

CHAPTER 7

Conclusion and Policy Implication

This chapter summarizes all of results and discusses the policy implication for the farmers and relevant agencies.

7.1 Concluding remarks

The analysis of the GCSC of Arabica coffee to enhance competitiveness of highland farmers in Chiang Mai province is on the area-based research and development which had applied the cluster technique as a developmental tool in the coffee supply chain, as well as having analyzed the optimal operation in the GCSC, assessed the appropriate value sharing in the GCSC, and evaluated the farmers competitiveness. The research focuses on the Arabica coffee farmers in the highland in the Pamiang and Pang Ma-O areas. The findings are summarized as follow:

Driving factors for GCSC of Arabica coffee

- 1) The results on the appropriate physical domain and community context of the sample areas reveal that Pamiang and Pang Ma-O areas are suitable in the aspects of land elevation, soil fertility, abundant water resource, temperature, average rainfall per year, and relative humidity.
- 2) The results from current cluster analysis of Arabica coffee point out the specific strengths of current cluster in facilitating the development of green supply chain of Arabica coffee in the sample areas. The strengths come from the suitable physical factors, farmers' experience as well as knowledge regarding coffee production techniques and technologies, farmers' awareness of environmental value, and the cooperation among coffee farmers. However, the collaboration among the farmers and the cooperation between the farmers

and the relevant agencies are the weakness of the GCSC development due to the doubtful continuity and sustainability.

- 3) To understand the underlying factors for coffee farmers to adopt green practices in production, waste management, and transportation for realizing an environmentally friendly supply chain, the logit model was used as the analytical tool. The results revealed the significant factors that have strong positive effect on farmers' adoption of all three green practices to include the concern of farmers about input cost and the information accessibility of and utilization by the farmers.
- 4) In addition, the analysis of external environmental factors with the use of modified GEM model revealed that the available resources indicator particularly the technical and technological progress element, and the existing infrastructure with convenient and fast transport and communications are the strengths that can be used to create GCSC of Arabica coffee in Pamiang area, while the green relation in production, transportation and waste disposal is the major weakness of cluster development. With respect to Pang Ma-O area, the environmental friendliness and the structure and strategies are the strengths that can be used to develop the GCSC of Arabica coffee here. However, the external market factor is considered a major weakness compared to other indicators which affect the cluster development. Moreover, the calculated GEM scores to judge the competitiveness of the two sample areas point out that if the indicators in Arabica coffee cluster are not developed, the two sample areas will gradually incur the loss of market share to competitors.

Simulation of the GCSC practices and costing

- 1) In the conventional model, the activities of the farmers in the Arabica coffee supply chain consist of two major activities such as the parchment coffee production (procurement of production factors, coffee cherries production and parchment coffee processing) and transportation. At the assembler level, the main activities are classified to include the parchment coffee collecting,

the inventory management, and transportation. Meanwhile, the operations of the RPF are divided into the factor management, the inventory management and the green coffee bean production. The results of these activities bring about the average cost of the farmers in the Pamiang and Pang Ma-O areas at around 81.58 and 79.99 baht per kilogram of the parchment coffee, respectively. The highest proportion of the cost comes from the cost of labor, and followed by the cost of chemical fertilizer and materials. Considering the assemblers, the Pamiang RPDC and the Pang Ma-O RPEC, their costs are equal to 106.94 and 107.09 baht per kilogram of the parchment coffee, respectively, with the highest proportion of costs in purchasing the parchment coffee and warehouse components. While the cost of the RPF is approximately 190.55 baht per kilogram of the parchment coffee. The purchasing of parchment coffee and inventory shares the highest proportion of the costs.

- 2) In terms of being environmentally friendly, the greenhouse gas emissions are assessed to indicate the impact of the product life cycle of Arabica coffee on the environment. The results show that the activities causing global warming in high proportion consist of transportation, waste and wastewater from parchment production, and chemical use of the farmers; transportation of the assemblers, and the wastes from the green coffee bean production of the RPF.
- 3) From the findings mentioned above and the possibility of farmers' adoption of green practices, the simulations of the green practices are set to reduce the costs and the environmental impacts including the green production by simulation of the chemical used reduction, the green waste management by building sewage manholes and composting, and the green transportation by using alternative energy. The adoption to abide by the environmental practices are ambiguous because the judgment levels of each other are different in terms of contributing to the fuzziness in the costs of changing activities from the conventional to the green supply chains. The results present that the green activities bring about the reduction of the total cost of the farmers. For the assemblers and the RPF, although the green practices

have a little effect on their costs, the changes are beneficial for decreasing the global warming and solving the problem of having a high volume of garbage.

- 4) The findings from the analysis on the simulations of the GCSC models confirm that the adoption and implementation of the green practices contribute to the reduction in the total cost and environmental impacts.

Optimal solution for revenue sharing in GCSC

- 1) Because the adoption of green practices by individual farmer is different, the cost of modification of conventional practices toward environmentally friendly operations is vague. Thus, the analysis of the optimal operation of the GCSC of Arabica coffee has applied the Fuzzy Mixed Integer Linear Programming (FMILP) to estimate the models. The results show that the optimal model is the GCSC model that brings about the reduction in the cost of supply chain approximately 18.99%.
- 2) Moreover, the revenue sharing contracts is used as a tool for establishing the coordination. There are two scenario models consisting of the non-GCSC without revenue sharing contracts and the GCSC with revenue sharing contracts. The results show that the decision of revenue sharing contracts selection depends on the goal of the stakeholders in the supply chain. If the goal of the contracts is the profit maximization of the farmers, the GCSC model with revenue sharing contracts, which is 10% of revenue share from the RPF to the assembly centers and the 10% of assembly centers to the farmer clusters, is the best choice. In the other view, if the revenue sharing contracts focuses on maximizing the total profit of the supply chain, the optimal model is the 10% of revenue share from the assemblers in each area to the farmer cluster in the same area without the sharing of the RPF.

In deciding on selecting the best model for revenue sharing contracts, the GCSC with revenue sharing contracts in the case of maximized supply chain profit orientation is appropriate. The contracts should suggest a 10% revenue share only from the assemblers to the farmer cluster increasing in the profit

of farmers that is approximately 76.38% and the profit of supply chain around 17.25%. Although this form does not lead to the highest profit of the farmers, it contributes to not only the maximum profit of the supply chain indicating the highest social welfare but also brings about the second highest earnings of the farmers known as the second best choice.

- 3) Results from the analysis above bring about the assessment of the expectation of farmers' competitiveness derived from the green adoptions and cluster practices. The farmer competitiveness was analyzed using the composite index which is constructed based on the supply chain operations reference (SCOR), diamond model, and environmental friendly aspect. The model of non-GCSC without revenue sharing contracts and the model selected, GCSC with revenue sharing contracts, are used to compare the competitiveness of the farmers. The results demonstrate that the competitiveness of the farmers in Pamiang and Pang Ma-O areas increase in all indicators, both the competitive position and the operation aspects in the supply chain. The environmentally friendly operations and cooperation as the cluster of the farmers in Pamiang area result in the rise in the ability to manage the wastes from the production. Moreover, the use of organic or biological materials in the production process remains the predominant factor in creating competitiveness. However, the farmers in Pamiang and Pang Ma-O areas still have the weakness in the assets and profitability dimension.

7.2 Policy implications and procedures

The research summaries in Section 7.1 show that the GCSC contributes the benefits for the whole supply chain in terms of the cost reduction, income and social welfare augmentations, and competitiveness enhancement. Therefore, from the findings and procedures of this research, the GCSC initiative programs for Pamiang and Pang Ma-O areas are established in three steps, how to prepare the farmers for operating under the GCSC, how to construct the GCSC, and how to evaluate the solution of GCSC. The procedures are expressed as followed:

1) Preparations of the farmers to GCSC

- 1.1) The strong relationships among the partners such as the farmers and the relevant institutions, e.g. local authorities, educational institutions, and private organizations, etc., especially the knowledge and facilities should be enhanced. Meanwhile, the collaborations between the farmers and other organizations in the areas are to continually be activated for the sustainable development of GCSC in the long term.
- 1.2) The procedures for preparing the farmers to participate the GCSC can be represented as follow:
 - (1) Building the trust and relationships among the farmers and stakeholders in the supply chain

For building the trust and partnerships in Pamiang area, the farmers and stakeholders should be stressed on the joint visions and goals, the transparent decision, and the continuous actions, as well as the representations of the cost and benefit comparisons between the non-GCSC and GCSC situations. Since the non-GCSC costs are higher than the GCSC costs, the trust building processes have taken place.

In views of the Pang Ma-O area, the verbal agreement between the farmers and stakeholders, the pusillanimity of the leaders of the farmer group, and the intervention by local middlemen are the key cause of mistrust and less collaborations. Thus, the way to build the trust among the farmers in this area should be focused on the joint visions and goals, the processes of collaborative education/communication, the eagerness to share information, and the transparent decision. Meanwhile, the trusts between the farmers in Pang Ma-O area and the stakeholders are built by engaging the contracts to sustain the partnerships in the long term.

- (2) Establishing the collaboration and choosing the strong leaders

After building the trust among the farmers and stakeholders, the collaborations among them are occurred. The ways to establish the collaborations among the farmers and relevant actors in both areas consist of the horizontal collaboration among the farmers for

sharing the information, joint production and transportation, and joint waste disposal management, and the vertical collaboration among the farmers, the assemblers, and the processor with the “revenue sharing contracts”.

(3) Choosing the strong leaders

The leader is the important person who leads the group or cluster operating in the same patterns and achieving their goal. Since the cluster have been established, the cluster leader is selected. The qualifications of collaborative leaders in Pamiang and Pang Ma-O areas should be comprised of being faithful, sacrifice, and responsible, developing the visions, creative problem solving, planning, negotiating, motivating and inspiring, building and maintaining credibility, recognizing and rewarding, developing the collaboration, engaging additional partners, building social capital, political leadership, and managing complexity. Moreover, the leaders should be able to access, utilize, and share the useful information to the members.

(4) Providing the correct information of GCSC.

The accessibility of information of the farmers in the Pamiang and Pang Ma-O areas is the key factor for adopting the new practices. The findings show that the farmers who have more ability to access the information tend to positively adopt the environmentally friendly practices. Therefore, the correct method in providing information dealing with the approaches and outcomes of the green and cluster practices should be aligned with the benefits for the farmers that are accepting and participating in the GCSC.

(5) Simulating the GCSC practices.

The best ways to demonstrate the GCSC the Pamiang and Pang Ma-O are the learning by doing and proposing the empirical knowledge because these means bring about the obvious outputs and outcomes. The demonstration of green practices, such as green production, green waste management and green transportation, is the pathway to build the trust and achieve the GCSC.

2) Construction of the GCSC practices

Although this research uses the simulation approach to construct the GCSC practices, in the practical ways, the GCSC activities can be established under the collaborations and the agreement among the farmers and stakeholders.

The green practices consists of the chemical used reduction by using the organic fertilizers instead of chemical fertilizers and the waste disposal by composting, the wastewater disposal by building the sewage manholes, and the use of alternative energy.

To establish the cluster, there are two ways for clustering such as the horizontal collaboration of the farmers in the supply chain and the vertical coordination among the farmers, the Pamiang RPDC, the Pang Ma-O RPEC, and the RPF.

2.1) Horizontal collaboration of the farmers in the supply chain

This way is associated with closely working together among the farmers in planning and implementing to achieve the main goals and mutual benefits, such as information sharing, joint decision, resource sharing and joint transportation by establishing the group of the farmers. This research assumed that the results of horizontal collaboration lead to the reduction of production, waste disposal management, and transportation costs.

2.2) Vertical coordination among the farmers, the assemblers, and the processor in the supply chain

The vertical coordination is the cooperation with at least two partners in the different levels of supply chain. The tool applied for setting the vertical coordination among them is the “revenue sharing with pairwise contracts” between the farmers, and the assemblers, and between the assemblers and the processor. The share of revenue depends on the goal of contracts and power of negotiation between the parties involved.

3) Evaluation of GCSC performance

The performance of GCSC is measured along three main dimensions:

(1) Cost reduction

The first measure involves improvement in production, waste management, and transportation from the conventional practices to the green practices by establishing the groups of the farmers for sharing information and resource, joint decision, and joint transportation. The tools for evaluating are the analyses of GCSC practices and costing. Moreover, the linear programming is the advance tool for measuring the optimal operation.

(2) Income increase

The second measurement associates with the contribution of revenue sharing contracts. In the vertical coordination, the revenue contracts are the important tool for setting up the linkage between them. Moreover, the decision of revenue sharing contracts selection depends on the goal of the stakeholders in supply chain, profit maximization for the farmers or profit maximization of the supply chain aspects, and the power of negotiation among them. The solutions of both orientations should bring about increasing the revenue of the farmers and total supply chain.

(3) Competitiveness enhancement

Although the competitiveness assessment is the ideal analysis with the opinion data, in the practical pathways, this measure is useful for indicating the various perspectives of the ability to compete with each other. The composite index is the crucial tool helping to know what indicators should be improved and which ones are better than the conventional form, or not.

In addition, the GSCG practices contribute to an increase in social welfare. The findings represent that the goal of profit maximization of supply chain is the best choice in terms of increasing the total gain of supply chain and farmers' revenue, as well as representing the highest social welfare. Although this income from the supply chain orientation does not contribute to the maximized profit of the farmer, the farmers obtain the second best benefits.

The research conclusion and policy implications contribute to the GCSC initiative program for the farmers, the Pamiang RPDC, Pang Ma-O RPEC, RPF, and relevant organizations to be used as the guidelines on green cluster supply chain development in the target areas and expansion into other areas. This is shown in Figure 7.1.

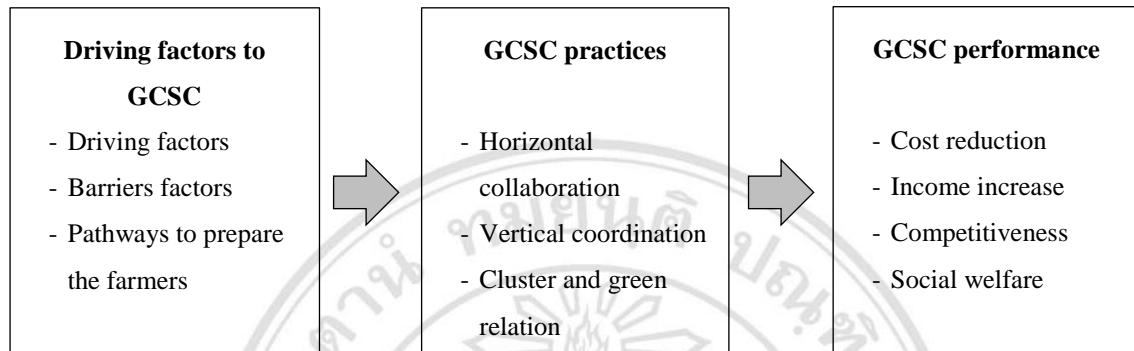


Figure 7.1 GCSC initiative program

7.3 The limitations in this research

- 1) Arabica coffee is a crop having an exact time period to yield the production of cherry coffee and parchment coffee. So, production and marketing information that is not recorded brings about more time in gathering for the next period.
- 2) In assessing the competitiveness of farmers participating in the GCSC, the findings cannot be measured in the short term. So, it relies on estimates based on available data from both the experts and stakeholders by interview trends and results will happen when the concept of an environmentally friendly is applied and the interviews from the farmer provide an estimation of what will happen when those practices are implemented.