (herbicide, insecticide, fungicide and rodenticide) and labour cost. Thus, the benefit from rice in Tra Vinh site was lower than in Soc Trang site. The benefit cost ratio (BCR) was 1.2 in Tra Vinh

and 1.6 in Soc Trang when it is included all costs (including family labour). The BCR is low because few farming households received technical farming training.

Table 15 Rice income and return in wet season 2013

Item	Soc Trang (n=80)	Tra Vinh (n=80)	All (N=160)
Rice yield (t/ha)	5.4	5.1	5.3
Rice income/ha (VND)	29,869,091	27,130,546	28,499,818
Cost input (VND/ha)			
Seed cost	1,702,775	1,541,777	1,622,276
Fertilizer cost	5,590,199	5,054,858	5,322,529
Herbicide cost	448,017	694,842	570,643
Insecticide cost	846,689	888,824	867,891
Fungicide cost	1,250,841	1,594,361	1,424,803
Rodenticide cost	47,192	116,236	109,959
Molluscide cost	583,174	580,776	582,007
Hired labour cost	5,693,467	6,474,401	6,083,934
Imputed family labour	1,127,945	4,425,914	2,776,929
Other cost	1,091,803	1,019,021	1,055,412
Total input cost including family labour	18,382,101	22,391,011	20,416,383
Total input cost without family labour	17,254,157	17,965,097	17,639,454
Net return/ha with family labour	11,486,990	4,739,535	8,083,435
Net return/ha without family labour	12,614,935	9,165,449	10,860,365
BCR with family labour	1.6	1.2	1.4
BCR without family labour	2.4	3.0	2.6

The study shows that climate change and extreme weather affected gender roles in agricultural and non-agricultural activities. In the Soc Trang sites, male farmers' workload increased in land preparation, replanting (due to death of plants) and seed sowing. Male farmers also use more time in irrigating due to hot and dry weather. Similarly, male farmers had to spend more time in fertilizer and pesticide applications and supervision of labour. Female farmers were burdened with transplanting and supervision of labour in rice production. More female than male labourers spent more times in livestock rearing, childcare and household activities including preparing food and cooking (**Feil! Fant ikke referansekilden.**). Similarly, during climate variability in Tra Vinh site male labours increase their roles in land preparation, replanting, seed broadcasting, irrigation, fertilizer and pesticide applications, harvesting, drying and supervision of labours. Female labours increase in replanting and drying. More female than male labours increase their roles in animal care, childcare and household care, getting food and cooking during climate variability **Feil! Fant ikke referansekilden.**.

5.2 Coping strategies

The study showed that a majority of the farmers adopted different measures to cope with climate change and extreme weather. A majority of male and female farmers changed to new rice varieties, followed by leaving the land fallow for the onset of monsoons to sow or plant crops.

The other strategies were: change of the cropping pattern; growing more cash crops (e.g., water melon); more water pumping; shifting sowing window (change crop calendar); more use of fertilizer; selling land to repay debt; working as hired labour in mills and in rice harvesting using combined harvester; waiting for rains to reduce salinity and acidity to sow rice; raising cow/ milking cow to have extra income. Most of the men decided to change to new rice varieties, whereas only one-fifth of the households took a joint decision involving both husband and wife. Only in 3% of the households, the women themselves made the decision to change to new rice varieties.

Table 16 Changes in farming activities in a year of severe weather change (salinity, drought, rains, typhoons (*)

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male (n=80)		Female (n=80)		Male (n=80)		Female (n=80)		Male (n=160)		Female (n=160)	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Change in rice variety/lines	60	75	56	70	58	73	51	64	118	74	107	67
Change in cropping pattern	5	6	4	5	4	5	4	5	9	6	8	5
Shift from crops to livestock	3	4	4	5	8	10	10	13	11	7	14	9
Grow more cash crops	1	1	3	4	3	4	2	3	4	3	5	3
Grow more kinds of crops	1	1	2	3	-	-	-	-	1	1	2	1
Grow input-saving crops (Planting crops that require less inputs)	3	4	-	-	-	-	1	1	3	2	1	1
Grow water-saving crops (Planting crops that require less water)	1	1	-	-	1	1	-	-	2	1	-	-
Cultivate smaller area than usual	1	1	3	4	-	-	-	-	1	1	3	2
Grow dry fodder crops	-	-	-	-	2	3	1	1	2	1	1	1
Leave as fallow	8	10	4	5	6	8	5	6	14	9	9	6
No change	15	19	19	24	14	18	17	21	29	18	36	23
Others	8	10	1	1	2	3	1	1	10	6	2	1

(*) Multiple response

Others : more pumping, sowing late, more fertilizer, selling land to repay debt, raising cow, working as hired labour in miller/ in rice harvesting using combined harvester, waiting for rains to reduce salinity and acidity to sow rice, raising cow/ milking cow to have extra income

Table 17 Who decides what rice varieties to grow.

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male (n=80)		Female (n=80)		Male (n=80)		Female (n=80)		Male (N=160)		Female (N=160)	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Husband	63	79	59	74	62	78	61	76	125	78	120	75
Wife	1	1	2	3	3	4	2	3	4	3	4	3
Both H&W	14	18	15	19	12	15	13	16	26	16	28	18
Grown children	2	3	4	5	2	3	3	4	4	3	7	4
Elders	-	-	-	-	1	1	1	1	1	1	1	1
Total	80	100	80	100	80	100	80	100	160	100	160	100

Both men and women responded to negative impacts of severe climate change as drought, salinity. Both male and female farmers had equal access to credit and money loans to respond to the severe climate change. More female than male farmers spent less, stored food and basic needs in response to severe climate change. More male than female farmers seek for wage labour and migration in response to severe climate change. The other responses to the negative impacts of the severe climate change as drought and salinity were, taking support from the relatives, selling assets, mortgage land, raising animals, seed sowing early to avoid salinity, apply fertilizer to reduce acidity, renting land in the other place where it is more favourable condition, and engaging in income generating activity as repairing motorcycle.

Table 18 Coping strategies in man and woman response to negative impacts of severe climate change as drought, salinity (*)

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male (n=80)		Female (n=80)		Male (n=80)		Female (n=80)		Male (N=160)		Female (N=160)	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Migrate	2	3	2	3	15	19	12	15	17	**11**	14	**9**
Wage labour	20	25	16	20	30	38	21	26	50	**31**	37	**23**
Go to neighbouring villages for labour work	4	5	6	8	12	15	6	8	16	10	12	8
Shop keeping as hired labour	1	1	4	5	-	-	-	-	1	1	4	3
Acquire loan	45	56	44	55	38	48	36	45	83	52	80	50
Take support from relatives/friends	7	9	5	6	10	13	5	6	17	11	10	6
Children drop-out from school	-	-	2	3	-	-	1	1	-	-	3	2
Mortgage land	5	6	3	4	2	3	-	-	7	4	3	2
Sell assets	2	3	4	5	3	4	2	3	5	3	6	4
Spend less	65	81	70	88	64	80	67	84	129	**81**	137	**86**
Store food and other basic necessities	6	8	10	13	3	4	2	3	9	**6**	12	**8**
Others (a)	4	5	1	1	7	9	5	6	11	7	6	4

(*) Multiple responses

(a) Others: raising animals, seed sowing early avoid salinity, apply fertilizer to reduce acidity, rent land in the other place where is more favourable condition, raising cow, repair motorcycle to have income

Women in one-third of the households are left behind as husbands migrate, another option to respond to the negative impacts of climate change and reducing vulnerability. These women have to take the responsibility in farming and household management in the absence of the husbands. In households with adult children migrating, both husband and wife stayed behind. The rate of adult children migration in the Soc Trang site was higher than in Tra Vinh site. In addition, the elders were left behind (Annex 25)

5.2.1 Support during natural hazards

More than half of the male and female farmers have received support from the Government and other institutions during severe drought, salinity, rain and/or typhoon. The support is mostly in the form of public services and assets, and consisted of pension, health insurance, housing training on new rice technologies, livestock, land for agriculture, supporting seed cost. The government agencies giving support are People Committee (mostly), State, Health Department and Agricultural Department. The other sources of support were from agricultural universities and pesticide/fertilizer companies that supported in training on new rice technologies, as pesticide and fertilizer use (refer to next table).

Table 19 Support from government and other institutions during severe drought or salinity, rain, typhoon

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male		Female		Male		Female		Male		Female	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Get support from the government and other institutions during severe drought or salinity, rain, typhoon												
Yes	62	78	48	60	55	69	51	64	117	73	99	62
No	18	23	32	40	25	31	29	36	43	27	61	38
Support resource (*)												
Government	61	98	48	100	54	98	51	100	115	98	99	100
Other Institutions	7	11	-	-	4	7	-	-	11	9	-	-
Kind of support from government (*)												
Housing	-	-	-	-	5	9	4	8	5	4	4	4
Pension	59	98	44	94	39	74	39	76	98	87	83	85
Loan from bank	1	2	-	-	-	-	1	2	1	1	1	1
Health insurance	3	5	5	11	10	19	8	16	13	12	13	13
Training on new rice technologies	1	2	-	-	-	-	2	4	1	1	2	2
Support for farming activities	2	3	-	-	3	6	-	-	5	4	-	-
Others (cow, land for agriculture, support seed cost, rice seeds)	-	-	-	-	4	8	4	8	4	4	4	4
Source of support from government (*)												
Agricultural department	7	11	3	6	9	17	4	8	16	14	7	7
Policy Bank	2	3	-	-	-	-	1	2	2	2	1	1
Cooperatives	-	-	-	-	-	-	1	2	-	-	1	1
People Committee	52	85	42	88	38	70	37	73	90	78	79	80
State government	3	5	1	2	4	7	5	10	7	6	6	6
Health department	3	5	4	8	9	17	9	18	12	10	13	13
Agricultural universities	-	-	-	-	1	2	-	-	1	1	-	-
Others (secondary & high school)	-	-	-	-	1	2	1	2	1	1	1	1
Kind of support from other institutions (*)												
Training on new rice technologies	4	57	-	-	1	25	-	-	5	45	-	-
Support for farming activities	3	43	-	-	-	-	-	-	3	27	-	-
Others (clothes, hat, pesticide)	1	14	-	-	3	75	-	-	4	36	-	-

Source of support from other institutions (*)												
Agricultural universities	1	14	-	-	-	-	-	-	1	9	-	-
Pesticide/fertilizer company	7	100	-	-	4	100	-	-	11	100	-	-

(*) Multiple responses

5.2.2 Access to information

The recipient of information on agriculture are typically the husbands. When it comes to formal information, neither male nor female farmers accessed adequate information from the Government through e.g. technical staff from DARD (Department of Agriculture and Rural Development), extension agents and research institutes/universities. Nevertheless, a majority of the farmers could access the information from informal sources such as from other farmers, friends, relatives and input dealers/companies (refer to Table 20). Male farmers were more often invited to agricultural meetings and trainings organized by the extension programs, than women. Men dominated as members of farmers' association at the village level. The information obtained was mostly from television, neighbours and family members. The other sources of information on agriculture was from government organizations, input dealers, traditional knowledge from peers, farmer's association, attending workshops, other farmers, and veteran's organization. More female than male farmers received information on agriculture from television and family members because women do not go out to get information as men often do (refer to Table 21).

Table 20 Access information on agricultural technologies by sources

Source of information	Soc Trang (n=80)				Tra Vinh (n=80)				All (n=160)			
	Male		Female		Male		Female		Male		Female	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Technical staff from DARD, extension agents												
Yes	23	29	10	13	33	41	14	18	56	35	24	15
No	57	71	70	88	47	59	66	83	104	65	136	85
Research institute/ University												
Yes	7	9	2	3	6	8	2	3	13	8	4	3
No	73	91	78	98	74	93	78	98	147	92	156	98
Other farmers, friends												
Yes	68	85	61	76	69	86	58	73	137	86	119	74
No	12	15	19	24	11	14	22	28	23	14	41	26
Relatives												
Yes	68	85	64	80	70	88	62	78	138	86	126	79
No	12	15	16	20	10	13	18	23	22	14	34	21
Input dealers/ companies												
Yes	69	86	49	61	60	75	49	61	129	81	98	61
No	11	14	31	39	20	25	31	39	31	19	62	39

Table 21 Source of information about cropping practices

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (n=160)			
	Male		Female		Male		Female		Male		Female	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Access information on agriculture												
Yes	74	93	42	52	73	91	46	57	147	92	88	55
No	6	7	38	48	7	9	34	43	13	8	72	45
Source of information on agriculture (*)												
Government organizations	9	12	5	12	7	10	2	4	16	11	7	8
NGOs	3	4	2	5	5	7	-	-	8	5	2	2
Private organizations	3	4	-	-	2	3	-	-	5	3	-	-
Input dealers	16	22	1	2	10	14	2	4	26	18	3	3
Radio	1	1	-	-	4	5	3	7	5	3	3	3
Newspaper	1	1	-	-	1	1	-	-	2	1	-	-
Television	55	74	36	86	64	88	45	98	119	81	81	92
Neighbour	26	35	8	19	23	32	17	37	49	33	25	28
Family member	9	12	12	29	13	18	9	20	22	15	21	24
Traditional knowledge	9	12	6	14	9	12	5	11	18	12	11	13
Others (Farmer's Association, attending workshop, other farmers, Veteran's Organization)	14	19	1	2	5	7	1	2	19	13	2	2
Recipient of information on agriculture (*)												
Husband	52	70	11	26	49	67	7	15	101	69	18	20
Wife	3	4	2	5	3	4	5	11	6	4	7	8
Both H & W	17	23	28	67	18	25	33	72	35	24	61	69
Male grown children	6	8	2	5	6	8	5	11	12	8	7	8
Female grown children	1	1	2	5	1	1	1	2	2	1	3	3
Elders	1	1	1	2	-	-	1	2	1	1	2	2
All members	1	1	1	2	1	1	-	-	2	1	1	1

(*) Multiple responses

Around one-fifth of the male and female farmers have access to information related to animals and aquaculture, mostly from television (refer to the next table).

Table 22 Source of information about livestock and fishing activities

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (n=160)			
	Male		Female		Male		Female		Male		Female	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Access information on animals & aquaculture												
Yes	20	25	14	18	15	19	14	18	35	22	28	18
No	60	75	66	83	65	81	66	83	125	78	132	83
Source of information on animal and aquaculture (*)												
Private organizations	-	-	1	7	-	-	-	-	-	-	1	4
Input dealers	-	-	-	-	-	-	1	7	-	-	1	4
Radio	-	-	-	-	2	13	1	7	2	6	1	4
Newspaper	-	-	-	-	1	7	-	-	1	3	-	-
Television	20	100	13	93	14	93	12	86	34	97	25	89
Neighbour	-	-	1	7	5	33	4	29	5	14	5	18
Family member	-	-	-	-	1	7	2	14	1	3	2	7
Traditional knowledge	-	-	-	-	1	7	1	7	1	3	1	4
Other farmers	1	5	-	-	-	-	-	-	1	3	-	-
Recipient of information on animal and aquaculture (*)												
Husband	13	65	6	43	10	67	2	14	23	66	8	29
Wife	-	-	-	-	-	-	1	7	-	-	1	4
Both H & W	7	35	8	57	4	27	10	71	11	31	18	64
Male grown children	1	5	1	7	2	13	2	14	3	9	3	11
Elders	-	-	1	7	-	-	-	-	-	-	1	4

(*) Multiple responses

The majority of the farmers, both men and women, had access to information on weather through television. Other sources of information are neighbours, family members, and from traditional knowledge. See next table.

Table 23 Source of information about weather condition

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (n=160)			
	Male		Female		Male		Female		Male		Female	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Access information on weather												
Yes	79	99	70	88	74	93	68	85	153	96	138	86
No	1	1	10	13	6	8	12	15	7	4	22	14
Source of information on weather (*)												
Government organizations	1	1	-	-	-	-	-	-	1	1	-	-
Private organizations	-	-	1	1	1	1	-	-	1	1	1	1
Input dealers	-	-	-	-	-	-	1	1	-	-	1	1
Radio	3	4	-	-	2	3	-	-	5	3	-	-
Television	74	94	69	99	73	99	67	99	147	96	136	99
Neighbour	11	14	10	14	18	24	19	28	29	19	29	21
Family member	14	18	14	20	12	16	16	24	26	17	30	22
Traditional knowledge	5	6	8	11	2	3	6	9	7	5	14	10
Others (Loudspeaker, other farmers)	1	1	-	-	-	-	1	1	1	1	1	1
Recipient of information on weather (*)												
Husband	34	43	9	13	38	51	6	9	72	47	15	11
Wife	1	1	2	3	3	4	5	7	4	3	7	5
Both H & W	37	47	55	79	30	41	55	81	67	44	110	80
Male grown children	5	6	5	7	6	8	3	4	11	7	8	6
Female grown children	-	-	-	-	2	3	3	4	2	1	3	2
Elders	-	-	1	1	3	4	1	1	3	2	2	1
All members	6	8	3	4	2	3	1	1	8	5	4	3

(*) Multiple responses

5.2.3 Access to training

In the studied sites, only 13% of the farming households had been offered training on technologies related to agriculture and climate change. Nevertheless, most of them had not yet attended. See next table.

Table 24 Attended trainings related to climate change and agriculture by farming households

Attended trainings	Soc Trang (n=80)		Tra Vinh (n=80)		All (n=160)	
	Count	%	Count	%	Count	%
Yes	8	10	12	15	20	13
No	72	90	68	85	140	88
Total	80	100	80	100	160	100

The common types of training opportunities available to farmers were “Rice pest control as IPM”, “Crop cultivation technologies (as rice, corn, peanut)”, “Technology on reduction of fertilizer and pesticide”. “Technology of rearing cow”, “Producing seed”, “Method of pesticide spray”, “Method of land preparation, seed establishment, pesticide spray and water management” and “Method of protection from strong winds and typhoon” (**Feil! Fant ikke referansekilden.**). The extension workers and the scientists in general recommended farmers to reduce their chemical use (fertilizer and pesticide) in order to reduce input cost and environmental hazards. More than one-third of the farming households attended sponsored workshops organized by pesticide and fertilizer companies (**Feil! Fant ikke referansekilden.**).

The majority of male and female farmers surveyed were not trained on climate change and agriculture adaptation issues. Regarding trainings needed to enhance skills and knowledge to better adapt to climate change, more male than female said that they need to be trained on seed health management, crop production management (rice, peanut, corn, vegetables, custard-apple), water management, crop nutrient management, pest management (weeds, insects, disease) and post-harvest including storage of rice and peanut. Male and female farmers were equally interested to be trained on animal management (cow, pig, chicken, duck, and prevention disease for pig, fish, giant prawn, and buffalo). More female than male farmers need to be trained on income generation (ways to increase income, handicraft, vocational training, trading, upland crop to increase income). Most of the male and female farmers were not members of any organization.

Table 25 Trainings related to Climate change and agriculture

Item	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male		Female		Male		Female		Male		Female	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Undergone any trainings related to Climate change and agriculture												
Yes	7	9	2	3	11	14	4	5	18	11	6	4
No	73	91	78	98	69	86	76	95	142	89	154	96
Name of trainings (*)												
Crop/Rice production technologies	-	-	-	-	6	55	1	25	6	33	1	17
Cow rearing technologies	-	-	-	-	1	9	-	-	1	6	-	-
Method of pesticide and fertilizer use, reduction of fertilizer	1	14	-	-	3	27	1	25	4	22	1	17
Pest control, IPM	5	71	1	50	4	36	1	25	9	50	2	33
Upland crop model	-	-	-	-	1	9	-	-	1	6	-	-
Household economy management	-	-	-	-	-	-	2	50	-	-	2	33
Technologies in aquaculture	-	-	-	-	1	9	-	-	1	6	-	-
Community based-groups for development	-	-	1	50	-	-	-	-	-	-	1	17
Control the strong wind, disaster organized by Red Cross	1	14	-	-	-	-	-	-	1	6	-	-
Kind of trainings need to enhance your skills and knowledge to better adapt to climate change (*)												
Seed health management	44	55	17	21	60	75	24	30	104	65	41	26
Crop production management	70	88	24	30	73	91	40	50	143	89	64	40
Water management	35	44	13	16	51	64	24	30	86	54	37	23
Crop nutrient management	55	69	15	19	69	86	32	40	124	78	47	29
Pest management (weeds, insects, disease)	57	71	16	20	69	86	29	36	126	79	45	28

Post-harvest including storage	24	30	4	5	37	46	20	25	61	38	24	15
Animal management	38	48	38	48	48	60	41	51	86	54	79	49
Other income generation (a)	20	25	24	30	22	28	24	30	42	26	48	30
Member of any organization												
Yes	17	21	7	9	25	31	17	21	42	26	24	15
No	63	79	73	91	55	69	63	79	118	74	136	85

(*) Multiple responses; (a) Other income generation: ways to increase income, handicraft, vocational training, trading, upland crop to increase income.

5.2.4 Credit

Access to credit in times of need, especially when there was a typhoon or flood. These helped farmers to replant the crop lost, or attend to damages to the property. In both the provinces, farmers had access to credit from different sources as shown in the table below. Both men and women had in general access to credit from commercial banks, relatives and private moneylenders. In some situations government provided credit support to compensate losses from extreme weather (Table 26).

Table 26 Access to credit by source

Easy access to credit	Soc Trang (n=80)				Tra Vinh (n=80)				All (N=160)			
	Male		Female		Male		Female		Male		Female	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Local bank												
Yes	64	80	57	71	45	56	45	56	109	68	102	64
No	16	20	23	29	35	44	35	44	51	32	58	36
Government support												
Yes	39	49	41	51	39	49	35	44	78	49	76	48
No	41	51	39	49	41	51	45	56	82	51	84	53
Other farmers, friends												
Yes	40	50	34	43	39	49	35	44	79	49	69	43
No	40	50	46	58	41	51	45	56	81	51	91	57
Relatives												
Yes	47	59	46	58	49	61	52	65	96	60	98	61
No	33	41	34	43	31	39	28	35	64	40	62	39
Private money lender												
Yes	40	50	38	48	49	61	49	61	89	56	87	54
No	40	50	42	53	31	39	31	39	71	44	73	46

5.3 Adoptation of technology

In Soc Trang and Tra Vinh, both male and female farmers are likely to adopt technological interventions to reduce vulnerability to climate variability, by the use of stress-tolerant crop varieties, planting of suitable duration rice (early, medium or late varieties) to avoid crop loss in case of drought/salinity, development and use of crop varieties resistant to pests and diseases, and improved animal health management. They are also likely to adopt new land management techniques, do changes in agricultural water-management techniques, and pest and disease management techniques. In Tra Vinh, they also adopt new livestock breeds. There are similar levels of adoption in the study sites of the above-mentioned technologies. Both male and female farmers are highly unlikely to shift the cropping system that they are familiar with and do not want to do early sowing to grow other crops. In addition, they reported difficulties in shifting the calendar due to shortage of water. The next table shows the response (in percent) to the question about how men and women are likely to adopt technology interventions to reduce vulnerability to climate variability in Soc Trang and Tra Vinh.

Table 27 Response (in percent) on how men and women are likely to adopt technology interventions to reduce vulnerability to climate variability in both Soc Trang and Tra Vinh provinces

Impacts	Male (n=160)					Female (n=160)				
	Highly unlikely	Unlikely	Neither likely nor unlikely	Likely	Highly Likely	Highly unlikely	Unlikely	Neither likely nor unlikely	Likely	Highly Likely
Use of stress-tolerant crop varieties	2	1	7	**42**	**48**	6	1	12	**54**	**27**
Shift to improved cropping systems or other activities	**44**	**23**	21	11	2	**49**	**19**	24	7	1
Planting of suitable duration rice (early, medium or late varieties) to avoid crop loss to variations in drought/salinity occurrence	1	1	9	**61**	**29**	6	3	14	**61**	**16**
Early sowing/production of rice to grow other additional crops	**39**	21	18	13	8	**36**	19	24	16	4
New land management techniques (i.e., zero tillage for rice or minimize tillage, resource conserving techniques, Biochar)	23	9	19	**38**	11	25	8	20	**39**	8
Changes in agricultural water-management techniques (alternated wetting and drying method)	12	15	18	**42**	14	18	9	24	**39**	10
Pest and disease management techniques such as IPM	8	8	16	**48**	21	16	8	17	**46**	13
Development and use of crop varieties resistant to pests and diseases	1	3	15	**41**	**41**	9	6	10	**54**	**21**
New livestock breeds	19	14	20	28	19	19	12	27	26	16
Improved animal health management	15	11	15	**32**	**27**	14	11	16	**37**	**23**

The results of the Wilcoxon test is presented in the next table.

Table 28 Wilcoxon test on response on how men and women likely adopt technology interventions to reduce vulnerability to climate variability

Impacts	Soc Trang (n=80)			Tra Vinh (n=80)			All (n=160)		
	Male	Female	p-value	Male	Female	p-value	Male	Female	p-value
Use of stress-tolerant crop varieties	4.4	3.8	**0.000**	4.3	4.1	**0.014**	4.3	4.0	**0.000**
Shift to improved cropping systems or other activities	2.0	1.9	0.519	2.1	1.9	0.087	2.1	1.9	0.109
Planting of early, medium or late varieties to avoid crop loss to variations in drought/salinity occurrence	4.1	3.8	**0.002**	4.2	3.9	**0.003**	4.2	3.8	**0.000**
Early sowing/production of rice to grow other additional crops	2.5	2.5	0.842	2.1	2.2	0.506	2.3	2.3	0.580
New land management techniques (i.e., zero tillage for rice or minimize tillage, resource conserving techniques, Biochar)	3.1	2.8	0.143	3.0	3.1	0.457	3.1	3.0	0.446
Changes in agricultural water-management techniques (alternated wetting and drying method, …)	3.4	3.1	0.080	3.2	3.2	0.965	3.3	3.1	0.150
Pest and disease management techniques such as IPM	3.6	3.2	**0.005**	3.7	3.5	0.081	3.7	3.3	**0.001**
Development and use of crop varieties resistant to pests and diseases	4.2	3.5	**0.000**	4.2	3.9	**0.020**	4.2	3.7	**0.000**
New livestock breeds	2.9	2.9	0.874	3.3	3.2	0.402	3.1	3.1	0.517
Improved animal health management	3.1	3.2	0.723	3.8	3.7	0.637	3.4	3.4	0.947

6. Lessons learned and policy recommendations

Viet Nam has experienced a major socio-economic transformation over the past quarter century, rising from one of the poorest countries in the world to a middle income country (World Bank 2011). From a gender perspective, Viet Nam‘s stands out a success and example in the region in closing gender gaps (Smyle & Cooke 2013), particularly within education, employment and health. Women are more economically active in agriculture than in other sectors, leading to what some have called the “feminization of agriculture”. Market orientation in agriculture has given access to more income earning activities and decision-making by women. Yet, problems remain in implementing gender equality guaranteed by the law in the titling of land user rights, access to bank’s credit and to agricultural extension. The Government of Viet Nam has acknowledged climate change as an important challenge, and a National Target Program on Responding to Climate Change (NTP) was approved in December 2008. Even though, Viet Nam has had a considerable progress on gender mainstreaming in general, important gender differences remain that leave women more vulnerable to the impacts of poverty and climate change. Thus, addressing gender-specific implications of climate change has been identified as a cross-sectoral concern in the UN’s work with the Government of Viet Nam (United Nations 2008).

In this study, socio-economic and gender-differentiated impacts and perceptions of climate change among rice producing farmers in Southern Viet Nam was studied. The coastal areas of Vietnam, and particularly in the study sites in Soc Trang and Tra Vinh provinces in the Mekong delta, are affected by salinity, drought and low rainfall due to climate change. The survey indicated that rice contributed to 79 % of the farmer’s total income. Rice land area per household varies from 1.04 ha in Tra Vinh to 2.30 ha in Soc Trang. The source of water for farming is surface water from rivers and canals. The two dominant cropping pattern are triple rice and double rice systems. Non-certified seeds were used more than certified seeds. Direct seeding (manually) with high seed rate was still widespread. Most of the farmers sell rice to middlemen after harvest. The benefit from rice production in salinity area are low, BCR is only from 1.2 to 1.6. In the last 10 years, 95 % of the Soc Trang households and 89 % of the Tra Vinh province had experienced damage to their livelihoods due to salinity and/or drought. Both male and female farmers perceived the existence of climate change and recognized its adverse impacts on crop production, animal husbandry, and fishing, as well as other household activities. Low crop yields,

and even occasionally total crop losses, were rated as the major impacts, leading to increased debt and food insecurity. Farmers coping strategies included change of rice varieties; leave land fallow during severe drought; change of the cropping pattern; more growth of cash crops; and off-farm work. The NTP does not address the different roles of men and women, their responsibilities or decision-making powers that are critical issues as climate change. According to the UN report (2008), these are crucial to not worsen existing gender inequalities that could create additional workloads for women and lead to higher vulnerability of women in poor households. Women did the same tasks as men in farming, and traditionally, they also contributed in seed preparation, replanting, hand weeding, drying, and sacking. During climate variability, men were burdened more in farm activities, while women contributed to replanting, drying and livestock rearing, childcare and household responsibilities including cleaning, obtaining food and cooking. It was mostly small children, women and older people whose health was affected more severely. In Soc Trang and Tra Vinh sites, male farmers were more likely to adopt technologies to reduce vulnerability to climate change than female farmers. These technologies were the use of stress-tolerant crop varieties; planting of early, medium or late varieties to avoid crop loss to variations in presence of drought/salinity; pest and disease management techniques; and development and use of crop varieties resistant to pests and diseases. Both male and female farmers received support from the Government and other institutions during severe drought or salinity, rain, typhoon. In addition, they acquired loan (formal and informal) equally in response to severe climate change. This was a positive observation as women normally have less access to credit than men in Vietnam (United Nations 2008). Female farmers spent less money, stored food for basic needs, while male farmers often did wage labour or migrated, leaving women, children and elders behind. Despite the fact that women are responsible for many decisions, they seem more vulnerable than men to effects of climate change because of less off-farm opportunities and sometimes less control over cash. Most respondents, particularly women, reported a lack of adequate extension and technical information about how to cope with agriculture under climate variability.

Salinity and droughts will be the two major problems that people and governments in the Mekong delta will have to face and address to reduce the vulnerability from the impacts. The study showed that access to technology, credit, training, information and extension services are

important to help farmers, both men and women in order to adapt to climate change and extreme weather conditions.

Farmers, i.e. both men and women perceive and respond differently to climate change and extreme weather. As we have seen in Soc Trang and Tra Vinh, there is a need to improve the access to various technologies, organize more trainings targeting men and women household members to adapt to climate change. Climate-smart farming systems should be introduced in the provinces and at the same time, trainings and necessary inputs should be planned to upscale such practises in the areas. Farmers are willing to learn, and it is up to the provincial government to provide necessary resources for training and adoption of climate-smart farming practises. Both salinity and droughts need to be prioritised while planning future adaptation strategies in the provinces. Some of the specific measures to be developed include rice seed varieties tolerant to salinity and drought, new crops and cropping patterns, improving irrigation infrastructure to make fresh water available and improved soil and water management measures.

Women now outnumber men in agriculture. Nevertheless, women's role is neither fully accepted nor supported by rural development policy and programmes (World Bank 2006). Given the important role of women in rice production, rural extension should not ignore women farmers in the development of the extension programs related to agriculture and climate change. Ethnic minorities, as main respondents in this study, has low education, therefore farm training or extension program on climate change, mitigation and adaptation measures should be simple using their local languages. Moreover, the extension staff must be skilled in dealing with training for the ethnic groups and *Kinh* people together. Since women and ethnical minorities (and children) normally are the most vulnerable to weather extremes and impacts of climate change, they should be at the centre of programmes and plans to reduce climate change-related risks and adaptation to climate change both in the study sites and beyond. Moreover, their vulnerability as well as their capacities to adapt should be priorities for future research and analysis. Policy analysis thus requires gender and vulnerability analysis as an indispensable aid to identify key issues and all population groups to be addressed by policy. This will help in the formulation of policies on how vulnerable rural women and their families and community needs and interests can be met. Mitigation measures should address the needs of both men and women, and ethnic people living in the areas affected by climate change. Any new adaptation measures have to be simple, implemented in a local language, help in reducing GHGs, low cost and easily adaptable, since the

majority of farmers are small or marginal landholders with little education and low investment capacity and the government does not have adequate resources.

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