Chapter I
Context and Problematic

I.1. SMEs and Industry Cluster

Small and Medium Enterprises (SMEs) have been pillar of the economies of developing and developed countries for a long time. However, in the last decade, change of rivalry in the global market and also knowledge-based economy drive SMEs to adapt themselves to the new economic paradigm. For this reason, knowledge becomes one of the new production factors from traditional production factors. Young and Molina give the motive of altering that, in the past, three production factors (i.e. land, labor and capital) were abundant, accessible and were considered as the reason of economic advantage, knowledge did not get much attention [Young 03]. Thus, the enterprises that are capable to utilize their knowledge and shift their business into new economy will survive in the global market competition. Not only the large enterprises require the alteration but also SMEs are trying to use available information and knowledge to gain more competitive advantages in their market. The study also assumed that one way of surviving in today's turbulent business environment for business organizations is to form strategic alliances or mergers with other similar or complementary business companies. The assumption of Young and Molina's study supports the idea of industry cluster which is proposed by Prof. Michael E. Porter [Porter 90].

The concept of the industry cluster was implemented in many continents over the world. The main objective of the industry cluster is to improve the competitive advantages of their industry and country. Even if many clusters have a great success and became the major industry of the country such as Silicon Valley in USA, electronic industry in Taiwan and leather industry in Italy, number of established clusters could not develop themselves as the competitive cluster.

In this chapter, we will describe about the global view of SMEs, problem of the industry, the support from their governments and the force that group them together as industry cluster. The second part of this chapter focuses on the behavior of the industry cluster, the development of the cluster, the best practices and the key success factors of the cluster development. In the last part, related researches and methodologies that are used in the industry cluster development are reviewed and compared with cluster development in Thailand which is our case study. The objective of this study is positioned to improve the three key success factors of cluster development i.e. knowledge sharing, collaboration and the CDA (cluster development agent). The details of these factors will be described later.

I.1.1. Small and Medium Enterprises

SMEs are recognized as playing an essential role in regional economic growth and sustainability for the country. UNIDO (United Nations Industrial Development Organization) endorsed that their contribution to employment generation, poverty reduction, and wider distribution of wealth and opportunities represents a major window of opportunity for most developing countries [Dowson 03]. For these reasons, governments tried to support the SMEs by both fiscal policy and monetary policies. An in-depth view is that the SME is the business in the small to medium size that was driven from a unique skill product using a local raw material that is flexible and feasible to the local people way of life and the world market demand [Lertwongsatien 05]. The mentioned business includes manufacturing, agriculture and service industry which are embedded in the skill of local people that live near by the business establishment. Thus, SMEs generate income to its natives and bring the advantages to the region which will be a shock absorber to the fluctuation of the national economy.

The definition of the SME may be differed by the policy of the government and the size of economy in each country. The criteria that are commonly used to classify small, medium and large enterprise are number of employees (headcount) and amount of investment (turnover). The examples of definition of SME in various countries are compared in table I.1.

Category	Headcount				Turnover			
	USA	UK	EU	Thailand	USA	UK	EU	Thailand
Large	>500	>250	>250	>200	>50M. $	>22.8M. £	>50M. €	>100M.B
Medium	<500	<250	<250	<200	≤50M. $	≤22.8M. £	≤50M. €	≤100M.B
Small	<100	<50	<50	<50	<6.5 M. $	≤5.6 M. £	≤10M. €	≤20M. B
Micro	-	-	<10	-	-	-	≤2M. €	-

Table I.1: Definition of SMEs in each region

The European Union (EU) seems to put more focus on the SMEs than other continents. From the statistic of 2008, EU comprises 23 million of SMEs, providing around 75 million jobs and representing 99% of all enterprises [EC 03]. These SMEs are the major source of entrepreneurial skills, innovation and employment in this region. In 2005, EU has adopted new recommendations regarding the SME definition to promote the *micro enterprises*. This helps the new investors to access to capital, start-up their business and improve to the SMEs level.

These criteria are also used to classify the range of enterprises which are able to obtain the support from the government. The objective of government support is to improve the capability of SMEs in their country through fiscal and monetary policies. Thus, many policies are custom issued for the SMEs. For example, in USA, there is a Tax Credit for the investment in the venture capital or Local Seed Capital in states level, and offering on Capital Gain Tax Cut is indexed by inflation of SMEs. In UK, there are many supporting policies such as encouraging an investment in venture capital and unlisted stocks SME, tax exemption for the dividend from venture capital, exemption on capital gain tax and allow to deduct loss from income, and allow a tax relief as a percent of the investment [Lertwongsatien 05]. In term of financial support, many specific financial institutes were established to support SMEs' business activities such as SME banks and regional funds, etc. These implied the effort of government to increase the competitiveness of the SMEs in the country or region.

However, only fiscal and monetary policies from the government itself are no longer sufficient to maintain the economical competitiveness of the nation in the present competition. SMEs also required developing their competitiveness through the product and service innovation. The innovation is the driving force behind the long-term competitive advantage of the country [Bornemann 03] which requires the

knowledge and collaboration between the members of SMEs in the industry. The following section will describe the development of SMEs in Thailand and their competitiveness improvement model.

I.1.2. SMEs in Thailand

SMEs have long been a leader of Thai economy. They create a large portion of national economy in terms of output, employment and effective utilization of regional resources. From national statistics, more than 90% of the total numbers of establishments in the manufacturing sector in Thailand are SMEs, which are scattered around Bangkok metropolitan and regional areas. In the past, Thailand aimed at being an industrialized country by developing its schemes based on the large foreign investment, labor-intensive production and advanced technology while neglecting the skills and know-how of local people. Since the severe economic crisis happened in Thailand in 1997 (known as Tom Yum Kung crisis), numbers of large enterprises closed down or relocated to other regions. Foreign capital and technology were transferred to new production bases. Meanwhile, SMEs also suffered from the impact of the crisis. Although many of them are closed, many of them were adaptable to the change and grew during the crisis. Hence, SMEs were the main mechanism for Thailand to pass through the crisis. Moreover, this phenomenon brought the Thai government to realize that SMEs are an important function of the country to survive and compete in the globalize world [Intrapairot 03].

Since then, Thailand's government has attempted to support the SMEs in various ways such as establishing a SME development bank, the office of SME promotion, the SME training center, etc. With the support from the government and capability of the SMEs, the economy of Thailand has grown up step by step. In 2006, there were 2,274,525 SMEs, 99.5 % of the total enterprises in Thailand and engaged 76.7% of the work force. The structure of enterprises in Thailand is classified into four sectors: manufacturing, commerce and maintenance and service sector, as shows in table I.2 [OSMEP 08].

	No. of Enterprise in 2006 (Firm)					No. of Employment in 2006 (Thousand)				
Size of Firm	Total	Production	Commerce and Maintainance	Service	Un defined	Total	Production	Commerce and Maintainance	Service	Un defined
Un defined	**8,240**	1,211	1,134	1,365	4,530	-	-	-	-	
LE	**4,292**	1,836	1,230	1,212	14	**2,687.9**	1,732.0	411.4	544.1	0.4
SMEs	**2,274,540**	672,351	908,846	678,637	17,706	**8,863.4**	3,496.2	2,443.4	2,923.4	0.4
ME	**9,791**	4,320	1,781	3,661	29	**1,338.4**	861.5	108.7	368.2	-
SE	**2,264,734**	668,031	907,065	674,961	17,677	**7,525.0**	2,634.7	2,334.7	2,555.2	0.4
Total	**2,287,072**	675,398	911,210	681,214	22,250	**11,551.3**	5,228.2	2,854.8	3,467.5	0.8

Table I.2: Statistics of established SMEs in Thailand in 2006 [OSMEP 08]

From the table, we see that 40% of SMEs are in the commerce and maintenance sector and the most employment (39.4%) is in the manufacturing sector. These SMEs have grown up by domestic demand and cost-focused products in the world market. They bring wealth and sustainability to the villages and regions in where they are located.

In recent years, the emergence of two new factors has severely affected the SMEs' markets.

- The first factor is the alteration of world's economic paradigm. This influenced three elements (i.e. knowledge, innovation and competitiveness) which became the significant factors in SMEs' business.

- The second factor is the entrance of new, lower cost, competitors in the global market.

These factors impelled SMEs to realize that they could no longer rely on cost-focus strategy alone. The competitive development model concerned both public and private sectors. Thus, the concept of industry cluster was seriously implemented in Thai SMEs. The details of this concept will be discussed in the next part.

With the support of many organizations, neighboring SMEs in the same industry have been regrouped to form industry clusters. One interesting example is the ceramic industry. This industry was established in Thailand more than a hundred years ago, and became a competitive industry for Thailand since then due to the fine quality of clay in the country and the high skill of craftsmanship. It had proved its performance by being one of few industries that grew during the economic crisis. The largest ceramic manufacturing network is situated in Lampang province. Lampang

province is located in the middle of northern Thailand which has the highest density of ceramic industry (43.46% of Thailand's total ceramic industry) [MIT 08]. It is the source of several positive factors for ceramic business such as fine quality of white clay, a raw material for ceramic production, low labor cost but good quality, skilled, craftsmanship. Moreover, supportive factors such as logistic convenience, availability of a ceramic exposition center, etc. have been key success factors for rapid growth of ceramic SMEs in Lampang in the last two decades.

The ceramic industry in Thailand can be classified into 2 categories by using type of product i.e. traditional ceramic and new ceramic [MTEC 08].

1   *Traditional ceramics*: tile, mosaic, sanitary-ware, tableware, souvenirs & decorative items, and electric insulators.

2   *New ceramic*: structural ceramics (for high temperature resistance) and functional ceramics (for electronic application).

Most numbers of the ceramic industries in northern Thailand are traditional ceramic producers. The total export value of traditional ceramics in 2007 was 30,129.14 million baht [TCD 08] which had grown from 2003 (21,833.7 million baht) by about 37%.

I.1.3. Forces behind the industry cluster

Since the Thai economic crisis in 1997, numbers of ceramic SMEs became bankrupt and closed down, but many still survive by maintaining their *comparative advantages* such as a focus on lower cost of production, and the quality of the products slowly moved from "C" to "B" class (low to medium range product). However, the price and quality of products meant that these latter were able to compete in domestic and international markets. Nowadays, the comparative advantage itself is not enough to help them survive in the new economy. The SMEs are facing a new crisis from lower-cost product from neighboring countries such as China and Vietnam, the former having greater comparative advantage since it entered the World Trade Organization (WTO) in 2001 [Untong 05]. Part of the domestic market segment was taken by lower priced products from neighboring countries. The report of the Department of Industrial Promotion of Thailand [DIP 08] confirmed that

ceramic enterprises in Lampang province tended to close their business down rather than set up new factories in recent years. The rest are focusing on the accessing to the new international market.

Another problem for this industry is a lack of Research and Development (R&D) on their products. From the results of questionnaires in this research, we found that 55% of these companies are Original Equipment Manufacturers (OEM). About 33.67% of manufacturers are Original Design Manufacturers (ODM) and only 11.33% are Original Brand Manufacturers (OBM). The designing process has mostly been done by customers from foreign countries such as the United States, Japan, France, etc. Due to this, SMEs focused on keeping the cost of production as low as possible, to maintain their advantage for a long time, without focusing on any product development. This is the cause of deficiency in developing product and process innovation, and enables easy copying by other manufacturers.

Accordingly, branding and marketing processes were also done by overseas customers, resulting in a lacking of experience in competition in foreign markets. This also created considerable problems for SMEs in the present situation, due to the demand for ceramic products in the country being less than the supply in the last few years [DIP 08]. This circumstance pushed SMEs to search for market opportunities in the global market by themselves. The lack of knowledge in the international markets made them lose out in the strong competition.

These three problems are driving forces that lead to alterations in the ceramic industry in Thailand. The ceramic producers are aware that they are losing their comparative advantages in the domestic and global markets. This aroused national and local government to pay more attention to the competitiveness of ceramic SMEs, which used to be a good potential industry of the nation. Hence, the competitiveness creating model was considered by the government and academic institutes in order to build the competitiveness of the industry in Thailand. The concept of the model is illustrated in figure I.1.

- Competitive
  the advantage ensures corporate longevity

- Innovation
  the driving force behind long-term
  competitive advantage

- Knowledge
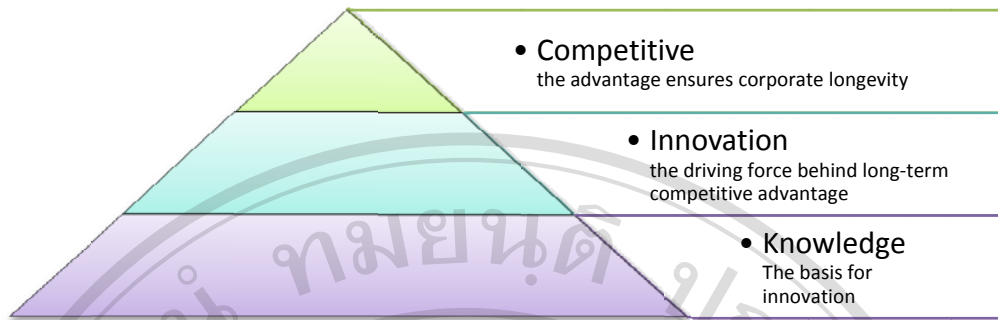 The basis for
  innovation

Figure I.1: Knowledge as a basis of competitive advantage

From the model above, it is clear that improving the competitiveness of the industry requires developing of innovation and the knowledge of the industry. Actually, innovation could mean renewal and change, but in today's business, it has come in particular to mean the development of new corporate services, products, processes and structures. To cope with innovation, organizations must become more flexible, and one certain way for them to do so is to *strengthen their potential to learn as organizations* [Bornemann 03]. Thus, the term "*knowledge*" becomes an essential driver and a key factor in value creation in each organization. Creating the knowledge-based organization can be done either by learning from others (such as colleagues, partners, third party content, etc.) or creating new knowledge through innovation. Both processes help secure sustainable competitive advantage. In brief, the *competitiveness* of the SMEs can be improved by combining the expertise of cooperative partners to generate new knowledge and innovation which are sources of competitiveness.

From this perception, the Thai government adopted the concept of "*industry cluster*" proposed by Porter [Porter 90] and officially applied it to the ceramic industry in 2002, in order to improve their competitive advantage. Moreover, the local government in Lampang also put the ceramic cluster development agenda into the provincial strategy. The goal of this strategy is to promote Lampang province as "*the Asian Ceramic center in 2012*". Hence, many government projects have been proposed to support these SMEs, such as establishing ceramic showrooms and distribution centers, ceramic development centers and ceramic competence centers for labor skill development [Untong 05]. Grouping as the industry cluster seems to be a good solution for the Lampang ceramic industry in order to enhance its

competitiveness and shift the industry to the new economic paradigm. The next part will depict the general view of the industry cluster, characteristic, and the methodology used in the development and the implementation in the Thai economy.

I.2. Industry Cluster

The concept of *industry cluster* is in the focus of many countries since it was proposed by Porter in his book named "Competitive Advantages of Nations" in 1990 [Porter 90]. A few years later, industry cluster became an economical development policy of many nations which tried to improve the competitiveness of their industry and nation. These policies represent a major shift from traditional economic development programs, which focused on individual firm oriented policies. Cluster policies, on the other hand, are based on the recognition that firms and industries are inter-related in both direct and indirect ways [Cumbers 98]. However, there are considerable debates regarding the definition of an industry cluster, how to identify industry clusters, and what factors drive the development of an industry cluster.

Doeringer and Terkla have affirmed that there is no single definition of the industry cluster. From the most simplistic view, an industry cluster is

"geographical connections of industries that gains performance advantages through co-location" [Doeringer 95].

Rosenfeld has enlarged the connections to those companies that also provide complementary services, including consultants, education and training providers, financial institutions, professional associations and government agencies. He defined the industry cluster as

"a geographically bounded concentration of similar, related or complementary businesses, with active channels for business transactions, communications and dialogue that share specialized infrastructure, labor markets and services, and that are faced with common opportunities and threats" [Rosendfel 97].

Also, Porter defined the industry cluster later in 1998 in his book named "On Competition" as

"a geographically proximate group of companies and associated institutions in a particular field, linked by commonalities and complementarities" [Porter 98b].

In this study, we adopted the definition by Thailand's government that defined industry cluster as

"a geographically proximate group of companies in a particular field that linked by commonalities and complementarities, faced with common opportunities and threats, and include service providers, financial institutes, supporting industries and government agents" [NESDB 04]. From this definition, a cluster map can be illustrated as in figure I.2.
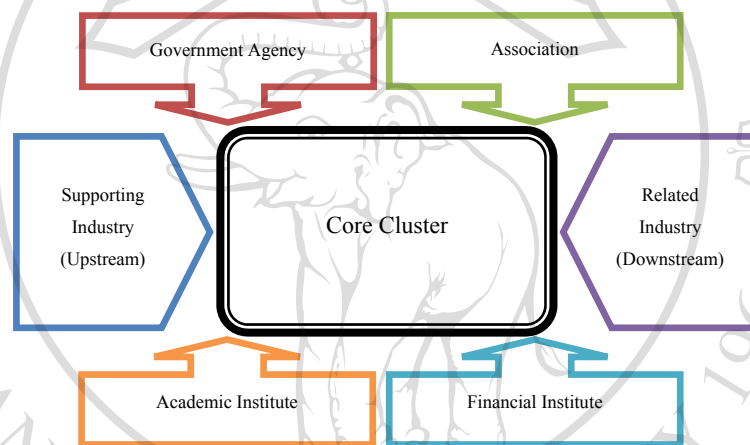

Figure I.2: Outline of the cluster map

The cluster map implies that the industry cluster includes *core cluster,* which is firms or enterprises that are the key players in the industry. *Support cluster* means government agencies, associations, academic and financial institutes, up-stream and down-stream industries which provides support to the core cluster in terms of knowledge, finance, opportunity, etc.

Although the definition of the industry cluster differs due to the economical environments in each country and continent, the objectives and characteristics of the cluster are similar. Thus, it is necessary to understand the objective, networking, environment of the core cluster in the different industry cluster. The following section will analyze the specific attributes of the industry cluster, especially in the core cluster, the key players in the cluster.

I.2.1. Objective of the cluster development

Actually, the main objective of the industry cluster development is to improve national competitiveness which will enhance people's welfare is affected by increasing of productivity of the industries. From Porter's theory [Porter 98a], the objective of the development is divided into 2 levels from different points of view.

- *Macro-economic level (Government's view)*: The objective is improving the competitiveness of the country in the world market. The important factors in this level are government policy, industrial promotion, law and regulation.

- *Micro-economic level (Enterprise's view)*: The objective is improving the innovation and productivity of the enterprise. The fundamentals of manufacturing, commerce and service business are the key factors of this level.

Although the objective of the industry cluster development is clearly defined in both levels, the objective of clustering of the SMEs could not be obviously defined. The objective of the SMEs to participate in the industry cluster is different and is depending on the expectation of the enterprise. From literature review [Sureephong 06], there are many objectives that attract SMEs in the industry to group together as an industry cluster. We classified these objectives into four categories i.e. connection, collaboration, competition and collective efficiency.

1   *Connection*: participants in a cluster are connected in both vertical and horizontal ways to share information and knowledge between Enterprises, Education, Research and Development, Financial Institutes, Government, and Private sector e.g. members expected to gain advantages from networking in the cluster.

2   *Collaboration*: participants are able to have collaboration not only in opportunity but also threat e.g. members shared their opportunities and tried to solve the problem together.

3   *Competition*: to improve *positive competition* such as new product, product design or production process e.g. members initiate joint research to improve the innovation of product and service.

4   *Collective Efficiency*: not only information and knowledge can be shared between participants within the cluster, but other issues such as resources or negotiating power are able to be shared e.g. members try to aggregate demand to reduce cost on production, marketing, human resource development, infrastructure, and etc.

In a single industry cluster, we can find more than one objective/expectation of the enterprise in the collaboration. These objectives can be noticed in term of the activities that are usually done by the members of the cluster. The more activity supports these objectives, the more value-added factors become available for the members of the cluster. These collaborations are also indicators for the growth of the industry cluster.

The acquired benefit of the enterprises who participated in the cluster differed by the objective of the particular collaborations and activities in which they participated. However, the global benefit of the cluster can be explained by the characteristics of the industry cluster. Many researches [Keeble 00] [Storper, 97] pointed out that transaction cost savings alone is insufficient to explain the growth and persistence of the clusters. One explanation is that large firms try to expand their business in horizontal and vertical ways. They are able to do so because they have economies of scale [Patrice 05]. But, SMEs are limited in their access to specialized resources and intelligent capital. Taylor and McRae-Williams [Taylor 05] posit that clustering simulates large firm behavior, e.g., when small firms are not in a position to internalize externalities through economies of scale, they cluster to access resources, to reduce costs, to compete with larger firms, and to innovate. In other words, by networking and sharing knowledge, small firms are able to compete and access specialized resources and information as well as internalize competencies and assets that typically are internalized by large firms with economies of scale [Tayler 05]. Clustering hence provides SMEs benefits that would be unavailable (or available at a greater cost) to non-clustering members. While value-added factors and activities such as R&D, access to a global client base and advanced business services/production are clearly major contributing factors for small business clustering, the need for access to localized explicit and tacit knowledge networks has proven to be a central driver for clustering [Keeble 00].

As we mentioned, the collaboration in the industry cluster is the key for the SMEs to gain the benefits from being a member of the cluster. However, the collaboration in the cluster comprises various types of network. Some types of network stimulate the collaboration in the cluster, but some types of networks obstruct the collaboration. The next section will describe each type of network in the industry cluster.

I.2.2. Networking in the industry cluster

As the concept of the industry cluster has become increasingly popular, and used to pursue a wide variety of objectives, so the definition of network in the cluster has diversified. Some emphasize the key objective that drives the cluster e.g. trade-driven and knowledge-driven [Johnston 03]. However, the most common way to define the network in the cluster is physical topology of cluster. Porter [Porter 90] stated that there are two types of networking in the industry cluster i.e. vertical and horizontal clustering.

- Vertical clustering is made up of industries that are linked through *buyer-seller relationships* as can be found in a supply chain.

- Horizontal clustering include industries which might share a common market for the end products, use a common technology, labor force skills, or similar resources, likes *competitor-like relationship*.

Anderson [Anderson, 1994] had emphasized the importance of the relationship within a cluster using three categories:

1 *Buyer-Seller Relationship* concentrates on vertical interactions between the core production processes and the inputs and distribution of the goods and services.

2 *Competitor and Collaborator Relationships* exist because competitors frequently share information about product and process information and may, in fact, formally collaborate to develop such innovations.

3 *Shared-Resource Relationship* identifies horizontal relations stemming from shared technology, labor force or information, even among companies that may produce unrelated goods or services.

The main objective of networking in the cluster is to build the *co-operation* on the *competition*, called "**co-opetition**" [NESDB 04], by jointly creating a core objective, strategy, exchanging information and knowledge, and resources between members of a cluster for improving collective efficiency/productivity. Moreover, clustering also facilitates the knowledge distribution between organizations which will create innovation in the industry. Fostering the linkages between the members of a cluster is one of the most important elements of any cluster development strategy [DTI 05]. It is the key to growth for SMEs within a cluster to gain strength through the competition and collaboration by utilizing the formal and informal networks [OECD 96]. The critical point of networking is that all members gain some benefits from their participation. From the study of DTI, the successful clusters seem to have strongly embedded networks and relationship systems [DTI 05].

The size of network can vary from a small group of companies working together on collaborative ideas to associations with a large number of members. However, size of network is less important than the fact that they serve a purpose and there are benefits to membership. Some networks are highly specialized, whilst others cover many different topics. Trust and interpersonal relationships are highly developed, providing the cluster with a strong degree of social capital.

From the definition of cluster networking, we can see that the cluster comprises the concept of supply chain, virtual enterprise and extended enterprise together in the network. The study of Ron Johnston [Johnston 03] described that industry cluster is an alternative way to create the value chain in SMEs. However, there are debatable arguments about the similarity and dissimilarity between these concepts and the industry cluster. The next section will provide the comparison and illustration on this issue.

I.2.3. Industry cluster and manufacturing network

Today's manufacturing, companies are trying to re-invent their businesses and maintain their competitive advantage through collaboration. This collaborative practice can be seen as supply chain, value chain, extended enterprise, virtual enterprise or industry clusters. However, these manufacturing collaborations are

becoming commonplace. One confusing issue is the objective of the collaboration. The collaboration in the manufacturing network such as supply chain, virtual enterprise and extended enterprise aims at increasing utilization and synchronization of the chain, resulting in tangible benefits for each participating company [Anand 00]. Within this context, it could be seen as a collaborative network of organizations working together to maximize the value of a product to the end consumers. To be able to reduce conflict within this complex system, companies need to have common goals, clearly defined domains and especially a uniform understanding of situations. This collaboration increases the ability of the network to make rapid decisions [Davenport 98] in order to decrease the cycle time and increase the flexibility to respond to the change of customer's demand [Romano 03]. In this way, enterprises share knowledge to improve the global value carried out by the supply chain [Larsson, 98].

In fact, they are focusing on the same objective but in a different point of view. Industry cluster is created in the area of dense manufacturing networks. The objective of the cluster is to improve the competitiveness of the enterprises in the network by integrating government agencies, financial and academic institutes, associations, and supporting industries in the network of industry cluster in order to create innovation and enhance the knowledge in the supply chain [Sureephong 08]. Although supply chain and industry cluster have common objectives, there are differences in the characteristics of the collaboration which can be compared in table I.3.

Supply chain	*Industry Cluster*
• Restricted Membership	• Open membership
• Based on cooperation	• Based o cooperation and competition
• Have common business goals	• Collective vision
• Formal or Informal agreements	• Social norms, trust and reciprocity
• Accesses specialized serves at lower cost	• Attract specialized services to the region
• Enhances ability to build complex products	• Generates more firms with similar and related capabilities

Table I.3: Characteristic of supply chain and industry cluster network [Rosenfeld 97]

Another view to differentiate the industry cluster from the manufacturing network is physical network topology. In general, these manufacturing networks are

integrated in the core cluster. Chain topology represents the relationship as a supply chain. Star topology represents firms that work on shared resources likes extended enterprise. Peer-to-peer is firms working together as partners to complete some task/project. Figure I.3 demonstrates the general view of the integration of supply chains and extended enterprises in an industry cluster [Jordan 00].
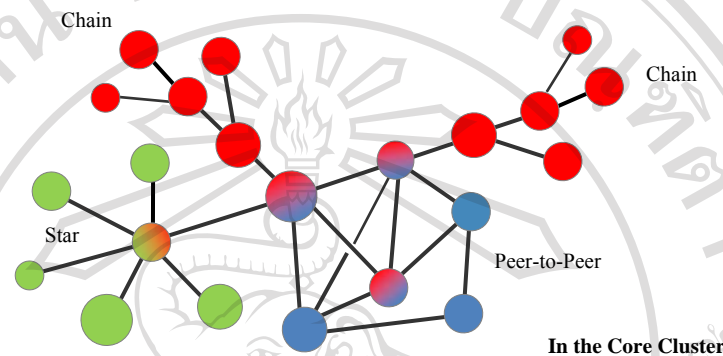

Figure I.3: Industry cluster and supply chain network

Industry cluster and supply chain are in the different levels of management, but focus on common objectives. However, there are many benefits from the industry cluster that can enhance supply chain activities as follows;

- Networking in the cluster can improve the capability of company in the supply chain to search and select their partners.

- Collaboration in the cluster will improve knowledge and information sharing between partners in the supply chain.

- The cluster supporter, such as an academic or financial institute could improve the knowledge and innovation in the supply chain.

The comparison gives us better understanding about the general requirements for developing the industry cluster on the relationship likes supply chain or extended enterprise. However, developing the industry cluster in the different phase requires distinct intervention in each phase. Thus, the industry cluster lifecycle will be analyzed below section.

I.2.4. Cluster Lifecycle

Clusters are dynamic and have a recognizable lifecycle. The interventions that appropriate at an early stage in the lifecycle of a cluster are likely to differ from those suitable for later stages. The lifecycle is often described in different ways but can be represented simply as a cyclical process containing four stages [DTI 04] (illustrated in figure I.4):
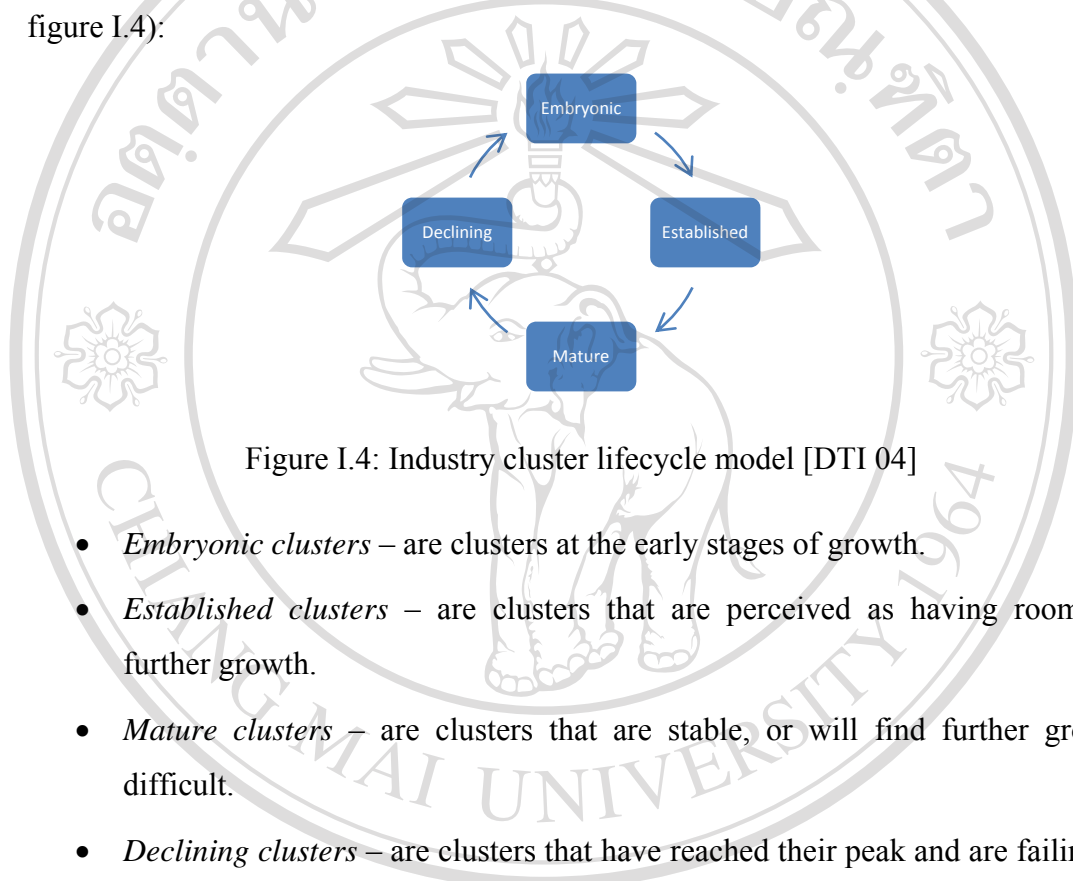

Figure I.4: Industry cluster lifecycle model [DTI 04]

- *Embryonic clusters* – are clusters at the early stages of growth.
- *Established clusters* – are clusters that are perceived as having room for further growth.
- *Mature clusters* – are clusters that are stable, or will find further growth difficult.
- *Declining clusters* – are clusters that have reached their peak and are failing or declining. Clusters at this stage are sometimes able to reinvent themselves and enter the cycle again.

DTI's research suggested that different interventions are likely to be appropriate at different stages of the cluster lifecycle. In embryonic clusters, government and cluster development organization are important in encouraging collaboration and acting as information brokers, a role that may not be needed at a later stage. They do not only help to maintain the competitiveness of the clusters, but also act as starting point for promoting the development of new industries.

The cluster development organization is the key success factor in these stages. However, many clusters failed to develop after the embryonic stage because they get

used to support from the government. Thus, the appropriate interventions in the lifecycle are required to support the cluster development. However, the type of required support is different in each stage of the lifecycle. For example, the intervention in the established cluster required amounts of collaboration and knowledge in the cluster in order to develop the competitiveness to their cluster than the earlier stage. Moreover, developing from the established stage to the mature stage requires an abundance of high degree on collaboration and knowledge sharing among the members of the cluster. This study will focus on the cluster which is in the established stage. The key success factors of cluster development in this stage will be explained in the next part.

I.2.5. Key success factors of cluster development

Although many clusters achieved their goal to develop the competitiveness of their industry, many clusters have failed. Most of them broke down after the establishing stage when the support of initiators or government declined. Thus, this stage is the critical point of development of the cluster. It requires many factors to maintain the collaboration of the industry cluster [Rosenfeld 02]. For this reason, we have studied many case studies to identify the key success factors for the industry cluster development.

The study of DTI in 2005 [DTI 05] stated that the critical success factors in the cluster development were collaboration in networking partnership and knowledge creation for innovative technology. It mentioned that about 78% and 74% of articles cited that knowledge and collaboration in the cluster were the success criteria. These two factors are the internal factors of the cluster. The study of the cluster initiative green book [Sölvell 03] stated that a Cluster Development Agent (CDA) is one of key success factors of the cluster. From statistics, about 89% of the successful clusters have a dedicated facilitator in the cluster. Thus, CDA is the external factor that critically affects cluster development.

Thus, to achieve the intention of this study which is supporting and improving the development of industry cluster; these 3 factors i.e. (1) Collaboration (2)

Knowledge sharing and (3) CDA, will be considered as the major domain of the research. The details of 3 key success factors will be explained in the following part.

I.2.5.1. Collaboration in the cluster

In the manufacturing domain, there have been rapid developments in term of collaborative network in the last two decades and involvement in networks contributing to knowledge and productivity to the industry. Collaboration in the industry cluster concerned obtaining sustainable competitive advantage from the maximization of value added benefits from working collaboratively. However, firms are often reluctant to share information and knowledge formally for fear of their competitive position being undermined. This dilemma was affected by the special relationship in the cluster, in which cooperator and competitor are in the same situation [Levy 03]. It has been observed that the cluster can collaborate in the *co-opetition* relationship as long as the common objectives of collaboration remained.

The goal of collaboration as an industry cluster accomplishes the collective objectives of the members; however the expected benefits to firms from the collaboration differ in the objective of participation. The table I.4 shows the reviewed objectives of firms from the collaboration in the industry cluster. These benefits not only attract SMEs, but also large enterprises to participate in the collaboration.

Objectives	References
to increase their market share	[Lewis 90]
to increase asset utilization	[Lewis 90]
to enhance customer service – reduction in lead times, customer complaints, etc.	[Lewis 90]
to share and reduce the cost of product development	[Lewis 90]; [Parker 00], [Horvath 01]; [McLaren 00]
to reduce time in product development	[Lewis 90]; [Parker 00]; [McCarthy 02], [McLaren 00]
to decrease risk of failure of product development	[Parker 00]
to increase quality of product	[Lewis 90]
to enhance skill and knowledge	[Lewis 90]
to have technological gain	[Lewis 90] ;[Parker 00]
to achieve economies of scale in production	[Lewis 90]
to reduce inventory – in the face of increasing technological complexity and rapid rate product development and obsolescence	[Parker 00]; [Holton 01]
to gain access to markets	[Parker 00]; [Gogilic 03]

Table I.4: Review of firms' objectives for the collaboration in the cluster

The table above implies the benefits that members of the cluster are able to acquire from collaboration in the cluster. However, the acquired benefits also depended on the quality of activity and degree of collaboration. Nowadays, the internet era, Information and Communications Technology (ICT) brought a shift in the phenomenon of clusters subjugating the importance of proximity and location by *virtual proximity*. Additionally, ICT fosters interregional collaboration, so the boundaries between regions important to regional clusters are no longer as distinct as they once were. It also accelerates the degree of collaboration in the cluster in term of frequency, quality of information, time, etc. Hence, ICT is a critical driver of integration and co-operation since it enables businesses to integrate activities and functions otherwise not possible [Levy 03].

In this study, collaboration, which is one of the most important key success factors for industry cluster is analyzed in order to understand the characteristic of collaboration and information sharing. Moreover, ICT used in the cluster is considered as an impact factor in the collaboration. The results of the analysis were used for designing a collaborative knowledge management system for the industry cluster [Jacobs 96].

I.2.5.2. Knowledge sharing in the cluster

The collaboration that generates *formal* and *informal* flows of knowledge and information throughout a cluster creates the success for the industry over time. Accessing this knowledge creates collective learning and more competitive performance for firms in the cluster. Both formal and informal networks enable a transfer of knowledge around the cluster. The knowledge dissemination, such as informal collaboration and extensive contact networks, can create a '*knowledge community*' within the cluster which is a source of competitiveness of a cluster [Huxham 96].

With the concept of knowledge networks, we entered a new era by accepting to assess not only internal values but, equally, values external to the enterprise. This requires two factors. Firstly firms must have the appropriate tools and capacity to communicate and to stock external knowledge according to its needs. Secondly, they

must have in place appropriate processes to assure access to, and management of, this knowledge in order to exploit it and so generate added value. In other words, firms looking to be involved in collaborative networks need to '*develop a new knowledge management process*' [EC 03].

The knowledge sharing through networks and partnerships can be achieved through ways which are direct (face-to-face) or indirect (through persons or information system). Information technology has advanced significantly in this respect, and cluster practitioners are using interactive cluster portals to facilitate networking, and share information about the cluster as well as using them for actual business to business interactions. Moreover, it is one of the effective tools for creating direct (e.g. chat) or indirect (e.g. discussion board) sharing.
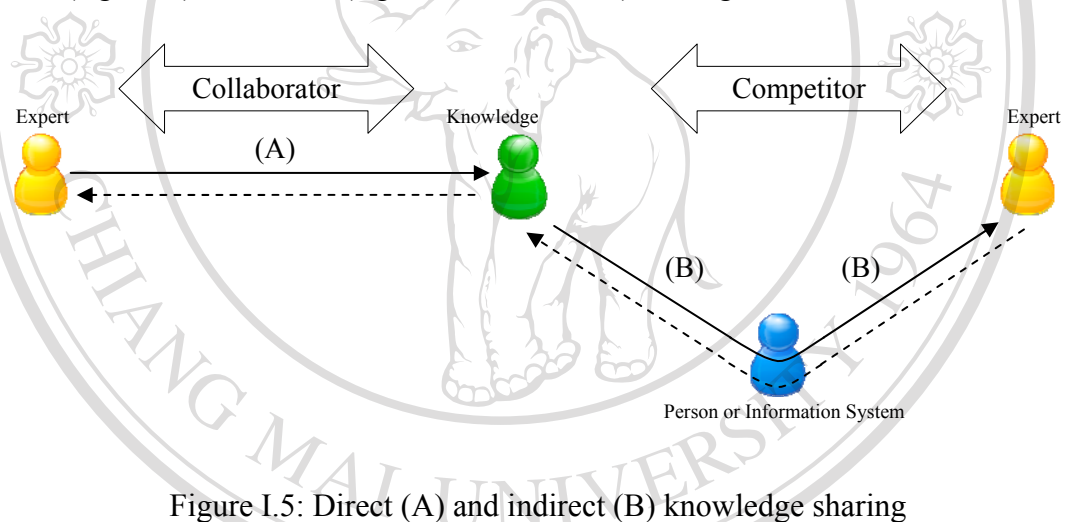

Figure I.5: Direct (A) and indirect (B) knowledge sharing

Although there is a consensus in many studies [OEDC 96] [Sölvell 03] [Porter 98a] [DTI 05] about the significance of knowledge sharing in the cluster, no study has proposed any methodology to create, share or maintain the knowledge in the cluster. Most of the researches depict that the knowledge sharing process is embedded in the process of collaboration. Firms will share their knowledge when they work together as partners. This study focused on improving the knowledge sharing process of the industry cluster. Moreover, the processes of knowledge creating, representing and utilizing were taken into account for enhancing competitiveness of the industry cluster.

I.2.5.3. Cluster Development Agent

Cluster Development Agent (CDA) is one of the external key success factors for cluster development. In practice, CDA can be person(s) or organization who acts as the cluster facilitator by conceptualizing the overall developmental strategy for a cluster and initiating implementation. He is also the facilitator between the various cluster players and the target cluster. From the cluster initiative green book [Sölvell 03] indicated the importance of CDA to the successful cluster. Almost all Cluster Initiatives (89%) have a dedicated facilitator, and many (68%) have some sort of permanent office and cluster facilitators tend to have an industrial background.

A guide to cluster development of Ukraine SMEs [GFA 06] described the characteristics of a CDA as follows. The primary role of a CDA is to help the cluster formation process and motivate potential cluster members to commit to joint activities. The typical goal of CDA is enhancing local economic growth by bringing together businesses in strategic grouping with a focus on developing collaborative engagement at cluster level. The facilitator will facilitate growth of existing firms and their support infrastructure, including government, educational resources, and research and development facilities.

In the developing phase, CDA takes very important roles in achievement of a cluster by facilitating information exchange among members of the core cluster, between core cluster and support cluster, and improving collaboration between all players. Moreover, CDA is such a good catalyst for two internal success factors by motivating the members to share their knowledge and participate in the collaboration. Although many studies claimed that these activities are necessary for a developing cluster, there is no study that proposed tools or methodology to support the activities. Thus, our study tries to support CDA in order to facilitate the collaboration and information sharing within the industry cluster. The proposed framework will include a set of services for assisting CDA in the architecture. The next part will give a brief review of methodology used and a case study in the cluster development in global view.

I.3. Related research on the cluster development

Since the concept of the industry cluster was popularized by Michael Porter in 1990, it has rapidly attracted attention from many governments, consultants, and academics. Porter had proposed the first model of cluster development which is known as *Porter's diamond model* [Porter 90]. The model relies on qualitative methods. This objective of the model is to determine competitiveness within an industry and illustrates how those forces are related. This model was widely used for analyzing the industry clusters in many nations. The overview of this model will be presented in the next part.

Afterwards, many researches were initiated in order to improve the potential of the industry cluster. One of the famous frameworks that aims to expand the Porter's model in term of quantitative methods is called the HHH framework, which proposed by the Hubert H. Humphrey Institute of Public Affairs, USA in 1998 [HHH 98]. This model focused on applying economical analysis such as location quotient and shift-share analysis for identifying the key industry for future development. However, the goal of both models is in the cluster initiation phase (embryonic stage). The methodology for developing the established cluster is still ambiguous for cluster initiators.

The first comprehensive study of cluster initiatives around the world was reported in the "*Cluster Initiative Greenbook*" published by Örjan Sölvell et al. in 2003 [Sölvell 03]. This report provides a clear view of the industry cluster development approach in various countries. The report provided better understanding about the key success factors for the cluster development for cluster facilitators. Moreover, it was used as the guide book for the government in many countries in order to initiate the government policy to support the development of the cluster after the establishing stage. This research has studied about 500 clusters in developed countries around the world. So far the results of the study have been extended to 1400 clusters in many countries.

In the mean time, the United Nations Industrial Development Organization (UNIDO) has proposed the model for industry cluster development which focused on SMEs in developing countries such as Mexico, Morocco, India and Indonesia.

UNIDO believe that productivity can be created by network and collaboration among the partners. This model relies on the Porter's model in the beginning phase and collaboration between CDA and members after the clusters are formed. Hence, UNIDO's model is generally used in developing countries because of the suitability of the model to the social and economical environments. Brief details of these related researches are as follows.

I.3.1. Related Research

I.3.1.1. Porter's diamond model

In practical analysis, Porter relied on both qualitative and quantitative methods to analyze the industry cluster. The *quantitative approach* towards identifying industry clusters is generally regarded as a critical component of a cluster analysis. This type of analysis provides an initial tool for identifying potential clusters and indicates the relative presence of different industries in the local region. The four corners of the diamond (figure I.6) include factor conditions, demand conditions, industry strategy/rivalry, and related and supporting industries.
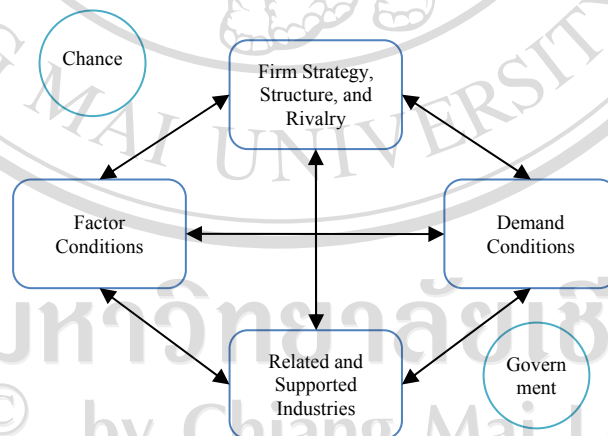

Figure I.6: Porter's Diamond Model [Porter 98b]

- *Factor Conditions*: The situation in a country regarding production factors, like skilled labor, infrastructure, etc., which are relevant for competition in particular industries.

- *Home Demand Conditions*: The more demanding the customers in an economy, the greater the pressure facing firms to constantly improve their competitiveness via innovative products, high quality, etc.

- *Related and Supporting Industries*: Competitive supplying industries will reinforce innovation and internationalization in industry at later stages in the value system.

- *Firm Strategy, Structure, and Rivalry*: The conditions in the country that determine how companies are established, organized and managed and that determine the characteristics of domestic competition.

The results from the model provide an initial analysis which illustrates the overview of the industry in terms of competition in the industry. This information is often used by government agencies for selecting potential clusters (from a set of clusters in the nation) to be promoted and supported.

I.3.1.2. HHH framework

The Hubert H. Humphrey Institute of Public Affairs proposed the "HHH Framework" [HHH 98] to identify the key industry by using only quantitative analysis. The objects of this framework are for determining which industries are growing and which are declining; the importance of an industry to the economy relative to its importance nationally, and competitiveness of regional industries compared with their counterparts nationally. The framework is composed of 8 steps, as follows:

- Step 1: Share of local employment
- Step 2: Change in employment
- Step 3: Location quotients
- Step 4: Change in location quotients
- Step 5: Shift-share analysis
- Step 6: Analysis of payroll data
- Step 7: Analysis of earnings data
- Step 8: Analysis of firm data

An example of the formula in this framework is Location Quotient (LQ). LQ is mostly used by many researches in the cluster initiation phase. The result of the analysis shows the sufficiency to satisfy the local demand.

$$LQ = \left[\frac{\begin{array}{c}Regional\ Employment\ in\\ industry\ X\ in\ year\ T\end{array}}{\begin{array}{c}Total\ Regional\\ Employment\ in\ year\ T\end{array}} \middle/ \frac{\begin{array}{c}National\ Employment\ in\\ industry\ X\ in\ year\ T\end{array}}{\begin{array}{c}Total\ Regional\\ Employment\ in\ year\ T\end{array}} \right]$$

- [LQ =1.0]   local production in the industry is assumed to be just sufficient to satisfy local demand, and the industry is assumed to contain no basic employment

- [LQ < 1.0]   local production in the industry is assumed to be insufficient to satisfy local demand, and require products to be "*imported*"

- [LQ > 1.0]   local production in the industry is specified and is assumed to exceed local demand, allowing the excess products to be "*exported*"

Many industry cluster analysts in the United States relied on this framework. The advantage of this framework is representing the importance and characteristic of industry in a mathematical model. The empirical result from calculation provides economical information for governments to make decisions. However, completing these 8 steps requires amounts of economical data from many sources. Thus, this framework is not popular in developing countries which lack complete data.

I.3.1.3. Cluster Green Book

The Cluster Green Book [Sölvell 03] introduces information about 250 cluster initiatives from 500 surveyed clusters around the world for Global TCI Conference at Gothenburg, Sweden in September 2003. The objectives of this study are identifying characteristics, patterns, vision, processes, and driving forces of cluster development in the global view. This study also proposed *Cluster Initiative Performance Model (CIPM)* (figure I.7) which considered fundamental elements such as social view, political view and economics of country, objective, and process of development. These elements are considered as key factors that will affect the clustering process.
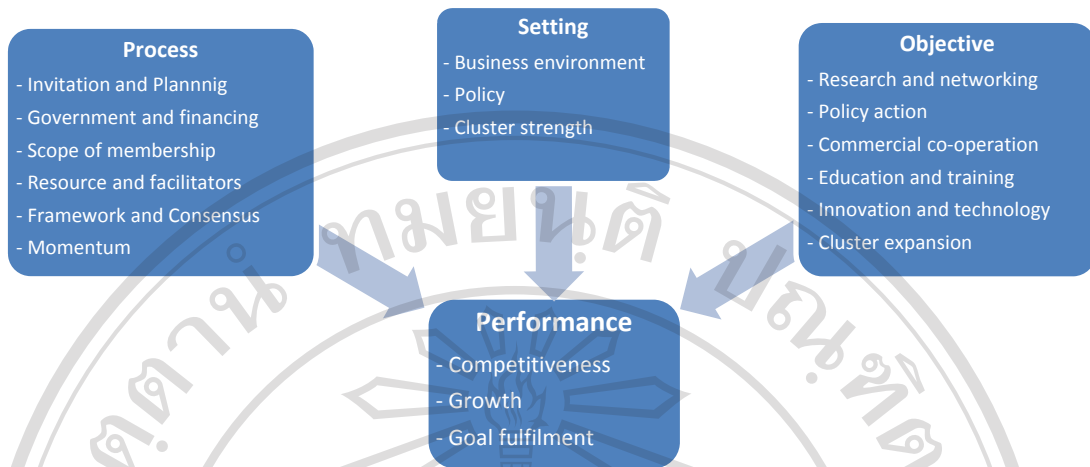
Figure I.7: Cluster Initiative Performance Model (CIPM) [Sölvell 03]

The report has shown that each cluster is developed in a different environment. There is significant dissimilarity between developed and developing countries, competitive and weak locations. The purposes of development for cluster can be classified into 6 reasons i.e. network research and development, government policy, collaborative commerce, resource, innovation and technology, and extending network collaboration. The interesting statistics from CIPM are displayed below:

- Over 50% of the clusters are concentrated in an area within 1 hour traveling time of each other, are open for general members, and usually do not include multi-national companies or very small companies.

- 89% of the clusters have full-time coordinators (CDAs)

- 68% of the clusters have their own offices

- 95% of the clusters have group leader and more than 10 members in the committee.

I.3.1.4. UNIDO's Model

The United Nations Industrial Development Organization (UNIDO) is an organization that is well known in knowledge and human resource development. The study of UNIDO focused on enhancing network of small and medium enterprises in developing countries. Thus, the idea of industry cluster was applied to the study. UNIDO believed that productivity can be created by network and collaboration

among the partners. This required trust, knowledge, understanding, and learning together is facilitated by a broker [Dowson 03].

UNIDO recommended using external cluster development agents (CDA) with no financial stake in the cluster. These CDAs were supposed to establish coordination and trust among the members. The members jointly define the vision, mission and strategic plan for competitiveness enhancement. The initial phase was to create understanding and analyze the enterprises, survey the group's requirements and collect cluster data by using local consultants who could later become CDAs. The data were analyzed under the guidance of an external consultant to ensure confidence among cluster members. The research also included analysis of the linkages of the cluster components based on the Diamond Model. Then, the CDAs worked to develop the cluster map as well as the vision, mission and strategic plan. UNIDO assisted with expenses for meetings, site visits, dissemination of knowledge as well as hiring CDA and supporting activities according to the strategic plan of the cluster. The level of assistance decreased after the cluster had developed and generated more reliable income [KIASIA 06].
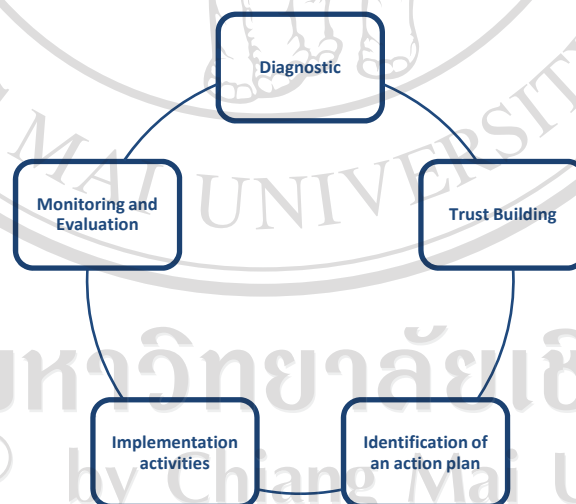

Figure I.8: UNIDO's cluster development model [Dowson 03]

UNIDO's model was divided into 5 steps: diagnosis, trust building, identification of an action plan, implementation activities, and monitoring and evaluation. This model aims at providing a guideline for CDA in order to develop the industry cluster from the beginning to the end of the cluster lifecycle.

Researches	Area of research	Method	Critique
Porter's Model	Japan, Taiwan, Canada, U.S., etc.	- Qualitative Analysis (Diamond Model) - Quantitative Analysis Economical Analysis	This model is useful in the cluster initiating phase but the method of development is not cleared defined.
HHH Framework	North America	Economic-based Analysis (8 steps)	This model tries to emphasize the dimension of quantitative analysis of Porter's model. This model is recommended for government in order to select suitable industry.
Cluster Green Book	Europe, New Zealand, Australia, etc.	CIPM (Cluster Initiative Performance Model)	This research aims to guide the developing cluster with key success factors obtained from successful clusters all over the world.
UNIDO's Model	Mexico, Morocco, India, Indonesia, etc.	- Cluster Map, - CDA - Collaboration	This research proposed a model to develop the SMEs cluster by focusing on CDA's activities.

Table I.5: Comparison of related researches on the cluster development

The studies presented were used as a guide by cluster practitioners in order to initiate and develop their cluster. However, the implementation depended on the economical and social context of each region. The table I.5 shows the comparison of four methodologies for the industry cluster development. The next section will introduce the cluster developments in the global view and a case study of implementation of these cluster development model in the context of Thai economy.

I.3.2. Cluster Development in Global View

The initiation of cluster development can be categorized into 2 types. *Private Initiative*: is a bottom-up approach. Core businesses of a cluster are grouped together to create their own objective, strategy and development policy, and then request support from government and related organizations. *Public Initiative*: is a top-down approach. Governments select competitive industry for supporting and stimulate collaboration from the private sector. Government acts as the facilitator of the cluster and assesses the development of clusters in a global view. However, cluster projects in these countries typically get support through local government in the form of budget and policy. Successful stories of clusters in many countries were reviewed in order to understand the best practice of cluster development in a global view.

I.3.2.1. Rhone-Alpes Cluster - France

The history of cluster building in Rhône-Alpes region (France) started around 200 years ago as humble collaboration of textile processing companies Although that to complex structures of today, this first cluster made pioneering brick-laying in the wall of regions current structure. Nowadays, the main objective of region Rhône-Alpes is to reinforce the competitiveness of the vehicles industry cluster. The cluster development in the region is divided into three phases: Firstly, establishing a common view on the challenges that the companies are facing. Secondly, the creation of shared vision which means that companies' demands are toughly analyzed and international differences is mapped. Finally, the action lines, which are meant to implement the defined strategies into real process. The action lines proposed are: international alliances, international expansion, collaborative development and sophisticated demand.

The Lyon Chamber of Commerce and Industry (CCI) acts as cluster facilitator in the region and was founded 300 years ago. It represents 52,600 companies today [CCI 09], of which the majority is SMEs. Today there are a total of 12 CCIs in the region. The CCI acts as information provider on various topics, facilitator for training and education centers, and stimulator for business start ups, acquisitions and internationalizations. Above all, the CCI offers individual customized support to companies in the region.

In the case study of the French cluster, we considered that the initiation type of this cluster is a top-down approach. The CCI in each regions act as Cluster Development Agent (CDA) by trying to facilitate their clusters, distribute information and knowledge, and perform as the interface between core cluster and support cluster for the dialog. Moreover, CCIs help SMEs in technology transferring activities within the "Presénce Rhône Alpes" initiative, where the 12 CCIs in the region collaborate to mediate contacts between support organizations and companies. The initiative helped increase transparency between supply and demand of innovation support services to one of the highest levels in Europe [ACENET 03].

I.3.2.2. Silicon Valley – USA

In the mid- to late 1990s, several successful computer technology related companies emerged in Silicon Valley in California. This led anyone who wished to create a startup company to do so in Silicon Valley. The surge in the number of Silicon Valley startups led to a number of venture capital firms relocating to or expanding their Valley offices. This in turn encouraged more entrepreneurs to locate their startups there. In other words, venture capitalists (sellers of finance) and dot-com startups (buyers of finance) "clustered" in and around a geographical area. The cluster effect in the capital market also led to a cluster effect in the labor market. As an increasing number of companies started up in Silicon Valley, programmers, engineers etc realized that they would find greater job opportunities by moving to Silicon Valley. This concentration of technically skilled people in the valley meant that startups around the country knew that their chances of finding job candidates with the proper skill-sets were higher in the valley, hence giving them added incentive to move there. This in turn led to more high-tech workers moving there [KIASIA 06].

The model of clustering in Silicon Valley is a bottom-up approach. The private sector and academic institutes are initiators of the cluster. The academic institutes (e.g. Stanford University) act as the CDA behind the collaboration of the members of the cluster. The success of the initiation brought great competitiveness to the electronic and software industries in this region. With the support from national government, this cluster has become one of the core industries of the U.S [Sternberg 91].

I.3.2.3. Textile Cluster - Italy

A textile cluster was started in Italy after 2nd World War by a group of manufacturers, large enterprises but with products which were not of such high quality. While the economy of Italy was growing, many small enterprises became linked with the cluster. Now, the Prato industrial zone is 700 sq. km. in size, employs 45,000 laborers, includes 8,000 enterprises and accounts for 60% of exports of the country. The geographic location of Prato supports this cluster in terms of logistics. Moreover, many famous academic institutes such as the Tullio Buzzi Textile

Institution and the University of Florence are situated in this area. Financial institutions also provided short term loans for SMEs. Furthermore, government policy supports and motivates investors to invest in this area.

This textile industry cluster in Italy is one of the best examples of the private initiated cluster in term of knowledge sharing. The universities located in the area provide fresh knowledge, new technology, human resources, etc. to the cluster. These elements are the key factors that create competitiveness for the textile industry in Prato. Nowadays, Italy is one of the world leaders in textile fashions.

I.3.2.4. Cluster in Latin America

Cluster development in Latin America tends to be initiated in all levels of manufacturing i.e. micro enterprise, small and medium enterprise and large enterprise. The development is categorized into three types [KIASIA 06]:

- *Survival Cluster*: micro to small enterprises which need to be strengthened in order to survive in the strong competition of their market segment. This category includes small labor-intensive businesses producing low-quality products. Promotion of co-operation among such enterprises has usually proven to have limited success.

- *More Advanced and Differentiated Cluster*: that can adapt quickly to meet global competition. Government intervention usually takes the form of creating an enabling environment for new knowledge, technology and innovation development, as well as eliminating regulatory restrictions, encouraging entrepreneurs and trade associations to be more self-reliant.

- *Trans-national Corporation Clusters*: the government provides investment assistance for business expansion of the local medium to large enterprises in the supply chain to promote technology transfer. Most projects have consultants who act as coordinators. The outcome of these development efforts often depend on the level of understanding that members have in cluster development strategy and process.

Both the top-down and bottom-up approaches can be found in cluster initiation models in Latin America. The top-down approach is the potential clusters that meet

requirements in obtaining support and opportunity from the government. The bottom-up approach is the survival cluster that faced difficulties and grouped together to survive in their market.

I.3.2.5. Electronic Cluster - Taiwan

The electronics industry in Taiwan is one of the best examples of cluster development in Asia. It was developed from OEM (Original Equipment Manufacturer) to innovative electronic producers in recent years. The competitiveness of the private sector (i.e. skilled and low cost labor) and the strategy of the public sector (major technology based program) reinforced this country to become the "Asia Pacific Operation Centre". In 1995, the successful of HSIP (Hsinchu Science-based Industrial Park) cluster attracted many foreign enterprises to invest in it.

Taiwan has mapped six specific industries in accordance with its national industrial policy. The mapping is based on information on the income, number of laborers, number of establishments and location quotient to analyze the concentration and expertise of the industry and compare the data with that from other areas, as well as national averages. In addition data from the Input-Output table will be used to evaluate the strength of the linkages and study the industrial expertise in the area. After the cluster map at the company and organization level is created, Taiwan's government provides support to these clusters. The model of cluster development in this country is heavily based on quantitative analysis.

I.3.2.6. Ceramic Cluster - Thailand

The concept of network industry has long been recognized in Thai history. One good example of a clustering model in Thailand is the "Thai Food Market". Many well known markets in Thailand originated from a couple of mobile kiosks which sell food in an area. Over time, more and more mobile kiosks moved into the geographical area, which created variety of choices for customers. The entry of a new mobile kiosk creates competitiveness to the market in term of variety of food. Customers prefer to buy food at the market rather than from restaurants, because of the variety of food in

the same area and competitive prices which satisfy both sellers and customers. With the same concept, this culture created many industrial networks of small to medium firms in every area of Thailand. These SMEs have played an important role in the Thai economy for a long time. Although there are many government policies to support individual SMEs, a policy that supported SMEs as an industry cluster has never existed.

Fortunately, the cluster development in Thailand was officially initiated by the government in 2004 [NESDB 04]. It was set as a policy for developing Thailand's social and economic structure which is in the charge of Thailand's National Competitiveness Committee under the National Economic and Social Development Board (NESDB). Hence, 11 partners from the public and private sectors signed a Memorandum of Understanding (MoU) to create networks of cluster developments in the country. Thus, cluster analysis in the national view has been done to comprehend the present situation of clusters in Thailand, and assess the competitiveness of each cluster.

In the beginning, the cluster analysis in Thailand adopted Porter's Model. The government of Thailand allocated a budget to analyze the competitiveness of their industries. In the pilot project, 5 key industries: fashion, automotive, agriculture, tourism and electronics were chosen to be analyzed by *The Competitiveness Institute* which was conducted by Prof. Michael E. Porter. Later, 152 clusters in Thailand were chosen and analyzed by NESDB Thailand by using secondary data and quantitative analysis. However, the HHH framework, which could be useful in this phase, was neglected due to a lack of complete and up to date economic data in Thailand.

Then, 60 of the 152 clusters were selected for in-depth analysis. This analysis was conducted based on Porter's Model i.e. cluster mapping, supply chain and value chain analysis, diamond model and SWOT analysis. The result from this study is presented in Annex A. Finally, 20 highly competitive clusters were selected to be initiated and supported by the government. In the cluster development process, both cluster green book and UNIDO's study were considered. The Thai government tends to rely on UNIDO's model due to suitability in terms of methodology. However, the cluster green book is used for decision making in terms of cluster supporting policy.

The ceramic industry in Lampang is one of the twenty highly competitive clusters in Thailand. The origin of this cluster is the establishment of small ceramic factories in the region more than 60 years ago. "White clay", which is the raw material for ceramics, was found in the area of Lampang province [Untong 05]. The first product was "chicken-painted bowl" (figure I.9) which now is a symbol of this province. Then, other products such as Chinese tea set and oval bowl were produced by mixing another type of clay with white clay from this region to suit the form of the product. Since then, the ceramic products from Lampang have become varied and famous. Nowadays, the ceramic industry in Lampang is including 200 manufacturers. Most of them are original equipment manufacturers which mostly receive orders from Europe, the United States and Japan. OEMs in Lampang are well known by foreign traders due to high skill manufacturing and low production cost. However, changes in the world economy and the entry of new competitors (i.e. China and Vietnam) in ceramic markets are major forces that have pushed ceramic manufacturers to group together as an industry cluster.

Figure I.9: Examples of Lampang's ceramic products

The Lampang ceramic cluster is a privately initiated (bottom-up) cluster established by SMEs in a geographical area similar to many successful clusters in foreign countries. In the past, ceramic manufacturers focused mainly on reducing the cost of products rather than product quality development. The prices of ceramic products decreased due to a price war between manufacturers. Thus, manufacturers tried to solve this problem together by establishing the Lampang ceramic association. This collaboration helped manufacturers to survive the strong competition. Later, the government established a ceramic centre in this area which supported information, knowledge and technology for manufacturers and product development. In 2002, this

ceramic cluster generated revenue of about 4,000 million baht (approx. 90 million euros).

The strengths of the Lampang ceramic cluster development are: (1) Initiation by the private sector which is a core cluster that tries to solve problems together and creates commitment between partners to develop their industry. (2) The Government that supports and facilitates the cluster by providing knowledge, technology and opportunity. (3) The support cluster creates collaboration between manufacturers [NESDB 04]. Even though this cluster was well formed and obtained support from external organizations, it is still getting lost in between the co-operation and the competition of the cluster. Moreover, this cluster is facing external problems such as increasing labor costs and decreasing raw material in the area. These problems revealed that manufactures could no longer rely on low-cost product. Therefore, the collaboration of this cluster was extended to maintain their competitiveness in areas such as order sharing, cost sharing, problem solving, etc.

From our initial investigation into the Lampang ceramic cluster, we found that the cluster still has problems on collaboration and knowledge sharing, which are the key success factors of cluster development. The members of the ceramic cluster agreed that the cluster needs to develop its collaboration in the aspect of communications e.g. the frequency, coverage, quality and completeness of information shared in the cluster is insufficient. Information about the cluster's activity is a fundamental of the collaboration in the cluster. Because the structure of cluster organization is flat, distributing information about cluster activities requires an effective means of communication to satisfy all cluster members.

Moreover, they realized that the degree of knowledge sharing in the cluster is at an unsatisfactory level. This problem could be explained by the special characteristics of the industry cluster. The relationship among the members in the cluster comprises both cooperation and competition. Two contrasting, concurrent relationships cause the members of cluster to be uneasy in sharing their knowledge face-to-face (direct sharing). Some knowledge has been transferred from expert to knowledge worker unintentionally (knowledge spill-over). Sometimes, knowledge has been requested through the middle man (usually the CDA) and delivered to the

knowledge worker (indirect sharing). Knowledge spill-over and indirect sharing methods would help members to exchange their knowledge, but the quality of the knowledge is reduced. In this context, 'quality of knowledge' means delivering the right knowledge to the right person at the right place, at the right time and in the right format.

More details of these problems will be discussed in the organization model in Chapter 4. From these reasons, the problematic of this study were set to improve the collaboration and knowledge sharing of the industry cluster in the co-opetition situation. The next section will position our research problems and our concern.

I.4. Problematic

For a century, the ceramic industry has been one of the strongest SME industries of Thailand. However, changes in foreign and domestic markets, the entry of new competitive manufacturers from neighboring countries, and a lack of knowledge in the value chain has diminished the competitiveness of the industry. Many ceramic SMEs have closed due to this crisis. Fortunately, with the assistance from the government, institutes, consultants, and related industries, the ceramic enterprises in Lampang formed into a cluster a few years ago. They hoped that this collaboration could create competitiveness in the ceramic industry and would help them out of the crisis. Although the ceramic enterprises and supporting organizations are linked together as an industry cluster, they are still facing the problems of collaboration and knowledge sharing within the industry cluster, as we described in the previous part.

The literature [Sölvell 03] [DTI 05] insisted that collaboration, knowledge sharing and Cluster Development Agent (CDA) are key success factors for sustaining the industry cluster. The results of the studies also displayed that these problems were not unique to Thai ceramic cluster, but that many clusters all over the world were facing the same difficulties in developing effective collaboration and exchanging knowledge within the cluster. The initial investigation of this study about the problems in the industry cluster found that the relationship as "co-opetitor" makes the collaboration in the cluster unique. It also makes members feel uneasy to collaborate

or share their knowledge in the cluster. Hence, in order to analyze and propose the solution for these problems, knowledge management which is the discipline that helps spread individual or group knowledge across organizations [Levy 03], seems to be an appropriate methodology to implement in this study. In order to achieve this, we considered the Knowledge Management System (KMS), which is a system for managing knowledge in the organizations. This KMS could help CDA as a tool for managing and improving knowledge sharing and collaboration in the cluster.

As we mentioned, the collaboration and knowledge sharing model in the industry cluster are unique. Implementing a KMS in the industry cluster required analysis and knowledge sharing model of the cluster. Moreover, there is no study about the collaboration and knowledge sharing model in the industry cluster. Thus, in order to propose a KMS for supporting the SMEs cluster, these are our research problems:

1   *What kinds of knowledge are firms willing to share within the cluster, and what are the conditions of sharing?* Since the organizational relationship in the cluster is unique, we can either find buyer-seller relationships, as in the supply chain, or competitor-like relationships in the same cluster. Although competitor relationships in the cluster may create difficulty for the collaboration, these relationships also create innovation to the cluster via positive competition among the members. Analyzing this willingness to share knowledge and these conditions of sharing (the knowledge structure model of the cluster) is a challenge in our research.

2   *How to help the cluster to create, represent and share their knowledge?* These activities are the principle of knowledge management, and also the main objective of collaboration within the cluster. The competitive advantage of industry is a consequence of innovation process which is created from the knowledge of members in the cluster. Proposing the knowledge creating, representing, and sharing method is the main objective of the study.

3   *How can the knowledge management system help CDA to improve the cluster?* CDA is the external key success factor of the industry cluster. However, many CDAs do not comprehend their cluster. Moreover, there is no specific tool or information system that helps CDA to manage the collaboration or exchanging of

knowledge in their cluster. Thus, this study also tries to propose the knowledge management system which assists CDA to manage the main activities of the cluster.

4   *What general and specific infrastructures and architectures are needed to achieve a specific collaborative knowledge management system for the ceramic cluster?* The particular characteristics of an industry cluster that we mention earlier imply that the proposing system requires specific infrastructure and architecture that answer requirements of the cluster. At the end of this study, we try to propose and develop a specific KMS to apply to the general industry cluster. This proposed system will be adapted from a general knowledge management system and the specific requirements obtained from the analysis of the industry cluster.