Risk management for Rice value chain to adapt with climate change in the Mekong river delta, Vietnam

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Abstract

Rice is the most important crop in Vietnam. It is the livelihood of well over 50% population contributing around $ 1.5 billion in export revenue annually. Rice production, however, has to face increasingly difficulties due to potential impacts of climate change especially in the Mekong river delta and the red river delta where over 70% rice was produced. If the mean sea level rises 0.69 m as forecasted by IPCC, 91% Mekong river delta will be submerged that will adversely affect the rice production. Therefore, introducing a risk management system to mitigate the potential loss caused by climate change is extremely necessary. This paper research aims to find out the way to mobilize community resources for risk management emphasizing the cooperation of community and state to support rice production adapt to climate change. Furthermore, mechanism for sharing risk and value among stakeholders engaging to rice value chain and ensuring equality in allocating value and risk throughout value chain will be established.

Keywords: value chain, climate change, risk management

1. Introduction

Rice production plays an important role in agricultural production; it provides income for more than 50% population. Although rice area has been reduced in recent year due to urbanization and industrialization as well as sea water intrusion, rice production in the Mekong river delta significantly contributes to national food security and partly ensure world food security thank to its second biggest rice exporters in the world market. However, rice production, recently, faces many difficulties. Climate change that will bring temperature rise, shift in rainfall patterns and rise of sea level in fertile delta like Mekong river delta, increased degradation, erosion and lost of agricultural land, rapid spread of diseases and pest and lost of biodiversity. Especially, unpredictable change of flood, climate change, temperature, precipitation and unusual storms has affected yield and total profit of rice producers and other stakeholders. Therefore, it is essential to have a holistic strategy for risk management to adapt with climate change. In which, finding out mechanism to share value and risk among stakeholders is a key condition for sustainable risk management.

The recent results indicated that a doubling of the CO2 level would increase yield by 10-15%, but that this would be balance by the effect of the expected accompanying rise in temperatures(Matthews and Wassmann 2003). To the yield farmers produced at regional scale, it was observed that positive yield correlation with temperature was accompanied by positive correlation, while yields were also observed negatively correlated to temperature in several places when there is a positive correlation between yield and Rain accompanied (Zhang, Zhu et al. 2010). The Mekong river delta rice sector is now almost entirely commercialized, with only about 7% of the region's paddy production being held by farmers for own consumption rice production (Nguyen Cong Vinh, 2009). Thanks to the renovation policy, which was implemented in 1980s, Vietnam has achieved remarkable increases in paddy. From a rice importing country, Vietnam started exporting rice since 1989 and since then rice export has continuously increased, and Vietnam now become the

second largest rice exporter in the world just behind Thailand. There is advancement of rice market both in the domestic and international market; farmer is still most vulnerable actor due to climate change while they get least added value among stakeholders. Therefore. Value added that is created in rice value chain should be shared evenly among stakeholders to help farmers tolerate to negative impact of climate change.

2. Objectives

One of main objectives of this paper is to establish mechanism to share risk and value among stakeholders in rice value chain by using added value to compensate for risk and potential lost that may be encountered due to climate change.

Another objective is to a holistic strategy for rice value chain adapt with climate change by mobilizing community source, in which emphasizing institutional reform for risk management. Therefore, the cooperation among stakeholders and between the state and private sectors are also paid much attention.

3. Methodology

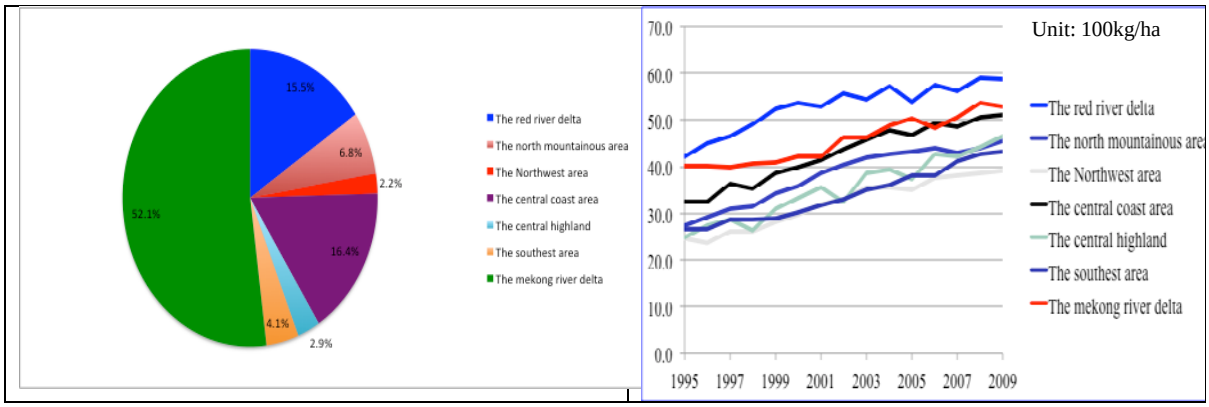
Using value chain approach to identify the change of added value through stakeholders in value chain. Value chain is a process form production to final consumption (Kaplinsky, R., and M. Morris, 2000). Beside, the method of regression to evaluate the affect level of climate factor will be estimated by using regression of rice yield and other factor affecting to rice yield such as precipitation, temperature, sunny time, CO2 concentration and fertilizer use. Based on this model, some scenario will be constructed such as appraise the impact of mean sea rise at different level and flood frequency. To predict the change of rice yield, time series analysis is also implemented based on the time series data of above-mentioned data.

4. Result

4.1. Rice production and rice yield fluctuation

Total rice production area in 2009 is about 4.7 million hectare; this area reduced because of urbanization, industrialization and some rice land area are transferred to cultivate higher value crops. Beside many regions in the Mekong river delta has to face seawater intrusion making it impossible to continue to produce rice anymore. In 2009, the Mekong river delta was account for 52.1% total rice production area of whole country, contributes almost all rice export volume with amount of over 5 million tons in 2009.

Figure 1: Rice production distribution and Yield change in Vietnam



Source: General Office of Statistics, 2010

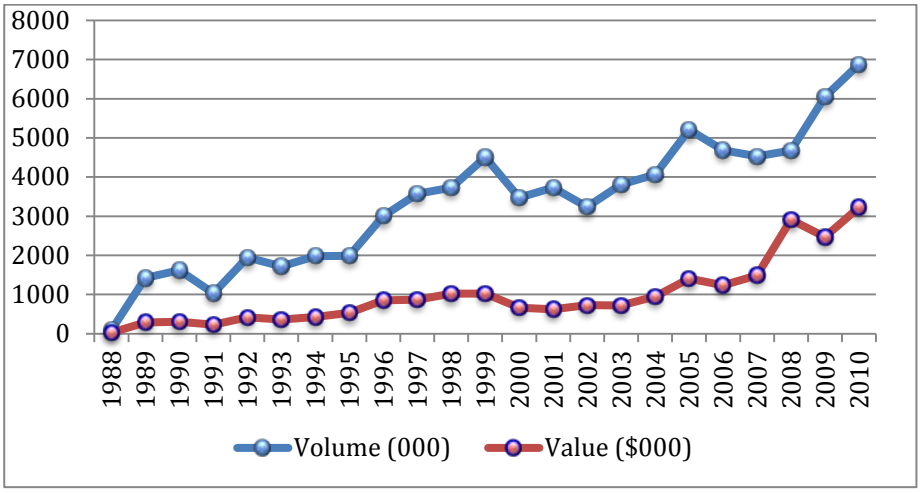
As shown in above figure, the rice yield gradually increases in all regions, but it is fluctuated from 2000 up to now. There many reason explain why there is so change of rice

yield, in which climate change is also responsible for rice yield fluctuation. Climate change causes unusual flow schedule that producers cannot respond to it timely. Accordingly, many rice production areas are submerged and cause huge post harvest lost. This situation becomes more serious in the recent years due to climate change.

4.2. Expand export market

Vietnam's rice export volume increased from 3.48 million tons to 6.05 million tons from 2000 to 2009. This increases precisely due to the growth in Mekong river delta. Rice production over this period increases from 10.85 million tons to 13.31 million tons. The role of rice production in food security has thus grown internationally, rather than nationally over the past decade. This is even more evident when one considers that a large and growing proportion of the export trade was carried out on the basis of government-to-government transactions with the shipped rice frequently being distributed through safety net or other concessional government programs. As a result of its recent expansion in trade, Vietnam's share of world rice exports has crossed the 20% mark, having been in the range of 10 to 13% earlier in the decade. None of the other leading exporters have experienced a similar upward trend in trade. In fact, the rice trade of these countries is notable for its volatility over the past decade.

Figure 3: Vietnam rice export expanded in 20 years



Source: Ministry of Industrial and Trade, 2010

The rice export of Vietnam increase stably from 2000, and it always takes the position of second largest exporter in the world behind Thailand. Even getting a lot of achievement in rice production and world market, value is not shared equality among stakeholders, while farmer still the most vulnerable actors due to risk of climate change. Farmers are always less profitable in term of market participation, while they are the most vulnerable in term of production risk compared to other stakeholders.

4.3. Producing more, farmers get less

In 2009, rice production was 38.9 million tons and export volume was 6 million tons milled rice equivalent to 9.23 million tons rough rice. So the total domestic use was 29.87 million tons. In which, 1 millions tons used for seed and 7.5 million tons used for animal feed including reserved stock and loss during storage. Accordingly, the volume of rice used for human consumption was 21.37 million tons (Bui Ba Bong et al, 2010). The survey of Mekong Delta Institute (MDI) has show clearly result that famers usually get less profit than other stakeholders.

Table 1: Domestic rice value chain

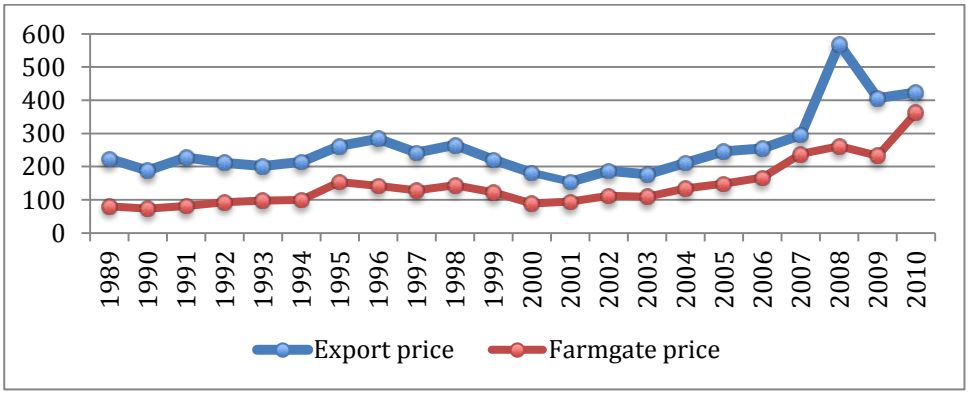
	Total cost (đ/kg)	Price (đ/kg)	Profit (đ/kg)	Average quantity/stake holder/year (tons)	Profit/stakeho lder (Million VND)	Profit/stakeho lders/year (USD1000)
Farmer	4,380	4,887	507	8.4	4.3	0.3
Traders	5,145	5,184	39	1,700	66.3	4.0
Millers	5,972	6,100	128	4,948	633.3	38.4
Polishers	6,893	6,943	50	1,300	65.0	3.9
Transporter	240	120	120	3,528	423.4	25.6
Wholesalers	8,095	8,822	727	1,200	872.4	52.9
Retailers	8,822	9,454	632	240	151.7	9.2

Source: Mekong Delta Institute, 2010

There are different value added reveived by other stakeholders from farmers to retailers even though it is domestic market or global one. In domestic rice value chain, farmer usually get lowest value compared to other stakeholders, whereas the wholesalers are the most profitable one.

Figure 2: The difference between farm gate price and export price

Unit: USD/tons



Source: Ministry of Industrial and Trade, 2010

One of the reasons why farmers are the most vulnerable actor in the rice commodity chain is that they get lowest profit, while they face most risks due to climate change. The price that farmer sell to wholesalers and other stakeholders are usually much less than those of the wholesalers sell to export companies or final consumers.

4.4. Risk identification and adaptation measures

- **Risk of seawater intrusion**

Because Vietnam in general and Mekong river delta in particular, when sea level rise from 0.2-0.6m, 100.000-200.000 hectare will be submerged that causes reduction of agricultural land, especially rice land. If the sea level rise 1 meter about 90% Mekong river delta will be submerged 4 to 5 months, in the dry season over 70% area will be salt intrusion with salt concentration is over 4g/l. it also predict that 2 of 4 millions ha will be loosed, this severely affect national food security and millions for rice farmers (MONRE, 2009). Some scientist believe that the calculation of th IPCC on sea level is slightly lower because not fully account the level of ice melted. Damage production by loss of rice land based on scenarios of climate change for Vienam is very serious. Most of the potetial flooded area including the red river delta and mekong river delta is the rice bowl of Vietnam. Institute

of Agricultural Environment also predicted that mekong river delta is the most affected area, where 38,29% of land will be submerged under sea water among that 31.16% are agricultural land and it is mainly allocated for rice production. It is also estimated that these area will lose7.6 millions tons of rice per year equivalent to 40.52% total rice output of mekong river delta today (IAE, 2010).

- **Increasing insects and disease**

Climate change also causes change of habitat condition of living insects, so many disease occur in rice production cause serious reduce rice yield in many regions, in some seasons the insect and disease can affect over 400,000 ha of rice in the Mekong river delta, it increase production cost and reduce rice yield. Normally, key pest and diseases on rice plant are usually occurred in a certain period. It observed that major pests and diseases on rice production like brown plant hopper (BPH), rice leaf folder, stem borer, rice plast, sheath blight, bacterial leaf blight, etc were often occurred in a certain period with interval 3 – 5 years. Taking the example form current status of rice growing in Vietnam shows that the only epidemic outbreaks of BPH in winter spring rice season 2005-2006 in mekong river delta occurred in the large area over 200,000 hectare with pesticide spray equivalent to 13% of total rice growing acreage. In the other seasons namely summer – autumes monsoon rice there were very high damages caused by both BPH and viruses and total crop loses worth over 2,000 billion VND, farmers has to tolerate all those losses.

- **Flood is unusual schedule and increasing weather extreme events**

Many weather extreme events will occur, flood in many irrigation constructions will increase suddenly, it sometimes causes overload of these systems and flood in many key production area. Beside climate change also causes change of precipitation in accompany with industrialization and urbanization, the current irrigation system cannot meet the water demand for both daily life and irrigation. As stated above, Mekong river delta play an important role in agricultural development, food security and stability. Recent decades has been suffering by climate change, in which the rollers are large fluctuations of flood, more and stronger hurricanes, more serious drought, forest fires, land erosion. Actually, climate change is responsible for many extreme events occurred in the Mekong river delta in las 10 year. In 2000, historical flood was recorded; 05 consecutive years with below-average flood, which in 2006 water level 4.00 m at Tan Chau. Mekong Delta 04 years have limited, particularly limited combination of runoff on the Mekong River in 2004; 02 times greater storms landed and affect mekong river delta. Landslide occurred more oftent in the river banks and salinity become more popular in the mekong river delta.

- **Abruptly temperature change**

In 2009, Ministry of Natural Resource and Environment (MONRE) recommended climate change scenario to Vietnam focusing on temperature and sea level rising in Vietnam in 21th century based on high emission scenario, medium and low. Result shows that by 2100, annual average of 1.1 to 1.9^0C for B1 scenarios; from 1.6 to 2.8^oC for B2 scenario and from 2.1 to 3.6^oC for A2 scenario. Additionally, IPPC (2007) estimated that sea level rise of about 26-59 cm by 2100. It is also forcasted that by the end of 21th century, the air temperature may raise 2-3^oC and it occurs rapidly in the the mekong river delta. Rainfall would be rise in average by 5% in rainy season and during a year, but reduced in dry season. This obviously impact very much on rice production, adversely causing water scarcity, drought, flooding, soil salinity, acidicity, unusual weather occurred: new emerging pest and disease, threatening rice sharply yield reduction and bad grain quality.

- **Rice production is also partly responsible for climate change**

Beside the negative impact of climate change on rice production, rice cultivation itself responsible for climate change due to releasing methane, N2O, Carbon monoside and oxide nitrogen (NOx). Therefore, green gas mitigation research and development of solution to apply sustainable agricultural farming techniques to enhance the agricultural production and to mitigate green house gas emission. Improvement of irrigation and drainage management in rice fields. Strengthening the capacities of agricultural institutions is very essential.

5. Discussion and conclusion

Vietnam has a long history with rice production and achieves a significant achievement in last two decades make Vietnam from a chronic rice import country become the world's second largest rice exporters. This achievement is firmly consolidated when both production and export value increase continuously in recent year. However, climate change severely affects rice production locally. It causes high risk for rice producers that require appropriate measure to mitigate losses that farmers may face in the coming time. There are two simultaneous measure should be regarded including indirect solution or economic solution and direct solution or adaptation solution. When it comes to economic solution that takes advantage of rice value chain itself. If use total value added evenly distributed to farmers and other stakeholders will make it feasible for farmer tolerate climatic change. Therefore, value chain approach and fair trade should be promoted to compensate for farmer to confront with climate change. The problem is how other stakeholders accept to share value to producers. The experience of many supply chain show that it is only all stakeholders share value evenly can achieve sustainable development, it is also call multiple win situation. So as to reach that achievement, it is essential to have transparent information system because unfair trade only can exist when there is asymmetric information. If all stakeholders share a same information system, they can be willing share their own value even their profit to get more profit in long run.

As regarding direct solution, if the economic solution focus on market institutions and solve the relationships among stakeholders in value change, this solution focus on production stages. Certainly, there is no solution can solve also problems of climate change causing for rice production, but risk management in rice production based on the risk classification and assessment. In this solution, two different measures are proposed including one for mitigate the impact of rice production on climate change and another one is to support rice to adapt with climate change. As mentioned above, rice can be an actor releasing GHG emissions, so it is appropriate techniques that can solve the problems. So the solution should be focus on issue as follows: 1) development of crop patterns suitable to climate change; 2) effective use of irrigation water; 3) upgrading of irrigation systems for agriculture; 4) development of new varieties that could tolerate against revere environmental conditions; 5) reserve and storage of local crop varieties, establishing crop seed bank and 6) development of farming techniques appropriate to climate change. Beside, improvement of irrigation drainage management in rice fields is necessary in which implementation of water drainage during maximal stem spreading and after grain-filling phases would save water, increase rice yield and mitigate methane emission. Establishing data bank and equipping calculation facilities to serve specialized research in agriculture and climate change. As for the future perspective, this research will be expanded by estimate and simulate the interactive level of production and market factor with climate change.

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