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主　論　文　の　要　旨

論文題目　Productivity and Efficiency of Rice Production: The Implication for Poverty Alleviation in Cambodia
(米生産の生産性と効率性:カンボジアの貧困削減への影響)

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論　文　内　容　の　要　旨

Despite the impressive economic growth, which has sustained for more than a decade, Cambodia is still one of the poorest countries in the world. The Cambodian poverty is largely a rural phenomenon as about 79% of the country's population is rural inhabitants, and the rate of rural poverty is significantly higher than the urban rate. The rural households, most of which are poor and low-skilled, generate income from four main sources: from agricultural crops, from waged employment, from non-farm self-employment, from remittances, and from transfer and scholarship. Agricultural crops provide the second biggest contribution to the household income, and because the Cambodian agricultural sector is undiversified, with rice being the dominant crop, income from agricultural crops is mainly generated from rice growing. Rice is lifeline of the rural households since they have cultivated rice for generations to supply household consumption and market to earn cash income. As rice plays important role in farming households' income generation, improving the economic performance, i.e. productivity and efficiency, of the rice industry is promising in reducing rural poverty, which will contribute to overall poverty reduction in Cambodia, but the study pertinent to this issue is scant.

This dissertation has two main objectives. First, the study examines the status of the productivity and efficiency of Cambodian rice production and to explore factors that affect the level of the productivity and efficiency. More specifically, this dissertation attempts to shed light on whether the productivity of Cambodian rice is low or high, and whether or not the rice farming households are cost efficient. Then, in order to improve the productivity and efficiency, factors that affect these two key indicators of economic performances are to be explored. The second objective is to examine the relationship between the productivity (land and labor productivity)

and efficiency, and poverty status of rice farming households in different regions. The study explores the impact of the improved productivity and efficiency on poverty in different regions in Cambodia to see if improving the rice productivity and efficiency can be beneficial to farming households in all regions. To achieve these objectives, the study answers the following research questions:

1. What is the status of the productivity of Cambodian rice?
   1.1 Is the productivity high or is it low?
   1.2 What are factors affecting the productivity?
2. Are Cambodian rice farming households cost efficient?
   2.1 What are factors affecting the level of the cost efficiency?
3. What is the impact of the growth of the productivity and efficiency of rice production on poverty among farming households?
   3.1 Does the improved land productivity raise the household consumption?
   3.2 Does the improved labor productivity raise the household consumption?
   3.3 Does the improved cost efficiency level raise the household consumption?

The main results are summarized as follows:

Chapter 4 compared the productivity of Cambodian rice to the rice productivity of other Asian rice producing countries. I used two indicators, rice yield and gross rice value per hectare. Both indicators showed that the productivity of Cambodian rice is among the lowest. To illustrate, the yield of Cambodian rice in 2012 was 3.1 tonnes per hectare while the rice yield in the Republic of Korea, the most productive rice producing country in terms of yield, was 7.6 tonnes per hectare. In 2007, the gross rice value per hectare in Cambodia was about US$ 465 while it was around US$ 9,430 in Japan, the most productive country in terms of gross rice value per hectare. These comparisons showed that the Cambodian rice productivity, both the yield and the gross rice value per hectare, has large room and large potential to be improved. There are various factors constraining the growth of Cambodian rice, which include: the inadequate funding for agricultural research and extension, the dilapidated irrigation system, the low availability of improved seed, the inaccessible to formal funding by the farmers due to lack of collateral, the stagnant of yield increase and the lack of human capital.

Chapter 5 used the Stochastic Frontier Analysis to test the cost efficiency of Cambodian rice farming households. The results showed that the wet season rice farming households in the Tonle Sap and Plateau/Mountain region are cost inefficient with the mean cost efficiency scores of 1.2 and 1.3 respectively. These mean scores indicate that in the Tonle Sap region, farming households wasted about 20% of their input in the production of rice while, in the Plateau/Mountain region, farmers wasted as much as 30% of their resources. Had these wasted resources been saved, farming households would have been able to allocate their scarce resources to consumption and other productive activities, thus improving income and welfare, and reducing

poverty. There is no evidence of cost inefficiency among dry season farming households in all regions and wet season farming households in the Plain and Coast. Factors that affect farming households' level of cost efficiency are the ratio of farmers to harvested areas, the education level of the household head and the age of the household head. The ratio of farmers to harvested area is significant in all cases. This ratio has a negative relationship with cost efficiency. The large ratio implies that either there are many farmers working in a plot of agricultural land, or the agricultural land is so small that the farmers cannot fully employ their labor to the optimum, i.e. disguised unemployment. If it is the case, the farming households are less cost efficient. The age of the household head was found to significantly improve cost efficiency in the Cambodian sample and in the Tonle Sap region but was not significant in the Plateau/ Mountain region. Age may represent the experience of farmers; older farmers often have spent many years growing rice. Therefore, they have more experiences than younger ones and are likely to be more cost efficient. Education of the household head is not significant in all cases. These results reflect the fact that general education may not necessarily improve agricultural efficiency as many agricultural techniques require specific training, which is not widely provided in Cambodia. In addition, farmers' education is generally low, only about 5 years of schooling, so it is difficult to observe the marginal effect of education on the production efficiency. Also, because many farmers still practice traditional cultivation methods, education may not impact much, but experiences may have greater effect on the cost efficiency.

Chapter 6 examined the impact of land and labor productivity, and cost inefficiency on poverty among rice farming households. The results showed that only the growth of the productivity, i.e. the productivity of land and labor, increases the per capita total consumption of the rice farming households. There is no evidence supporting the role of the efficiency in raising the consumption. However, if disaggregating the effect into different regions, only in the Plain and the Tonle Sap region that the improved productivity has a positive and significant relationship with the consumption. In Cambodia as a whole, 10% increase in the land and labor productivity contribute to 2.1 % and 2.5% increase in per capita total consumption respectively. In the Plain region, 10% increase in the land and labor productivity raise the per capita total consumption by 0.19% and 0.24% respectively while, in the Tonle Sap region, 10% increase in the land productivity raise the per capita total consumption by 4.8%, and 10% increase in the labor productivity raise the per capita total consumption by 4.4%. The elasticity was used to compute its effect on the mean consumption of rice farming households, and the result showed that, in Cambodia, 10% increase in the land productivity raise the average consumption from 5,456 KHR (one USD is about 4,080 KHR in July 2015) to 5,571 KHR while the 10% increase in the labor productivity increases the consumption from 5,456 KHR to 5,593 KHR. In the Plain region, the average consumption barely changes because the impact is too small whilst, in the Tonle Sap region, 10% increase of the productivity of land raise the average consumption from 5,385 KHR to

5,644 KHR and the 10% increase in the productivity of labor raises the average consumption from 5,385 KHR to 5,622 KHR. Given the same 10% increase in the productivity, the average consumption among the rice farming households in the Tonle Sap region improves more than those in the Plain region. As a result, the farming households in the Tonle Sap region become better off as indicated by the lower poverty rate after the increase in the productivity.

This dissertation concludes that rice is a key industry in Cambodia that provides one of the biggest sources of income for the rural households and has the potential to lift many poor households out of poverty, but the productivity of rice is low, and farming households are growing rice inefficiently. For these reasons, improving the productivity and efficiency should be a top priority for policy makers in formulating poverty reduction policy. Improving the productivity and efficiency of rice does not only benefit rice farming households, but also contribute to the growth of other sectors through the multiplier effect. Important constraints to rice production growth such as the inadequate funding for agricultural research and extension, the dilapidated irrigation system, the low availability of improved seed, the inaccessible to formal funding by the farmers due to lack of collateral, the stagnant of yield increase and the lack of human capital have to be remedied as soon as possible while factors that inhibit farming households from growing rice efficiently like small size of rice growing land, rural disguised unemployment and low educational attainment among household heads also have to be dealt with. Most of the constraints and factors that affect the productivity and efficiency have the nature of public goods and services; therefore, to solve those problems and constraints, the initiative, and the strong and effective coordination or intervention from the government is inevitable and needed.