A Study on Rice Production Efficiency and Sustainable Farming in the Vietnamese Mekong Delta

(ベトナムメコンデルタにおける米生産の効率性と持続的稲作農業に関する研究)

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In the restructuring policy of paddy sector to the year 2025 and 2030, Vietnam continues to move towards efficiency improvement and sustainable development targets. Since the year 2000, the orientation of intensive farming in the Mekong Delta, the "rice bowl" of Vietnam, has led to overuse of inputs such as fertilizers and pesticides. As a result, rice production in the region is now facing challenges including low efficiency, natural resource utilization and environmental pollution. For that reason, it is urgent and necessary to investigate about efficiency with regards to inputs management and the sustainable farming strategies of rice production in the Mekong Delta. This thesis comprises six chapters. In which, the introductory chapter presents the background of the study, followed by the discussion on research objectives and the significance of the study along with the organization of the thesis. Chapter 2 provides the present situation of the rice sector, environmental harms and some climate smart agriculture programs in Vietnam and the delta. The next chapters 3, 4 and 5 are carried out to: (i) measure the overall efficiency and calculate the excessive inputs usage – the input slacks – in special reference to farm size; (ii) assess the impacts of a climate smart agriculture practice on the economic performance of smallholders and (iii) evaluate efficiency and greenhouse gas emissions (GHG) mitigation capacity related to major rice variety groups in the Mekong Delta, especially aromatic and high-quality rice for export, respectively. Through the application of data envelopment analysis to the Vietnam Household Living Standard Survey 2016 dataset, the results of Chapter 3 indicate that small scale rice farms in the Mekong Delta obtain low overall efficiency at 59% due to overuse of inputs. Current excessive usage should be reduced with regards to seed cost by 28 USD/ha, pesticides by 61 USD/ha, and fertilizers by 155kg/ha. In addition, all types of efficiency could be improved and farmers could reach efficient production frontier if farm size is expanded overuse of inputs is minimized. The chapter 4 employs propensity score matching to estimate the impact of eco-friendly farming practice named "One Must Do, Five Reductions - 1M5R" on the economic performance of paddy households. It is concluded that this technical package helps farmers to reduce their production cost by 10%, increase a paddy's selling price by 4.5% per kg, and obtain

10% more profit, compared to traditional farming households. The return on investment of 1M5R adopters increased by 22%. Chapter 5 uses slack-based super-efficiency measure data envelopment analysis with household survey data to analyze the overall efficiency and input slacks of rice production. Main findings are: aromatic and high quality rice groups achieve high efficiency and can contribute to GHG mitigation with small slacks of nitrogen and water use. Finally, the major findings of the study are discussed in Chapter 6. There is an advantage of encouraging farmers for expanding farm size and improving production efficiency and farm environment through reduction of chemical inputs. Particularly, the government should take more active and appropriate measures to monitor climate smart faming and design specific regional schemes for sustainable rice production in Mekong Delta and Vietnam.

Keywords: rice production, Mekong Delta, efficiency, small holders, sustainable farming, data envelopment analysis, propensity score matching, climate smart agriculture, aromatic rice, high quality rice