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TABLE OF CONTENTS

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CLUSTER FORMATION AND COLLABORATION STRATEGY SELECTION OF PROCESSED ORGANIC *LONGAN* ENTERPRISES

DR CHANITA PANMANEE[1]; MR KASEM KUNASRI, LECTURER; DR ROENGCHAI TANSUCHAT, ASSOCIATE PROFESSOR; DR THANYANUN RITHMANEE, LECTURER

ABSTRACT

In Thailand, the concept of industrial clusters has been used extensively by relevant government and private agencies to create important industries and small and medium-sized enterprises (SMEs) by granting funds to potential industrial development projects. This paper aims to create a cluster of processed organic *longan* enterprises in Thailand in accordance with the concept of an industrial cluster by using the diamond models and the analytic hierarchy process (AHP) method as a tool for cluster formation and collaboration strategy selection. The results show that the interactions among actors related in the processed organic *longan* cluster have strong relationships in the upstream but weak connections in the downstream. The important collaboration strategies for sustainable cluster development are information sharing, seller–buyer contracts, and joint new product/innovation development. These findings will help the strategic plans of all stakeholders in a processed organic *longan* cluster to increase the sustainability of their performance and achieve their goal of competitive advantage.

Keywords: SMEs, industrial cluster, collaboration, diamond model, the analytic hierarchy process

INTRODUCTION

Small and medium-sized enterprises (SMEs) are the backbone of the economy for many countries. They create new jobs and provide employment in the private sector. Thus, SMEs are viewed as key to ensuring economic growth, innovation, job creation, and social integration. The World Bank (2019) states that SMEs play an important role in most economies, especially in developing countries. The World Bank reveals that 90% of SMEs provide job opportunities and more than 50% contribute towards global employment. In emerging economies, formal SMEs contribute up to 40% of GDP. To increase SME competitiveness, they should absorb the knowledge transferred by academics and/or research and development (R&D) institutions, related and supporting firms, and public and private agencies for increasing innovation in the production processes, which is known as industrial cluster development (Ketels, 2003).

Industrial clusters are an effective tool for increasing the competitiveness of business units and related institutions as a whole. Many firms use this concept to create collaboration with stakeholders for mutual benefit, especially in developing a competitive advantage. In Thailand, the concept of industrial clusters has been used extensively by relevant government and private agencies to create important industries as well as SMEs by granting funds to potential industrial development projects. However, currently, the business operations of SMEs are different to each other because of the characteristics and behaviour of their entrepreneurs, the size and duration of their enterprise development, and their limited resources (such as production inputs, capital, times, production techniques, production technologies, marketing knowledge, specialised expertise, etc.) (Gilmore et al., 2001).

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Regarding the organic processed *longan* enterprises in Thailand, although their products have been developed until they have been accepted by the markets, there are risks and uncertainties in production and marketing, such as the small number of *longan* growers who have been certified by the GAP and organic standards resulting in inadequate fresh *longan* being used as the main raw material for processing. The weak collaboration among stakeholders in the organic processed *longan* supply chain has also led to losses and waste in production and marketing processes, thus creating an imbalance in transferring between marketing data and product development.

These obstacles can be resolved by creating an affiliate network, known as an industrial cluster, throughout the supply chain. The *longan* growers are not only the raw material suppliers and the processed *longan* enterprises are not only the producers; they are also alliances that have been upgraded through the production of processed *longan* that increases value and is in line with the market demand. The marketing mediators are used as a tool to connect the global economic gateways, which cause the distribution of economic foundations. The networks can be created in a vertical linkage from upstream to downstream and in horizontal linkage between enterprises, supporting institutions, and related government agencies to achieve their goals of enhancing competitiveness and creating innovation (Porter, 2003a, 2003b; Patti, 2006), as can be seen in the study of Zhao and Liu (2011), etc.

This paper aims to create a cluster of processed organic *longan* SMEs in the north of Thailand in accordance with the concept of the industrial cluster, sustainability and competitiveness and analysis of business environmental conditions with diamond models. Due to the various possible practical ways in processed organic *longan* cluster, the analytic hierarchy process (AHP) method is used as a tool for deciding the collaboration management priorities.

THEORETICAL BACKGROUND

Industrial cluster

Cluster-based economic development is a popular issue for researchers and economic development experts. Porter (1998) defines an industrial cluster as a group of related businesses and institutions operating in a geographic proximity. The results of agglomeration bring about commonality and complementary in both vertical and horizontal linkages. The vertical network occurs from the linkage of firms from upstream to downstream and the horizontal linkages connect with various supporting industries including service businesses, trade associations, educational and training institutions, R&D institutes, and government agencies to achieve the goal of increasing sustainable competitive capability by increasing productivity and creating innovation together (Porter, 2003b; Patti, 2006).

Many researchers have defined cluster development in different ways depending on the scope of their specific field of study. Information Design Associates with ICF Kaiser International (1997) represent four steps of cluster development consisting of 1) mobilisation concerned with the creation of interest and participation in various components that require development, 2) diagnosis dealing with the assessment of economic factors and infrastructures that support the cluster operations, 3) a collaborative strategy involving working groups between demand-related and supply-related parties such as actors in the cluster, government agencies, supporting private agencies, etc. to solve problems together, and 4) implementation associated with the establishment of an agreement between the participants working in the cluster and related parties to ensure the sustainability of the cluster development. Ceglie and Dini (1999) express six steps of cluster development: 1) cluster selection for identifying the cluster to be developed, 2) diagnostic study regarding the

analysis of strengths, weaknesses, opportunities, and threats of the cluster, 3) vision building and action planning relating to the determination of the consistent vision and development strategies among the actors in cluster, 4) implementation such as management and coordination of the activities that are determined in horizontal and vertical network operation plans, 5) monitoring and evaluation of the outcomes from development, both in quantitative and qualitative respects, and 6) sustainability by working with private and government local institutions.

There are many factors to keep in mind when evaluating a cluster consisting of macroeconomic business environment and microeconomic business environment. Sövell et al. (2003) state the need to pay close attention to the macroeconomic business environment comprising of the law and culture in the area, the geographic location, general institutions, legal frameworks, and other relevant macroeconomic factors. In terms of the microeconomic business environment, Carrie (2000); Sövell et al. (2003) and Campaniaris et al. (2011) suggest the diamond model of Porter (1990, 1998) as an analysis tool. The diamond model is an analysis of the industry structure through four perspectives: 1) factor conditions such as labour, capital, natural resources, infrastructures, etc., 2) demand conditions such as order quantity, quantity of demand, quality of demand, consumer size, etc., 3) related and supporting industries such as assistance from buyers, sellers or distributors, the number of linked enterprises, raw materials being purchased together in the same industry, etc., and 4) a firm's strategy, structure, and rivalry, including product quality, product differentiation for marketing opportunities, competition in the market, public relations of products, certifications, etc. There are also indirect factors linked to the four perspectives mentioned above: chance and government (Porter, 1990).

Collaboration

Collaboration is an increasingly popular strategy for organisations in accessing resources, sharing risk, gaining information, managing cost, and creating better opportunities. There are many types of collaboration, such as joint venture, R&D participation, cooperative agreement, contracts, information sharing, etc. Chen et al. (2014) state that collaboration is an arrangement attended by a number of autonomous organisations with a common target. Thus, collaboration refers to working jointly with others for a special purpose. In collaboration, the stakeholders jointly make decisions and undertake activities together (Moharana, 2012).

Chen et al. (2017) represent three evolutionary trends in the research on supply chain collaboration: 1) the change from internal collaborations, such as process integration, cross-functional coordination, environment management systems, etc. to external collaborations, namely collaborations with suppliers, collaborations with customers, collaborations with competitors, etc., 2) the expansion from the study of specific issue such as efficiency, technical arrangement, and supplier control to whole studies such as relationships, education, communication, and shared responsibilities of the many parties, and 3) the outcomes of collaboration expanded from economic or financial effects to environmental and social impacts. Moreover, Reficco et al. (2018) remark that collaboration is a useful mechanism to create sustainable development. Economic collaboration increases value through adjustments of the supply and/or demand between the participants. The added value will be created by seeking the gap between the opportunity cost of suppliers and the willingness to pay of buyers. Social collaboration involves the relationships between people, bringing them together or fostering the coordination and protection of exchanges which create value in the processes. For environmental collaboration, the externalities from activities and costs are considered.

The framework for collaborative practice is divided into three dimensions: communication, coordination, and cooperation (Schuh et al., 2014). Communication provides

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ways of sharing information and enables sense-making. Information sharing significantly reduces the negative effects and improves overall productivity (Fiala, 2005). Sense-making is information interpretation to understand complex situations and assess the possible results (Schuh et al., 2014). The result of collaboration is new knowledge maintained in the organisation through the interaction of members. Considering coordination, there are two perspectives: resource pooling and goal-congruence. Resource pooling is associated with managing available resources, monitoring tasks, and arranging activities. It includes the allocation of necessary information, equipment, and human resources to achieve a collaborative goal (Samaddar and Kadiyala, 2006). Goal-congruence refers to the mutual understanding and agreement of the collaborating entities on the overall goals. The higher the degree of goal-congruence, the more productivity will increase. In terms of cooperation, it is expressed by employees' empowerment and cross-functional activities (Schuh et al., 2014).

METHODOLOGY

The main samples in this research are a processed organic *longan* enterprise which acts as a core business node, and the 200 stakeholders consisting of organic *longan* growers, related industries and/or firms, supporting industries, government agencies, and R&D and academic institutions. The snowball sampling approach was used to select the samples to investigate the conditions and environmental factors before the cluster formation. After that, 50 samples were chosen by voluntary participation in cluster formation and selection of collaboration strategies.

For research methodology, there are two major steps in the analysis:

Step 1: Analysis of conditions and environmental factors before cluster formation

Initially, the interactions among all actors involving in the processed organic *longan* cluster were considered, both in horizontal and vertical networks and represented by cluster mapping. After that, the macroeconomic and microeconomic business environments were analysed. The diamond model (Porter, 1990, 1998) was applied to diagnose the factor conditions, demand conditions, related and supporting industries, and the firm's strategy, structure, and rivalry, as well as chance and government support. The output of these analyses reveals the interactions between all cluster members and the impact of environmental factors on the processed organic *longan* cluster, which represent the knowledge for industrial cluster development.

Step 2: Formation of the cluster and selection of collaboration strategies

After obtaining the important fundamental information mentioned above, the vision and action planning were built among the actors in the processed organic *longan* cluster by using participatory action research (PAR) and focus group methods. The analytical hierarchy process (AHP) was applied for making the decision of the collaborative strategy selection.

AHP is the one of various deciding methods for best choice selection (Saaty, 1980). Many researchers, such as Saaty (2008), Thengane et al. (2014), Russo and Camanho (2015), and Singh and Nachtnebel (2016), use the AHP technique in making decisions to achieve a goal. The AHP procedure begins with setting a goal, then identifying the criteria for evaluating the suitability of the goal. Sometimes, sub-criteria may be set as indicators of the main criteria. After that, the alternatives, which are the choices for decision-making, are identified.

Because of the unequal importance of criteria used to make decisions, the priority weighted approach is used for specifying the key alternatives and criteria. This paper applies the pair-wise comparison matrix according to Saaty (1990, 2008), which sets the main scale

for comparison of importance at nine levels. Level 1 means the first alternative or criterion is of the same importance as the second alternative or criterion, whereas Level 9 means the first alternative or criterion is much more important than the second one. In addition, the reciprocals of Levels 1 to 9 represent the opposite. For calculating the important weights of evaluation criteria, the Simple Normalised Row Sum (SNRS) is used as a tool. Let C_i refers to the i^{th} alternative or criterion $(i=1,2,...,n)$, and W_i is the weight of the i^{th} alternative or criterion. The a_{ij} obtained from pair-wise comparing between the importance of C_i and C_j where $i \neq j$ is calculated by $a_{ij} = W_i / W_j$. The pair-wise comparison matrix, $A=[a_{ij}]$, is shown in Equation (1).

$$A = [a_{ij}] = \begin{bmatrix} W_1/W_1 & W_1/W_2 & \cdots & W_1/W_n \\ W_2/W_1 & W_2/W_2 & \cdots & W_2/W_n \\ \vdots & \vdots & \ddots & \vdots \\ W_n/W_1 & W_n/W_2 & \cdots & W_n/W_n \end{bmatrix} \quad (1)$$

The matrix A multiply by weighted vector is expressed in Equation (2).

$$\begin{bmatrix} W_1/W_1 & W_1/W_2 & \cdots & W_1/W_n \\ W_2/W_1 & W_2/W_2 & \cdots & W_2/W_n \\ \vdots & \vdots & \ddots & \vdots \\ W_n/W_1 & W_n/W_2 & \cdots & W_n/W_n \end{bmatrix} \begin{bmatrix} W_1 \\ W_2 \\ \vdots \\ W_n \end{bmatrix} = n \begin{bmatrix} W_1 \\ W_2 \\ \vdots \\ W_n \end{bmatrix} \quad (2)$$

Let v be the eigenvector of matrix A which is a weighted vector obtained from Equation (2). It can be shown as Equation (3).

$$v = \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_n \end{bmatrix} \quad (3)$$

After normalising the matrix A, the relationship between the $\lambda \max$, which is the maximum eigenvalue, and the eigenvector (v) are expressed as Equation (4) (Dong and Cooper, 2016; Karanik et al., 2016).

$$Av = \lambda_{\max} v \quad (4)$$

The alternatives or criteria that pass the evaluation are calculated for finding the local weights (LW), which represent the weight of each alternative or criterion. The global weights (GW) of each hierarchy are calculated by multiplying the weight of each element in that hierarchy by the weight of the same element in the higher hierarchy. Priority of choices can be determined.

Moreover, in the AHP method, the consistency ratio (CR), which is the consistency testing in comparison of weighting of criteria or alternative, should be evaluated. The formula is shown in Equation (5),

$$CR = \frac{CI}{RI} \quad (5)$$

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where CI is the consistency index calculated by $(\lambda \max - n)/(n-1)$, and RI is the random consistency index evaluated by following Saaty (1990). If the value in matrix A is perfectly consistent, the CI is equal to 0. Thus, a low CI value represents good consistency. This calculates that CI is used for evaluating CR by using the formula in Equation (5). The CR should be lower than 0.10 to confirm that decision-making is consistent and the eigenvalue can be used for weighting the criteria and/or alternatives.

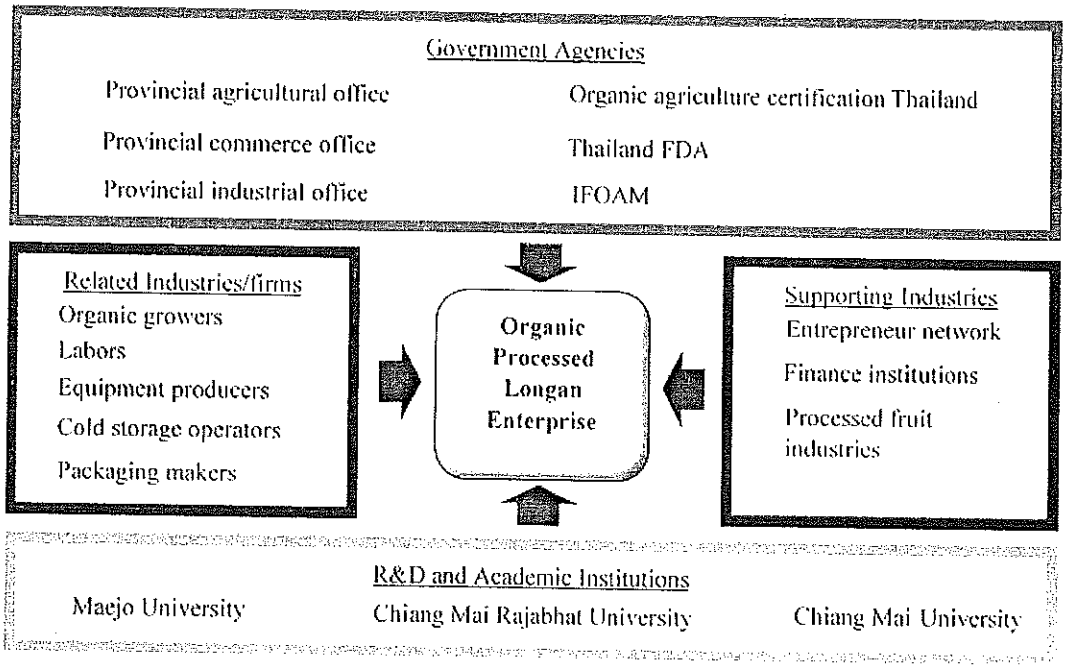
FINDINGS AND DISCUSSION

The findings of this research are separated into three parts: the actors in the organic processed *longan* cluster, the business environmental conditions of organic processed *longan* cluster, and the collaboration strategies for organic processed *longan* cluster.

Actors in the organic processed longan cluster

The results show that many actors are involved in a processed organic *longan* cluster, including processed organic *longan* enterprises, organic *longan* growers, labours, cold storage operators, packagers, financial institutions, processed fruit industries, government agencies, the Thailand FDA, Organic Agriculture Certification Thailand (ACT), the International Federation of Organic Agriculture Movements (IFOAM), Maejo University, Chiang Mai Rajabhat University, and Chiang Mai University, among others (Figure 1). Their interactions are strong in the upstream but weak in the downstream.

Figure 1: Actors in the organic processed *longan* cluster



Business environmental conditions of an organic processed longan cluster

Considering the business environment (Figure 2), it is found that the positive factors consist of suitable areas and weather conditions, organic agriculture certification, good management, high consumer demand, entrepreneurs and growers networks, and knowledge and R&D support institutions while the negative conditions are a lack of labour, inadequate production factors, high production costs, lack of public relations, many substitution goods, weak collaboration, lower interest rate access, high input price, and high competition.

Collaboration strategies for an organic processed longan cluster

The important fundamental information mentioned above is used as the basis for forming an organic processed *longan* cluster among the related actors via PAR and focus group methods. The vision of organic processed *longan* cluster is having globally competitive SMEs, and the goal is to establish a global market expansion.

After creating a cluster, cluster management methods are the main issues that should be considered. Due to the various possible practical ways in processed organic *longan* cluster, the AHP method is used as a tool for deciding collaboration management priorities. To achieve the goal of global market expansion, there are four criteria and five collaboration alternatives for decision-making. The criteria consist of economic aspects, social aspects, environmental aspects, and competitiveness aspects, and the choices of collaboration strategies are resource pooling, joint new product development, cross-functional activities, information sharing, and seller–buyer contracts, as shown in Figure 3.

Figure 2: Business environmental conditions of organic processed *longan* cluster

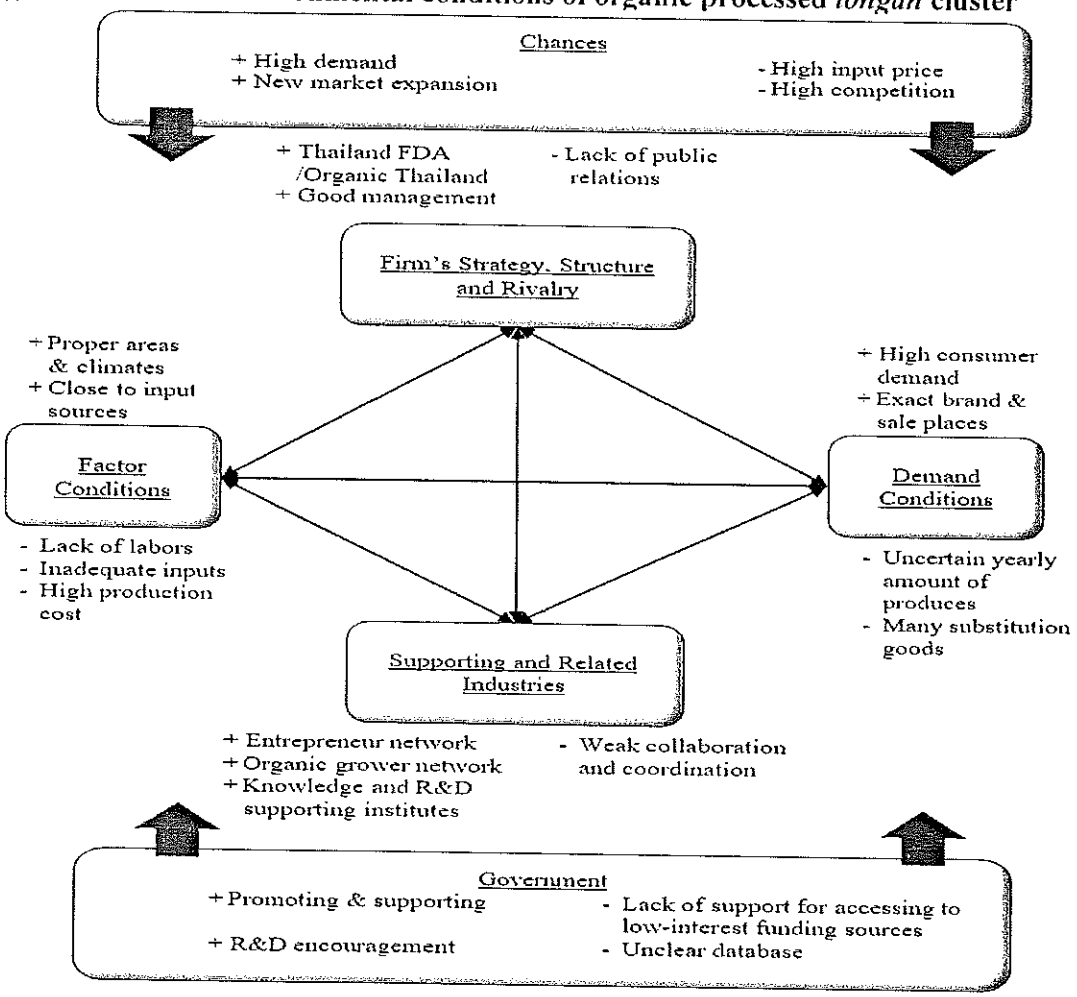


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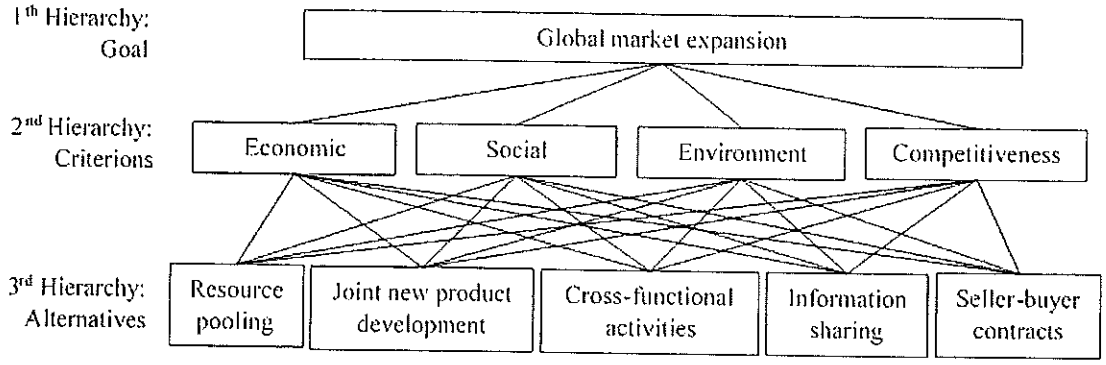
Figure 3: AHP for selecting collaboration strategy of organic processed *longan* cluster



The results from calculating the GW by using the SNRS approach are shown in Table 1. From the criterion perspective, the findings reveal that organic processed *longan* cluster members choose the economic aspect as the first priority, followed by competitiveness, environmental aspects, and social aspects, with a GW of 0.482, 0.272, 0.158, and 0.088 respectively. Why are economic and competitiveness criteria the most important options in decision-making? Following the policy of SMEs or community enterprise in Thailand, the primary objectives of community enterprise establishment are to promote a community economy for many people who are not yet ready to compete, and to support people in the community to gain and maintain local knowledge, create income, help each other, and develop their management capabilities to strengthen the community economy and upgrade themselves to a higher level of business unit. Therefore, it is not surprising that the economic variable and competitiveness are the top variables in decision-making. These findings correspond to the previous studies of Carvalho and Costa (2014), Ha et al. (2014), Ahmedova (2015), Pongwiritthon and Awirothananon (2015), and Wu and Parkvithee (2017).

Considering the collaboration strategy selection, this study found that information sharing is the first choice, with a GW of 0.359. In Thailand, access to information is a big problem for people in various communities. Although many public and private agencies try to gather important information on their websites and frequently publish them through various channels, people – especially local people – are not easily able to access it. Thus, the sharing of information between organic processed *longan* cluster members is a significant way to increase knowledge and be cognisant of the production and marketing situations, as well as to lead to an increase in income and competitiveness. These findings accord with the study of Ha et al. (2013), Connell et al. (2014), Kilelu et al. (2017), and Du et al. (2019), stating that the information-sharing strategy brings about positive outcomes of cluster performance if the industrial cluster is appropriately managed. Furthermore, the second and the third alternative priorities are seller–buyer contracts and joint new product development, with a GW of 0.261 and 0.156 respectively. Because of market uncertainty, seller–buyer contracts are a necessary mechanism for mitigating market risk (Wang et al., 2008; Pedrielli et al., 2015; Joffre et al., 2019). The members of organic processed *longan* clusters are willing to sign contracts between seller and buyer to purchase their production. These selected alternatives are used as strategies for collaborative management in an organic processed *longan* cluster.

Table 1: Weights and priorities of collaboration strategy selection

Alternative: collaboration method		Criterion				Total GW	Priority
		Economic (GW=0.482)	Social (GW=0.088)	Environment (GW=0.158)	Competitiveness (GW=0.272)		
Resource pooling	LW	0.043	0.188	0.258	0.034	0.087	5
	GW	0.021	0.017	0.041	0.009		
Joint new product development	LW	0.179	0.095	0.067	0.185	0.156	3
	GW	0.087	0.008	0.011	0.050		
Cross-functional activities	LW	0.068	0.601	0.200	0.073	0.137	4
	GW	0.033	0.053	0.032	0.020		
Information sharing	LW	0.442	0.082	0.426	0.261	0.359	1
	GW	0.213	0.007	0.067	0.071		
Seller–buyer contracts	LW	0.268	0.033	0.048	0.447	0.261	2
	GW	0.129	0.003	0.008	0.121		

Note: CR of criteria is 0.01, and CR of alternatives of each criteria are 0.07, 0.09, 0.09, and 0.02 respectively.

In addition, the CR of the criteria is equal to 0.01, and the CRs of collaboration alternatives of each criteria are 0.07, 0.09, 0.09, and 0.02 respectively. These values do not exceed 0.10, which implies that this decision is consistent, accurate, and reliable (Saaty, 1990).

CONCLUSIONS AND IMPLICATIONS

Industrial clusters are an effective tool for increasing the competitiveness of business units and related institutions as a whole. Many firms use this concept to create collaboration with stakeholders for mutual benefits, especially in creating competitive advantage. This paper aims to create a cluster of processed organic *longan* enterprises in the north of Thailand in accordance with the concept of the industrial cluster, sustainability and competitiveness and analysis of business environmental conditions with diamond models. Due to the various possible practical ways in processed organic *longan* cluster, the AHP method is used as a tool for deciding collaboration management priorities. The results show that there are many actors related in the processed organic *longan* cluster, including processed organic *longan* enterprises, organic *longan* growers, labours, cold storage operators, packagers, financial institutions, processed fruit industries, government agencies, the Thailand FDA, ACT, IFOAM, Maejo University, Chiang Mai Rajabhat University, and Chiang Mai University. Their interactions have strong relationships in the upstream but weak connections in the downstream. Considering the business environment, it is found that the positive factors consist of suitable areas and weather conditions, organic agriculture certification, good management, high consumer demand, entrepreneur and grower networks, and knowledge and R&D support institutions, while the negative conditions are lack of labour, inadequate production factors, high production costs, lack of public relations, many substitution goods, weak collaboration, lower interest rate access, high input price, and high competition. After creating a cluster, cluster management methods are the main issues that should be considered. The results of cluster collaboration strategy selection represent the top three practical ways to do so: information sharing, seller-buyer contracts, and new product/innovation development, respectively. These findings assist the strategic plans of all stakeholders in processed organic *longan* cluster to increase the sustainability of their performance and achieve their goal of competitive advantage. Furthermore, the relevant agencies can use these findings to promote SME clusters in the future.

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