

# Study on the Effects of Climate Change to Rice Production Efficiency and Adaptive Capacity of Farm Households in Ayeyarwady Delta, Myanmar

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Title : Study on the Effects of Climate Change to Rice Production Efficiency and Adaptive Capacity of Farm Households in Ayeyarwady Delta, Myanmar  
(ミャンマーのエーヤワディー川デルタにおける気候変動の米生産効率と農家適応能力に及ぼす影響に関する研究)

## Thesis Summary

The agricultural sector is the mainstay of Myanmar economy. Among the agricultural crops, rice is the dominant not only in terms of food security, but also in the nation's economic development. Ayeyarwady Delta, one of the Asian mega deltas, is the main rice bowl of the country, comprising approximately 30% of total production. The goal of Myanmar's rice sector is to ensure the nation's food-security by increasing the smallholders' household income from farming and to build an internationally competitive rice sector. The government's ambitious target for milled rice exports is to reach at least 6 million metric tons by 2029-2030 (MoALI, 2015). Myanmar, one of the agriculture-based countries, is already ranked as one of the most at-risk countries in the Asia-Pacific region to climate-related hazards, such as floods, drought, and cyclones (World bank, 2019). Moreover, El Niño–Southern Oscillation (ENSO) exacerbate seasonal and regional weather patterns in Myanmar, which can cause more flooding during the wet season and drier conditions during the dry season. Based on the historical rainfall patterns from 1980 to 2015, the average annual rainfall was about 10 percent lower in monsoon rice growing season during El Niño years compared to neutral (World bank, 2019). The delta area is also one of the most vulnerable regions to climate change in Myanmar, particularly, flooding from storm surges, river bank overflows, and greater exposure to intense rainfall from the southwest monsoon. Damage to embankments, sluice gates and drainage systems and delayed the rehabilitation process, and saltwater intrusion occurred even in the monsoon season (MoALI, 2015). As regards to climate adaptation practices, the country is in the early phase of implementation adaptation options, research into the identification and exploration of data, policy development and education, and training is still needed (Ansems et. al., 2017). This study attempts to investigate the technical efficiency of rice farming by controlling for environmental production factors. Then, the study also evaluates the profitability and profit efficiency of rice farmers taking into consideration the effect of weather shock and agricultural adaptation practices to climate variability. Moreover, this study explores the current agricultural adaptation practices and adaptive capacity of farm households to individual adaptation strategies in the study area. Two districts from Ayeyarwady Delta were selected based on their prime areas for rice cultivation and high weather fluctuations during monsoon growing season. The field survey conducted in June 2020 using a questionnaire survey delivered through an in-depth interview using a multistage sampling technique. Firstly, production frontier function and technical efficiency analysis of rice farmers for both the short (without environmental production factors) and the full (with environmental production factors) specifications were estimated using STATA Version 17. The findings of this study showed that controlling for measurable environmental production conditions could allow significantly higher technical efficiency and more precise estimates of the sources of technical inefficiency. The technical efficiency of rice production in the study area increases by 5 points from 88% to 93% while controlling for environmental production conditions. It is

important for policymakers and stakeholders to understand the impact of current managerial practices on rice production performance to improve rice development strategies. Next, the economic analysis of monsoon rice production among the farmer groups was estimated based on the effect of weather shock and climate adaptation practices. The result revealed that the farmers who did not experience yield loss and using climate adaptation practices have better benefit as expected. Then, the maximum likelihood estimates (MLE) of the parameters of the Cobb-Douglas frontier profit model was used to estimate the profit efficiency and inefficiency of farm households in delta area. With respect to the estimated results of factors affecting profit inefficiency models, highly educated and entrepreneurial farmers can achieve enhanced benefits from rice production by adopting new technologies and innovation, and efficient farming practices can easily be learnt from public and private organizations. The average profit efficiency level of the yield loss group was approximately 0.39, while the average profit efficiency score of the no yield loss group was 0.66, indicating a relatively large gap in the efficiency score between the two groups (27% wider distribution). Farmers' understanding of weather variability and upscaling the use of local climate adaptation strategies should be strengthened to mitigate crop damage from climate change and ensure the improvement of a net benefit from rice farming. Finally, this study explored the current agricultural adaptation practices to cope with climate variability and adaptive capacity of farm households to individual adaptation strategies in the study area. In the study area, 10 agricultural adaptation practices were commonly used to adapt the current climate variability. The findings of this study reported that floods, drought and saline water instruction are major constraints and threatening to rice farm households in the study area. Farmers' adaptive capacity was determined by observing the farmers' opinions about the agricultural adaptation strategies based on five attributes: knowledge, usage, availability to innovation, accessibility and consultation. The findings presented that the ability of sample farm households to adapt agricultural adaptation strategies is limited due to the lack of knowledge about the climate variability and adaptation strategies, lack of technical skill and inadequate financial resources. Moreover, choice of suitable options to match with climate variability and consultation with the agriculturist or agricultural extension officers are still weakness. The ordered logit model was used to explore the determinants of farmers adaptive capacity to agricultural adaptation strategies. This finding indicates that the higher educated farmers can increase the probability of adapting to cultural management practices among those with high adaptive capacities. Credit access was vitally important to employ for soil related agricultural adaptation practices. Moreover, training programs related with agricultural adaptation practices should focus to enhance the adaptive capacity of farmers on the adoption rates in the transformation of technology from field trials and on-farm demonstrations to real field situation. Non-farm income can support and improve the probability of adapting to agricultural adaptation practices, especially for water management practices. The findings of this study provide the information of farmers' adaptive capacity to agricultural adaptation practices and the important factors influencing on their capacity to adapt to each strategic innovations for improvement of climate adaptation strategies in delta area.