The rapid economic growth in Laos over the last two decades has been driven by the extremely utilization of natural resources and commercialization in the agricultural production. Through this production system, agricultural landscapes are being transformed from land use mosaics of subsistence and smallholder farms to large-scale plantations dominated by a few commercial crops. The capacity of these commercialized agricultural plantations for poverty reduction is increasingly weighed against its long-term impacts on sustainability of land and natural resources. In this perspective, the objective of dissertation is to analyze the sustainability of Lao farming system with regard to three aspects: environmental, socioeconomic, and technological.

Regarding to the environmental aspect, this study looks at the economic valuation of land uses with the potential incentives of the Reducing Emissions from Deforestation and forest Degradation (REDD+) mechanism can contribute towards poverty alleviation. The results demonstrate that commercial agriculture (maize and rubber plantations) does have the potential to support poverty alleviation in the short-run. It, however, exposes the land to serious environmental risks. By comparison, the traditional land uses studied (upland rice farming and non-timber forest products collecting) are largely subsistence activities that are still considered as sustainable, though this is increasingly affected by changing market and population dynamics. The results suggest that longer-term environmental costs can potentially cancel out short-term gains from the commercialization to mono-crop agriculture. Incentives for conserving ecosystem services, such as REDD+, may have a potential role in supporting diversification of traditional livelihoods and increasing the competitiveness of maintaining forests.

With respect to the socioeconomic aspect, the analysis on the impact of cassava contract farming on poverty reduction in Savannakhet and Vientiane provinces provides significant findings. Contract farming is a strategy with good potential to modernize agriculture and reduce rural poverty. Many farmers in both regions, however, failed to understand the details of the signed contracts because most of them were less educated and there was little explanation on the details of the contract. The main problem observed was the improper practices of the 2+3 model in Savannakhet. Farmers were required to follow the counterpart contractors and provide capital, which disposed them to the risk of indebtedness. In addition, the contribution toward poverty reduction in these regions was not significant because the result
indicates the negative impact of net return per capita of cassava compared with that of the alternative crops. These results imply that contract farming suffers from several weaknesses; if not carefully managed, it could lead to farmer exploitation. Therefore, intervention from a third party, particularly the public sector and corresponding partners, is necessary to solve these issues.

The empirical analysis on the technical efficiency of small-scale cassava farming in the two provinces also indicates unique findings. The elasticity of mean value of cassava output is estimated to be an increasing function of farm size, labor cost and variety cost in Vientiane and Savannakhet. There are, however, limitations on increasing farm investment, because smallholders often have less labor and small land size. The increasing return to scale was found for smallholder cassava farming in Savannakhet. The estimated mean score of technical efficiency are 75% and 72% for Savannakhet and Vientiane, respectively. The significant highlight of the determinant on technical efficiency in Vientiane expressed that planting cassava with good land preparation, suitable time period for plantation and young farmers play a key role in the improvement of technical efficiency for cassava farming.

In term of the technological aspect, the study investigates the economies of scale of smallholder rubber farming in Luangnamtha province, Lao PDR. The pioneer results indicate the existence of economies of scale in rubber plantation as the significant reduction in the costs per unit of output year over year. This implies that rubber plantations in this area could benefit from large-scale farming with the potential capacity to minimize the cost of rubber plantation, while smallholders tend to integrate with the large-scale farming for survival. The result also highlights the increasing returns to scale in cost of rubber farming. This implies that at the beginning stage, the initial cost (land clearing and planting costs) for rubber plantation is very important. There is a tendency that large-scale plantations have better condition and it is concerned that individual small-scale farmers would be replaced by large-scale concessions. When rubber plantation operate year over year, then the operating cost (labor use for tapping and management cost) will later become essential, due to all of the costs depend on the variable cost and the proportion of variable cost to fixed cost increase (Onishi H., 2015). This means that smallholders could compete with the large-scale farming in terms of efficiency of operating cost. If smallholders overcome such difficult situations by their own competitiveness and public support, their management for farming practices will better improve.
The analyses for sustainability of Lao farming system add important unique view points to the accumulation of literatures. Commercial crop production (rubber, maize and cassava) generates sufficient income and potentially reduces poverty in the short run; however, it exposes the land to serious environmental risks in the long run. In contrast, the traditional land-use practices in terms of upland rice farming and NTFP gathering are largely subsistence activities that can be considered as sustainable, but their contribution to poverty reduction is less.

The competitive investments for valuable resource utilization by large-scale plantations over smallholder ones poses many challenges for long-term availability of land and forest resources. Both large and small scale farmers can equally contribute toward social stabilization through rigorously taken in to account the environmental, socioeconomic, and technological aspects of sustainability analysis of Lao farming system in order to promote sustainability of farming system and significantly support poverty reduction in Lao PDR.