The Relationship between Industrial Clustering and Operational Performance within Indonesian Manufacturing SMEs

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Abstract

The main objective of the research is concerned with investigating the relationship between industrial clustering and operational performance constructs. This research treats both industrial clustering on operational performance as multidimensional constructs. Industrial clustering consists of four dimensions and operational performance encompasses three dimensions. Two different goals were pursued, namely examining the multidimensional and individual relationship between the two constructs. The data used in the analysis were perceptual measures that were derived from a cross sectional survey using a single respondent design. The sample used is limited to 112 manufacturing SMEs located in Cikarang Industrial Cluster, West Java Province of Indonesia. This research applied a Structural Equation Modeling and Multiple Regression Analysis in relation to the developed hypotheses testing. As has been hypothesized in this research, industrial clustering was found to have a positive effect on operational performance of manufacturing SMEs. The results also confirmed that the local network, the presence of related industries, the government support, and the local advantage contributed positively, but not equally to the operational performance of manufacturing SMEs

Keywords: industrial clustering, operational performance, manufacturing SMEs

1. Introduction

Recently, many manufacturing organizations have to cope with a business environment characterized by increasing uncertainty, competition, and globalization market. Such a condition has put increasing pressure upon manufacturing organizations, including small and medium-scale enterprises (SMEs) to search for new production and operation methods and strategies in order to improve their performance in term of product quality, cost, delivery (Antonioli, et al., 2010). Carpinetti, et al. (2008) highlighted the potential of this operational performance function as a source of competitive advantage for the company. In this regard, it is assumed that company's operational performance would lead logically to the increase of overall company's performance.

While it is commonly agreed that higher performance is equivalent to higher competitiveness, yet, manufacturing SMEs in developed and developing countries are still facing difficulties to compete in the regional and global competition mostly due to their low performance. Several problems have been identified as a common problem encountered by manufacturing SMEs. This includes less production and financial resources, weak networking, and lack of technological knowledge and expertise (Eisingerich et al., 2010; Takeda, 2008).

some empirical findings pertaining to determinants for SMEs performance enhancement. Industrial clustering, defined as the geographical concentration of similar or interrelated industries (Porter, 1998), have been widely proposed as a strategic option for manufacturing SMEs to overcome their production and operation constraints, despite of their size and types of business (Karaev et al., 2007). It is argued that several benefits could be derived by the companies from industrial clustering. For example, it will provide a greater opportunity for the companies to develop a production network, foster business specialization, and share of knowledge (Niu, 2010). It will also enable the companies to overcome their problems in terms of raw materials procurement, production processes, and marketing (Lin et al., 2006). In addition, it has been largely suggested that local cooperation network among the companies in the cluster leads to the creation of prerequisite condition for the companies to foster their innovation capability (Zhao et al., 2010). Industrial clustering is particularly important for manufacturing SMEs, considering that they commonly lack production and operation resources (Eisingerich et al., 2010).

Despite the wide attention has been paid to industrial clustering as an importance source to improve operational performance (Karaev et al., 2007; Porter, 1998), there are still many unresolved questions regarding industrial clustering concept itself and its effect on the performance (Hendry & Brown, 2006). Literature also suggests industrial clusters could serve as sources for the development of innovation capability of the cluster members (Baptista & Swann, 1998; Morosini, 2004; Porter, 1998). However, little is known regarding factors of industrial cluster that give rise to innovation capability (Chiu, 2009). Muscio (2006) highlight innovation dimensions and activities in industrial clusters have not been fully explored

In addressing the research problem and answering the research questions, this research seeks to achieve seven major research objectives; this is investigating the relationship between industrial clustering and operational performance of manufacturing SMEs. In this regards, two different goals were pursued. First, understanding the multidimensional effect of industrial clustering towards operational performance, and second, identifying which dimensions of industrial clustering associated with dimensions of operational performance. This research is significance, considering the existing literature often examines separately the impact of industrial clustering dimensions on operational performance. Little effort has been put to investigating the simultaneous effect of the dimensions on operational performance, particularly in the context of manufacturing SMEs.

2. Literature review and hypotheses development

2.1 Industrial Clustering Concepts

A large number of studies have been conducted to investigate the phenomena of industrial clustering as one instrument for improving industrial performance, particularly in the context of companies in developed countries. Review of literature revealed that industrial clustering have been conceptualized and defined in different ways. For example, industrial clustering is defined as geographic concentration of interrelated companies, including specialized suppliers, service providers, companies in related industries, and supporting institutions (Porter, 1998). Industrial clustering is also referenced as a group of companies from the same or related industries geographically located near to each other (Bell, 2005).

Furthermore, industrial clustering is also acknowledged as a group of production activities located in a certain region consisting of a few industrial sectors (Wennberg & Lindqvist, 2010). Despite the difference in definitions of industrial clustering, it is widely agreed that related or similar industries tend to cluster in a certain geographical proximity; presuming that it will brings benefits to them (Karaev et al., 2007). Referring to Porter (1998), industrial clustering benefits arise due to the presence of industrial cluster entities, namely factor conditions, firm strategy, structure and rivalry, demand conditions, and related and supporting industries.

2.2 Industrial clustering dimensions

Furthermore, a number of dimensions have been applied in investigating industrial clustering phenomena and its effects. Some researchers (e.g. Bertolini & Giovannetti, 2006) investigated the local network as one important dimension of industrial clustering. They suggested that industrial clustering would provide a greater opportunity for SMEs to build a local network as a means to obtain a higher performance. Other researchers (e.g. Kesidou & Szirmai, 2008) explored the role of knowledge sharing and spillover as an important dimension in improving the performance of companies operating in an industrial cluster. In this regard, they commonly agreed that knowledge sharing and spillover is an important characteristic of an industrial cluster and is essential for improving the innovation capability.

Another factor proposed as an important dimension of an industrial cluster is the presence of related industries and supporting institutions. Researchers such as Hervas, et al. (2007) and Muscio (2006) proposed that the presence of related industries and supporting institutions have an important role in supporting the development an industrial cluster itself and companies located in the cluster. In this regard, they are commonly agreed that the presence of related industries and supporting institutions positively related to the performance and innovation capability enhancement.

Meanwhile, other researchers (e.g. Jan et al., 2012; Lin & Sun, 2010) identified the critical role of the government support in contributing the companies and industrial cluster performance development. It is argued that the government support is necessary, in particular during the initial period of industrial development. In more specific, Jan et al. (2012) identified two important role of the government support, that is, to encourage

public and private organizations to incubate and provide sufficient manpower as well as to initiate infrastructure development and adopt various preferential policies to encourage the capital investment. In similar, Lin and Sun (2010) suggested the government support is considered necessary to encourage the company's performance and competitiveness, to stimulate demand for advanced products, to focus on specialized factor creation, to stimulate local rivalry, and to provide the infrastructural required for developing the cluster.

2.3 Industrial Clustering and Performance

A number of studies have been conducted to investigate the performance implication of industrial clustering, providing empirical evidence regarding the positive effects of industrial clustering on the performance. In this regard, Hervas et al. (2007) demonstrated that the presence of related industries and supporting institutions in an industrial cluster significantly impact on the improvement in productivity and financial-based performance of the clustered companies in Spain and Italy. In similar, Hendry and Brown (2006) confirmed that the local network is positively associated with financial-based performance of the clustered companies in UK. Bertolini and Giovannetti (2006) found that geographical proximity of related industries stimulates the existence of a local network. This in turn allows the clustered Italian SMEs to improve their innovation performance. The study of Chiu (2009) reveals evidence that the local network is positively associated with product and process innovation, as well as financial-based performance in the clustered Taiwan companies.

Furthermore, Chiaroni and Chiesa (2006) verified that geographical proximity enables the clustered companies to take advantage in term of productivity, innovation, and new business. Kesidou and Szirmai (2008) revealed that the knowledge spillover in an industrial cluster positively impact on the improvement of innovation performance of the clustered companies. Lin et al. (2006) provides evidence that the local advantage positively impact on the improvement of product and process innovation and labor productivity as well. Meanwhile, Muscio (2006) showed that the presence of related industries in an industrial cluster positively impacts on the improvement of product innovation capability.

Despite a number of studies have provided evidence concerning the positive effects of industrial clustering in improving the company performance and innovation capability, yet, previous studies also provide inconclusive results. For example, Hendry and Brown (2006) confirmed that industrial clustering do not support for developing innovation capability. They found that market selection and entrepreneurship of SMEs owners appears to be more effective to support the innovation capability enhancement. McDonald et al. (2006) verified that the local network is not significantly associated with the improvement in performance and competitiveness. Zhao et al. (2010) revealed that different industrial clusters have different aspects. Accordingly, different industrial clusters provide different effects in supporting innovation capability. Meanwhile, Kesidou and Szirmai (2008) verified that the knowledge spillover positively impact on innovation performance of the clustered companies, but not financial-based performance. They found that the effect of knowledge spillover on financial based performance take place indirectly, that is, through innovation performance. Considering the mix results provided by the previous studies, it is reasonable to argue that additional work is needed to explore the effects industrial clustering on operational performance. Takeda et al. (2008) underlined the need for additional empirical studies concerning the effects of industrial clustering on the economic and performance growth.

3. Research Methodology

3.1 Selection of sample

The sample selection was conducted using a purposive sampling method. Following the method, the selection of the sample engaged in the study intentionally was carried out in accordance with the requirements of the sample determined by the researcher. For the purpose of this research, three criterions were considered in choosing the company to be the targeted sample, namely the maximum net assets is IDR 10 billion (excluding land and properties), the maximum number of full time employees is 100 employees, and the targeted company is operating in an industrial cluster. Out of several available clusters, the research selected was Cikarang Industrial District, West Java Province of Indonesia for conducting the research. The population was obtained by two different sources, that is, the Indonesia Manufacturing Directory provided by Indonesian Statistic Center Board (ISCB) and the local SMEs Association Directory.

3.2 Data collection

This research used questionnaire as the main instrument to collect data. In order to increase the reliability of the research, the questionnaire was addressed to each SMEs owner. The supplementary letter asked the owners to

either participate him/herself or to pass the questionnaire to the person who possesses sufficient knowledge with regard to manufacturing, production, or operational function of a company. Out of 500 structured questionnaires directly distributed to respondents, a total of 112 questionnaires among of them were received.

3.3 Variables Measurement

3.3.1 Industrial Clustering Measurement

Following Porters' (1998) concept, this research refers industrial clustering as a geographical concentration of similar or interrelated companies, including related and supporting industries and institutions. As applied in Guerrieri and Pietrobelli (2004), this research focus on assessing the industrial clustering effects, namely the extent to which the agglomeration of companies in a certain region is perceived as an important approach that will provide benefits for manufacturing organizations in improving their performance. For the purpose of this research, four dimensions have been included in industrial clustering construct: the local network, the presence of related industries, the government support, and the local advantage. On the basis of previous studies, a total of 24 items were developed and utilized to assess the four dimensions of industrial clustering. Table 1 summarized the items included in industrial clustering construct. In the survey, respondents were asked to indicate the extent to which the industrial clustering is perceived as important factor by manufacturing SMEs in improving their performance on a five-point Likert-type scale, anchored with 1 = (not at all effective) to 5 (absolutely effective).

Table 1. Operationalization of Industrial Clustering Construct

Dimensions	Items
The local network	a. New market
	b. Production sharing
	c. Resources interdependency
	d. Access to business information
The presence of related industries	a. Suppliers
	b. Distributors
	c. Core industries
	d. Complementarities industries
The government support	a. Technical issues
	b. Managerial issues
	c. Policies and regulation
	d. Infrastructure development
The local advantage	a. Access to raw material
	b. Skilled labour
	c. Local demand
	d. Customers connection

3.3.2 Operational Performance Measurement

Operational performance is difficult to be defined and measured, particularly in the context of manufacturing SMEs due to the complexity of SMEs operations (Ha-Brookshire, 2009). While there are a wide variety of operational performance measures for a manufacturing company (Ahmad & Schroeder, 2003), this research focused on three widely recognized types of operational performance, namely product quality, manufacturing cost, and delivery performance. Table 2 presents the operationalization of operational performance construct. A total of 11 items, adopted from Alegre-Vidal, et al. (2004), were utilized to capture the three dimensions of operational performance. This research utilized perceptual measures to evaluate the three dimensions of operational performance. McDermot and Prajogo (2012) suggest that the use of a perceptual measure for operational performance is being consistent with objective internal performance and even with external secondary data. In the survey, the respondents were asked to indicate the extent to which their company performance in term of the three operational performance dimensions relative to that of their principal competitor. Five-point Likert scale was applied to measure their response, ranging from 1 (Much worse than the competitor) to 5 (Much better than the competitor).

Table 2. Operationalization of Operational Performance Construct

Dimensions	Items
Product quality	a. High performance products
	b. Consistent quality with low defects
	c. Durable products
	d. After sales support
	e. Working conditions and safety
	f. Environmental friendly products
Manufacturing cost	a. Material cost reduction
	b. Labor cost reduction
	c. Overhead cost reduction
Delivery performance	a. Dependable deliveries
	b. Fast deliveries

4. Results and Discussions

4.1 Measurement Model

In this study, industrial clustering was considered as a second-order construct composed of four dimensions: the local network, the presence of related industries, the government support, and local advantage. To validate industrial clustering as a second-order construct, a second-order measurement model test was performed with the four dimensions as four first-order constructs. The results suggest a reasonable fit of the second-order specification for the measure of industrial clustering. Fit indices for measurement model of industrial clustering construct are: $\chi^2 = 69.74$, $df = 31$, $p = 0.08$; GFI = 0.96; TLI = 0.97; RMSEA = 0.04). Furthermore, operational performance was also considered as a second-order construct comprising three dimensions: manufacturing cost, quality, and delivery. Toward this end, a second-order measurement model test was performed with the three dimensions as three first-order factors. The results generated $\chi^2 = 71.36$, $p = 0.09$; $df = 26$; GFI = 0.96; TLI = 0.97; and RMSEA = 0.05. This goodness of fit indices suggests a good fit of second-order specification for this measure of operational performance.

4.2 Test of Hypotheses

The first hypothesis of this research was dealing with the relationship between industrial clustering and operational performance of manufacturing SMEs. This research hypothesized that industrial clustering would provide a significant and positive effect towards the operational performance of manufacturing SMEs. A Structural Equation Modeling (SEM) was applied to test the hypothesis. The result of the SEM is presented in Figure 1. The results indicated that industrial clustering provides a significant and positive effect towards operational performance (standardized regression weight = 0.227; $p < 0.01$). Therefore, the first hypothesis is supported.
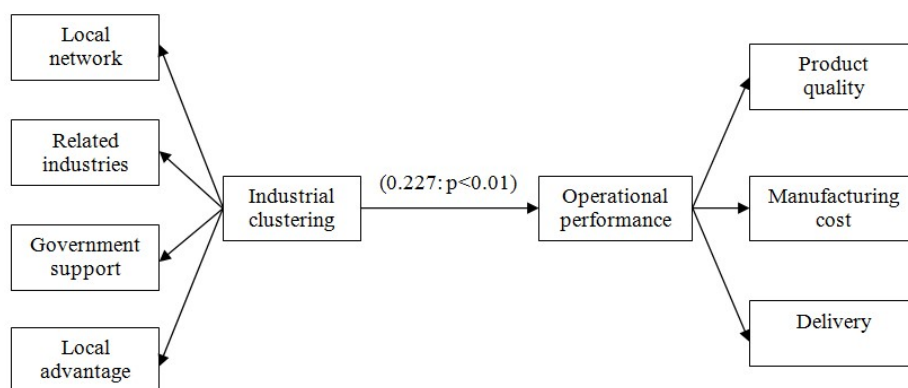

Figure 1. Multidimensional Relationship between Industrial Clustering and Operational Performance

To obtain more insight with regard to the relationship between industrial clustering and operational performance constructs, then the four dimensions of industrial clustering were regressed on the three dimensions of

operational performance. Three models of Multiple Regression Analysis (MRA) were applied to explore which dimensions of industrial clustering are associated with the operational performance dimensions. The results of these three MRA are summarized in Table 3. The results of MRA highlighted the important role of all industrial clustering dimensions, namely the local network, the presence of related industries, the government support, and the local advantage in improving operational performance. Each of these dimensions contributed positively, but not equally to the operational performance of manufacturing SMEs. Therefore, the second hypothesis is supported.

Table 3. The Results of MRA for Industrial Clustering and Operational Performance

Industrial clustering dimensions	Operational performance			VIF
	Product quality	Manufacturing cost	Delivery	
Local network	0.127	0.334 ***	0.107	1.176
Related industries	0.219 **	0.318 ***	0.219 *	1.824
Government supports	0.206 *	0.107	0.089	1.787
Local advantages	0.228 **	0.212 **	0.264 **	1.154
F-ratio	9.440 ***	7.726 ***	7.614 ***	

Note: Significance at, $*p<0.10$ $**p<0.05$ $***<0.01$

4.3 Discussions

The results of confirmatory factor analysis (CFA) confirmed that industrial clustering is a construct that consists of four significant dimensions, namely local network, the presence of related industries, government supports, and local advantages. The results of the CFA also verified that the three dimensions were valid to reflect operational performance construct, namely manufacturing cost, product quality, and delivery.

As has been hypothesized in this research, industrial clustering was found to have a positive effect on operational performance, as measured by manufacturing cost, product quality, and delivery (standardized regression weight = 0.368; $p < 0.01$). The findings, underline the important role of industrial clustering in enhancing operational performance of manufacturing SMEs. This phenomenon might be explained by the fact as proposed by Niu (2010), the SMEs operating in an industrial cluster tend to build a production network to improve their collective performance. Lin et al. (2006) provide a similar argument that industrial clustering enables the SMEs to overcome the problems associated with the production processes, marketing, and raw materials procurement. Meanwhile, Takeda et al. (2008) argued that the presence of related industries in an industrial cluster, such as raw materials and components suppliers, tend to reduce production and operational cost. Such condition would provide several benefit such as the availability of production resources for the SMEs operating in an industrial cluster such as the availability of production resources, improving product quality, and reducing manufacturing costs (Chiaroni & Chiesa, 2006; Lin et al., 2006)

To provide more insights regarding industrial clustering and operational performance relationship, this research developed five models of multiple regression analysis (MRA). The purpose was to examine which dimensions of industrial clustering are associated with operational performance dimensions. The first model aimed to examine the effect of industrial clustering dimensions on manufacturing cost reduction. The second model aimed to test the effect of industrial clustering dimensions on product quality improvement. Lastly, the third model aimed to assess the effect of industrial clustering dimensions on delivery improvement.

The results of MRA confirmed that the presence of related industries ($p<0.01$), government support ($p<0.10$), and local advantage ($p<0.05$) are positively and significantly related to manufacturing cost reduction. Meanwhile, two factors of industrial clustering, namely the local network ($p<0.01$) and the government support ($p<0.05$) are positively and significantly associated with product quality improvement. Furthermore, local network ($p<0.01$), the presence of related industries ($p<0.05$), and government support ($p<0.10$) were identified as significantly and positively related to delivery improvement.

The phenomena described, in part are in line with Gupta and Subramanian (2008) argument that one important characteristic of industrial clustering is the existence of a local network. A local network enables the member to share the appropriate resources required to produce a particular product. This in turn, would promote collective performance. In a similar, Takeda (2008) proposed that the SMEs need to build a network and cooperate with the SMEs group to jointly procure, develop, and utilize the productive resources they need. The premise is that the SMEs commonly also lack their own production and operational resources.

Literature on industrial clustering has proposed that government support is one determinant for the success of an industrial cluster, as well as companies operating in the cluster. In this regard, Bigliardi and Dormio (2009) argued that appropriate policies and regulation could promote the operational performance of SMEs within an industrial cluster. Chiu (2009) noted that the government guidelines and assistance are important instruments for clustered SMEs development. Meanwhile, McDonald et al. (2006) suggested that proper government policies are important in enhancing a local network and cooperation within an industrial cluster, including the firms, related industries, and supporting institutions

Local advantage was also identified in this study as an important factor of industrial clustering for operational performance improvement. As proposed by Lin and Sun (2010), local advantage is one of the important driving forces for establishing and developing a cluster. In particular, Takeda et al. (2008) noted that traditionally, the performance of companies is likely to be easily improved if the companies are located in the place wherein relevant economic resources are easy to be accessed. Accordingly, the companies in an industrial cluster benefit through reduced transaction cost. Similarly, Chiaroni and Chiesa (2006) argued that the local networking mechanism enables industrial cluster members to obtain better and cheaper raw materials. This in turn, will lead to improvement in their productivity and in their production facility utilization.

5. Concussions

The first objective of this research was concerned with the relationship between industrial clustering on operational performance. This research treats both industrial clustering on operational performance as multidimensional constructs. Industrial clustering consists of four dimensions and operational performance encompasses three dimensions. To provide more insight concerning industrial clustering and operational performance relationship, this research conducted two types of examination. The first examined the relationship between industrial clustering and operational performance as two constructs, and the second, examined the individual relationship between dimensions in the two constructs.

The findings support the notion that industrial clustering positively and significantly impact on the operational performance of manufacturing SMEs. However, it is important to note that not all factors of industrial clustering proposed in the literature can be perceived as a determinant for developing operational performance. In this regard, three factors were identified as a determinant for operational performance, namely a local network, government support, and local advantage. These three factors positively and significantly impact operational performance improvement, namely manufacturing cost, product quality, and delivery.

This research contributed to industrial clustering literature by examining the effects of industrial clustering on operational performance by utilizing four dimensions in industrial clustering and three dimensions in operational performance. While previous study conceptually proposed industrial clustering as important source for developing performance of the clustered companies, little is so far known as regards its effect on operational performance (Kesidou & Szirmai, 2008). The results of this research contribute towards understanding about the simultaneous effects of local network, the presence of related industries, government support, and local advantage on manufacturing cost, product quality, and delivery based on empirical data. The findings of this research confirm that industrial clustering provide a positive effect on operational performance of manufacturing SMEs. The findings imply that SMEs owners or managers should be aware that high operational performance is a prerequisite condition for the success to compete in the marketplace. For this reason, SMEs have to reorient their production and operation perspectives, including agglomerate with other similar or related SMEs in a certain region and establish an industrial cluster. In this sense, four dominant factors should be taken into account, namely the local network, the presence of related industries, the government support, and the local advantage

The research has several methodological and theoretical limitations that could be noted to point to lines for future research. First, this research was conducted by using cross-sectional sample design. The design does not allow in concluding the causality among the four constructs being investigated in this research (Keskin, 2006). Second, this research used a single respondent approach to collect data. While, the most desirable procedure to

collect data in a survey research is a multiple sources design (Bator & Bator, 2010), this research suggests future studies to apply a multiple source approach to obtain data. Finally, this research focused on operational performance rather than financial-based performance. In future research, it would be interesting to investigate how industrial clustering, manufacturing flexibility, and innovation capability promote financial-based performance.

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