# CLUSTERING AND ITS SPATIAL IMPLICATIONS: AN ECONOMIC DEVELOPMENT CHALLENGE FROM LOCATION PERSPECTIVE

*Iwan Rudiarto and Wiwandari Handayani*

## Introduction

Clustering as an industrialization strategy is not a new issue for economic development. Clustering process of several or many industries into a specific geographic area has indeed been giving benefits not only to the firms itself but also the actors who are involved. Efficiency has become the main reason why similar industries are geographically contiguous. This could either be supporting in the competition or complementary. At first, it will urge the competition among the firms and later on promote specialization, quality enhancement, and innovation into market differentiation. However, the current argumentation concerning benefits of cluster for enforcing local industrialization is mostly rooted from clustering concept from developed countries where industrial cluster is mostly characterized by larger industry that use higher technology. Whereas, many industrial cluster in Asian developing countries such as Indonesia is characterized by cottage industry that utilize traditional technology and family workers, which lead to lower productivity. Considering these typical features of industrial cluster, this article is aimed to further discuss on how the features lead to particular spatial implication. This study accommodates the issue by placing spatial aspect as the main concern in discussing industrial cluster and its spatial implications.

The phenomenon of industrial cluster concept has been developed for years and intensively studied by researchers since Porter (1990) published his research on competitive advantage

of nations. The understanding on how clusters emerge and how these in turn affects rate of entry and exit has become a core question among economists and geographers alike (Frenken, et., al, 2011). Cluster in the context of economic space, is a phenomenon where economic activities located in a competitive area in which many businesses simultaneously compete collaborate to gain different economic advantages (Boja, 2011). However, we Argued that such competitive advantage rooted from clustering concept in developed countries might be questionable in the case of cluster development in developing countries. In a general perspective, cluster industry is apparently the result from the interaction between an actor, an entrepreneur or a founding organization, and the surrounding environment that shapes the cluster to grow more dynamically. The growth of cluster industry in this term gives much concern on how both entrepreneur and organization is developed. Entrepreneur or individual founders which are mostly found in developing countries usually start their home business in their own region while organizational founders are more regionally established outside the main office. Meanwhile, the sustainability of a cluster industry in a specific location within a similar production activity very much depends on the personal characteristics and how the systems support their businesses. Personal characteristics such as age, education, and household income determine the ability of an individual to be an entrepreneur (Bosma, 2012). The systems are becoming more important when the business is running. Systems provide all the necessity needs of each cluster in order to support the activities in specific circumstances.

The condition mentioned above describes mostly the system of cluster industry in developed country. In fact, industrial cluster in developing countries in Asia such as Indonesia is characterized by cottage-small industry, likely to apply traditional technology, utilize family member as workers, and therefore lead on lower productivity. It was also

mentioned by Phelps (2011 as cited in Ngah et al, 2012) in his 2nd RRPG paper that many industrial clusters in developing countries were mostly found in small traditional firms and frequently these enterprises are in business system and culture that are in transition and partially detached from the non-capitalist relations of subsistence. Therefore, he suggested providing a more reflective framework of the industrial cluster theory in developing countries.

The domination of cottage-small industry in many developing countries such as Indonesia has been resulting in advantage at certain level where many entrepreneurs were able to exchange supportive materials such as knowledge, skill, and social capital. This advantage is determined by the existence of a homogeneous environment in terms of knowledge; the proximity to other companies and direct contact with people in the same field reduce risks and durations of the innovation process. However, the advantage is not always linearly correlated with the accommodating environment but also the location factor. Most of the traditional small firms put location as the main factor to sustain their firms in order to achieve efficiency. Efficiency in the spatial context is based on the industrial location theory that indicates efficiency as the total reduction in production costs, including minimizing transportation costs (Nugroho, 2010). Considering the emerging typical features of industrial cluster in attaining efficiency, this article further discusses on how the spatial features of cluster lead to the efficiency with regard to the location factor. The case of wood industrial cluster in Jepara – Central Java was elaborated to provide illustration of particular spatial model by looking from two different perspectives, that is, upstream and downstream. Upstream concerns on the distance from the suppliers while downstream is from the market perspective.

This article is organized into four parts. The first part is an introduction to explain the rationale of this article. The second part briefly explains the concept of economic geography in cluster models. The third part discusses spatial perspective of wood industry in Jepara district and the last part ended up with some conclusions.

**Cluster Models in Economic Geography**

Cluster industry is basically evolved from the principle of economic geography where location plays important role. The location of industrial cluster is spatially described by representing the location into a point. Point distribution of industrial cluster to some extent is able to show how the relation among those points is correlated. This concept relates to what was once called the "*first law of geography: everything is related to everything else, but near things are more related than distant things*" (Tobler, 1970 as cited in Rudiarto, 2010). So, spatial correlation of the distributed points incorporates two major things, i.e.: the proximity of locations and the similarity of the characteristics of these locations. The spatial pattern of a distribution is defined by the arrangement of individual entities in the space and the geographic relationships among them. Thus, the capability of evaluating spatial patterns is a prerequisite in understanding the complicated spatial processes underlying the distribution of a phenomenon such as the location of industrial cluster that can show the cluster model.

Cluster concept basically emphasized on the distribution of several small industries in specific region that include all relevant activities in terms of local economic development. Previously, the concept of cluster is concerned more on the social relationship by developing trust amongst the community members. Therefore, the social capital has been

considered as an important role in developing cluster models in a region. This clustering process was identified by Alfred Marshall in 1919 when he found that the benefit of a group of industries, called economies of localization, is not only individually promoted a single firm but also other firms concentrated in a specific geographic region. Furthermore, Porter (1998) describes cluster as a geographic concentration of interconnected companies and institutions in the particular field. This definition has been redefined by Porter (2000) that put commonalities and complementarities as the subfocus beside geographic issue where boundaries are taken into account. These boundaries can be ranged from a single city or state to a country or even a group of neighboring countries. Geographical criteria is much concerned on whether the economic efficiency or related distance exist and forming into different business activities that share benefit or not.

Morosini (2004) who has viewed industrial cluster from an economic and social perspective suggested that the complexity and richness of industrial cluster may contribute economic value to both economic agents and the social community involved, localized in close proximity in a specific geographic region. Concerning the geographic concentration and benefits that can be shared, clusters mapping is not only about how to group specific industrial sector in one specific region. It is more on the relationship and the integration between industrial clusters and its supporting institutions. Therefore, clustering is useful in conducting analysis to map important linkages, complementarities, and spill-overs in term of technology, skills, information, marketing, and customer's needs that cut across firms and industries. Firms or industries which are geographically connected may share two types of benefit, that is, passive and active benefit (Schmitz and Nadvi, 1999). Passive benefit is the benefit shared to the firms or industries within a cluster without doing any

activities while active benefit gives the opportunity to the firms or industries to gain more benefit, that is, if they actively performed actions.

The geographic concentration of cluster development had shown four different types of cluster models that describe the role of different cluster members and the interaction amongst them (Markusen, 1996 as cited in Boja, 2011). These cluster models are Marshallian, hub and spoke, satellite platform, and state centered, as described in Figure 1.
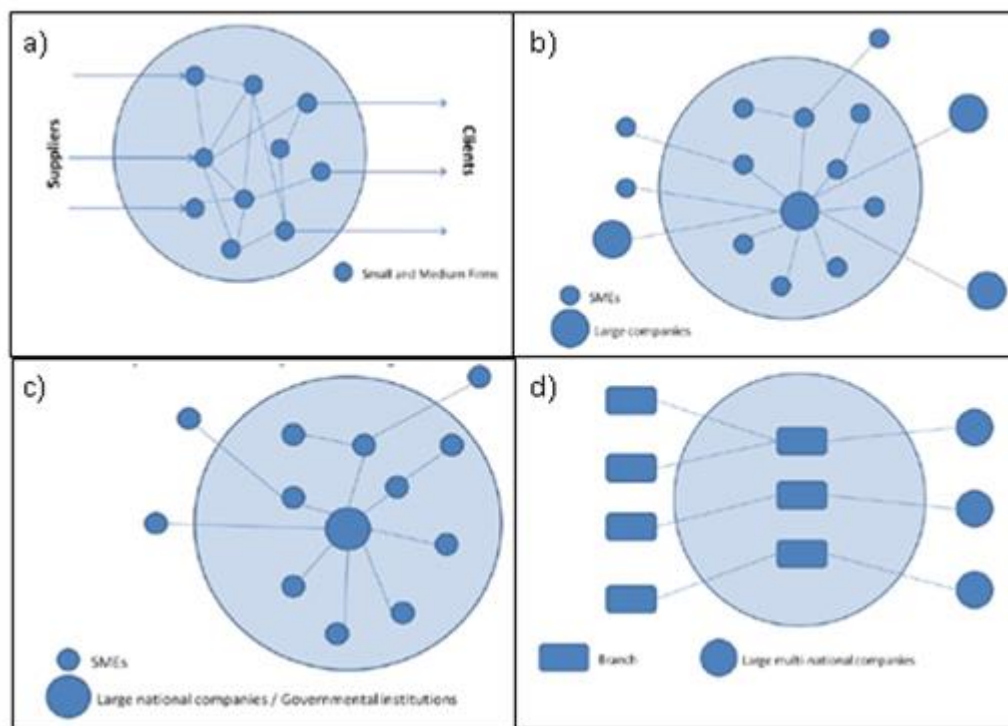


Figure 1. Cluster models; a) Marshallian, b) Hub and spoke, c), Satellite platform, and d) State centered

Source: Markusen (1996) as cited in Boja (2011)

In the Marshallian model, clusters are in rather homogenous form consist of small medium enterprises where each cluster compete one another in terms of supplier - producer relations. In Hub and Spoke model, clusters are not homogenous but more on the

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combination between big and small firms. Small firms are directly linked to the big firms which function as the cluster core. Numerous small firms usually correspond to the supplier of raw materials or external service provision to the core firms. Satellite platform model describes a more systematic cluster model where branches and large multinational firms are bounded in a geographic region in order to benefit from certain facilities, workers, or other benefits. Specific characteristics from this are that there is no direct relation between satellite firms and they are completely controlled under current firms. Meanwhile, state-centered model puts the governmental or non-profit organizations as the centre and dominates the region as well as the economic relation amongst clusters. Table 1 summarizes the typology of these clusters.

Table 1. Markusen's Typology of Industrial Cluster

| Cluster type growth | Characteristics of member firms | Intracluster interdependencies | Prospects for employment |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Marshallian | Small and medium-size locally owned firms | Substantial inter firm trade and collaboration; strong institutional support | Dependent on synergies and economies provided by cluster |
| Hub and spoke | One or several large firms with numerous smaller supplier and service firms | Cooperation between large firms and smaller suppliers on terms of the large firms (hub firms) | Dependent on growth prospects of large firms |
| Satellite platform | Medium-size and large branch plants | Minimum inter firm trade and networking | Dependent on ability to recruit and retain branch plants |
| State centered | Large public or nonprofit entity related supplier and service firms | Restricted to purchase-sale relationships between public entity and suppliers | Dependent on region's ability to expand political support for public facility |

Source: Markusen (1996) as cited in Yusuf (2008)

Referring to the different typologies of cluster industry, it seems that cluster model in Indonesia follows the Marshallian concept where the firms consist of small medium enterprises and substantial inter-firm trade and collaboration were found. However, the typology only touches the common concept of this model particularly at the surface level. Further elaboration on how the system works in the industrial cluster might indicate different results. Many industrial clusters in Indonesia do not have strong institutional support from the government and have very low level of economic support which may lead to inefficiency and unfair competition. On the other hand, insufficient infrastructure such as road network is also one of the main components in determining the successful of industrial cluster development in term of accessibility. Therefore, the location factor of industrial cluster and its system such as market, supplier, and other supportive entities have become the important aspects in cluster development. The relation amongst those entities can be described in terms of spatial relationship that is discussed in the next part.

**Spatial Issue and Economic Efficiency: A Case of Wood Industry in Jepara District**

There are very view studies that focused on spatial aspect with regard to industrial cluster development in Indonesia. One of them was conducted by Roda et al (2007) who studied spatial modelling in Jepara wood industry and it was then further discussed by Andriani et al (2011). As one of the large mature industrial cluster in Java, Jepara wood industrial cluster may be considered as a few success stories of small and medium industrial cluster in Indonesia.

Focusing on the case of Jepara or in the general case of industrial cluster in Java, Indonesia, there are at least two emerging issues with regard to spatial aspect. Firstly, as most of these small and medium based industrial clusters have been developing rather unplanned, the spatial distribution pattern is likely to ignore such locational theory principles. It may indicate that the emerging spatial development pattern was influenced mostly by market situation and the local embedding rather than taken into account such important location consideration -distance and transportation cost- to achieve optimum benefit of agglomeration. Therefore, both upstream and downstream efficiency that are efficiency due to distance and travel time/transportation cost from producers to end suppliers will hardly meet the maximum revenue.

The case of Jepara wood industrial cluster provides evidence that distance does not very much influence the emerging spatial pattern. As illustrated in Table 2 and Figure 2, by applying simple correlation formula, Andriani et. al. (2011) has found out that there was a negative correlation between revenue and distance to wood suppliers and furniture retailers whilst road density is a matter of fact has a positive correlation with gross revenue. This

finding indicates that infrastructure provision does matter but may not really functional to provide direction for the cluster spatial pattern. Moreover, closer distance amongst different players may not always lead to higher revenue. Indeed, the spatial pattern does not always develop in a conventional path in which distance is mostly taken into account.

Table 2: Revenue and Distance to Wood Suppliers and Furniture Retailers
for Each Sub-district

| Sub-district | Distance to Wood Supplier (km) | Distance to Furniture retailers (km) | Road density | Annual gross revenue (in million Rp.) |
|---|---|---|---|---|
| Bangsri | 1.46 | 10.48 | 0.0038 | 231,152 |
| Batealit | 0.78 | 0.79 | 0.0052 | 1,308,344 |
| Donorojo | 15.64 | 25.22 | 0.0033 | 6,788 |
| Jepara | 0.75 | 1.04 | 0.0043 | 1,312,824 |
| Kalinyamatan | 1.88 | 3.14 | 0.0058 | 23,528 |
| Kedung | 0.46 | 0.62 | 0.0055 | 402,600 |
| Keling | 10.58 | 21.24 | 0.0029 | 3,372 |
| Kembang | 3.16 | 14.68 | 0.0039 | 24,924 |
| Mayong | 1.78 | 4.16 | 0.0037 | 27,978 |
| Mlonggo | 0.90 | 7.22 | 0.0052 | 572,754 |
| Nalumsari | 8.11 | 10.92 | 0.0039 | 8,374 |
| Pakisaji | 1.02 | 3.24 | 0.0043 | 321,344 |
| Pecangaan | 0.76 | 1.22 | 0.0057 | 467,858 |
| Tahunan | 0.29 | 0.17 | 0.0066 | 3,306,500 |
| Welahan | 4.16 | 6.19 | 0.0059 | 7,380 |

Source: Andriani et al. (2011)
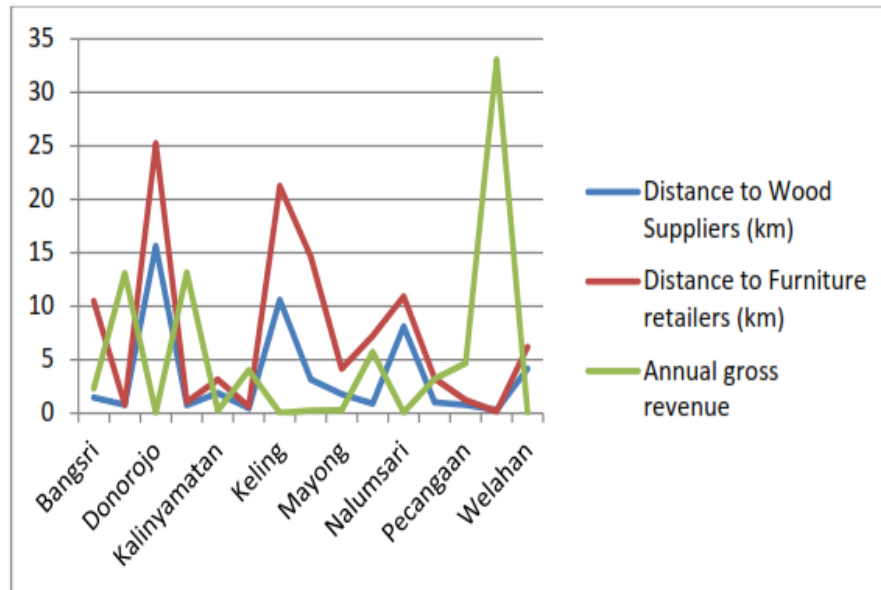
Figure 2: Correlation between distance (km) to wood suppliers and furniture retailers
Source: Andriani et al (2011)

Secondly, as most industrial cluster is characterized by such cottage industry with less than 20 workers for each industrial unit located in either one village or several different villages, the spatial pattern is likely to be dispersed following the pattern of human settlement area mixed with other types of build area, rather than compacted in a kind of particular industrial zone. According to Andriani et al. (2011), 98% of wood industry players in Jepara are classified as small scale. Only 1.9% are classified as medium-scale (20-100 workers) and 0.1% are of large-scale (> 100 workers). Even though the high concentration of activities only focused on particular districts and are likely to be closed with the main roads, the wooden furniture industry are located in almost all sub-districts in Jepara as shown in Figure 3.
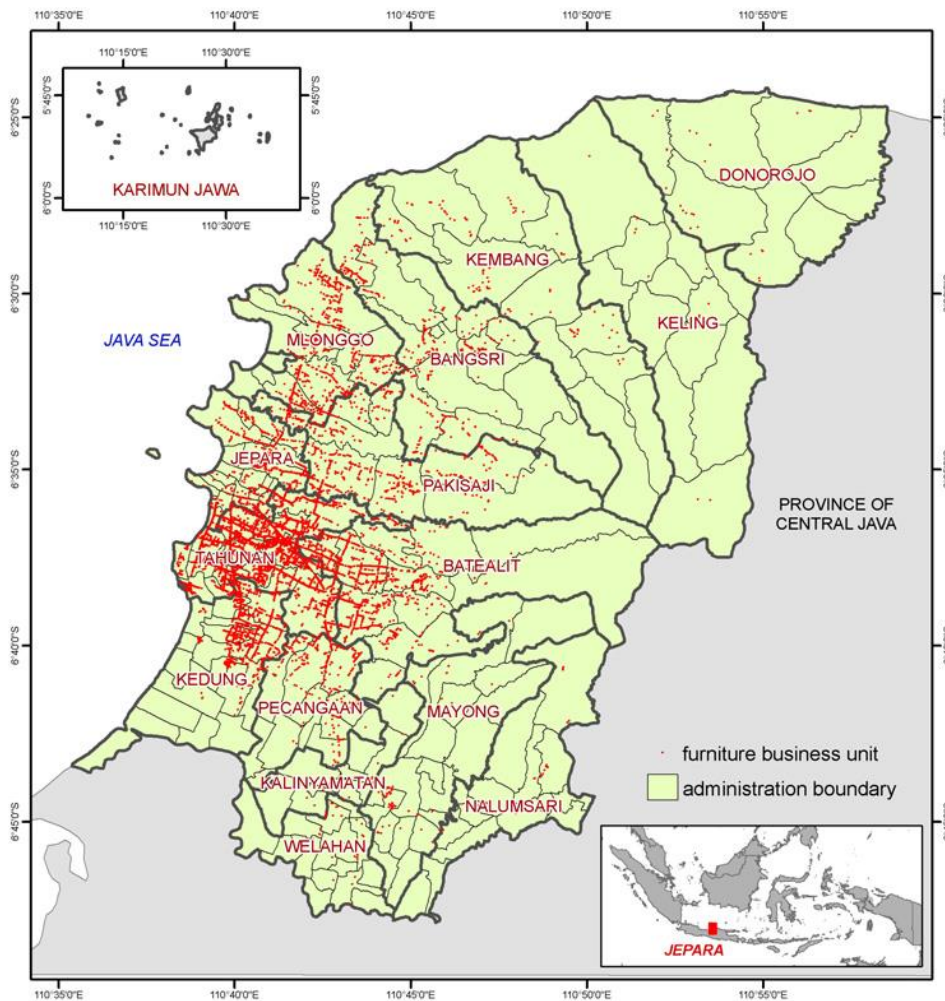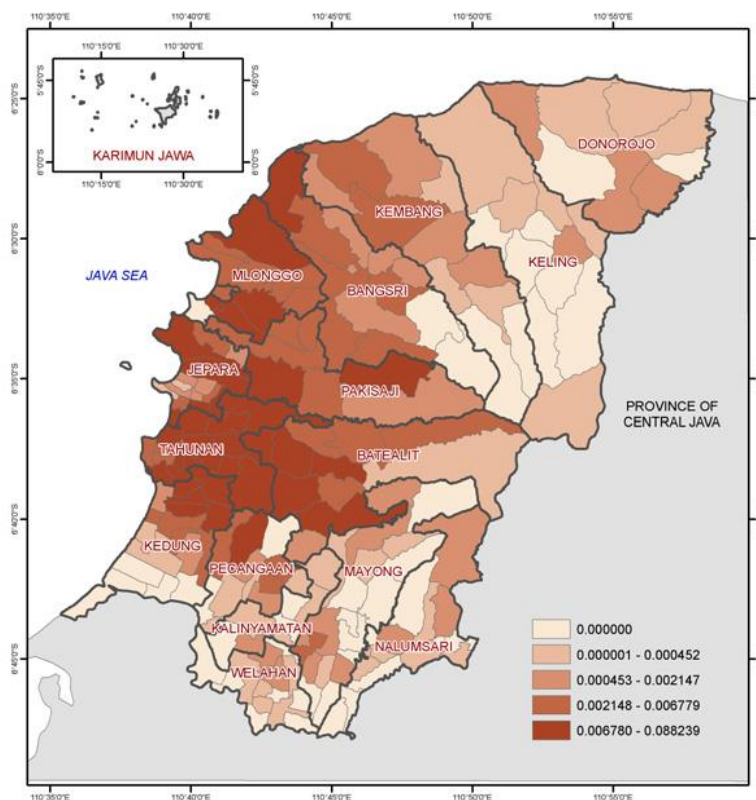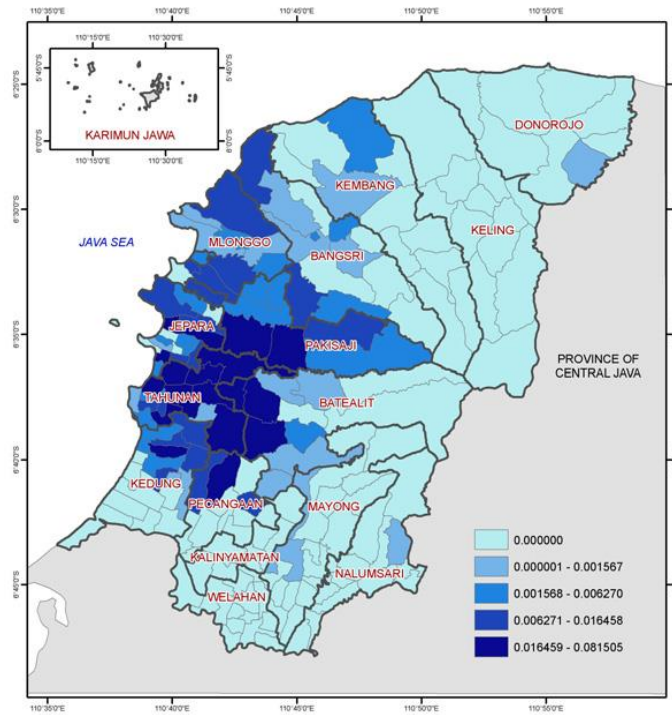
Figure 3: Spatial Distribution of Wooden Furniture Enterprises in Jepara
Source: Andriani et al, 2011

Looking further the distribution for each activity within the industry, Andriani et al. (2011) has found that spatial pattern of the cluster is likely to be buyer driven instead of raw material driven. The distance between the end suppliers and the workshops is much closer than the distance between the workshops and the producers. Accordingly, following the fact that there is positive correlation between road density and revenue, infrastructure provision especially roads network appears to be an important issue to enhance the development of workshops in remote areas.

Figure 4 (a), (b) and (c) illustrate that workshops of the wooden furniture industry are located in almost all sub district compared to the location of wood suppliers and retailers. Only particular sub-district closed to main road are characterized by mix activities including the workshops, wood suppliers, and retailers. As mentioned earlier, the current configuration has been developed mainly based on market driven, whereas efficiency might not have met its optimum level in terms of distance. However, upstream efficiency that resulted from optimum distance of suppliers and workshops is higher than downstream efficiency that is defined as efficiency due to its close distance between workshops and raw materials. Considering the current spatial pattern, it is very critical to support sufficient infrastructure provision to minimize the cost needed due to distance and bad transportation facilities to achieve higher efficiency level.



4(a)Workshops

4(b) Wood Suppliers
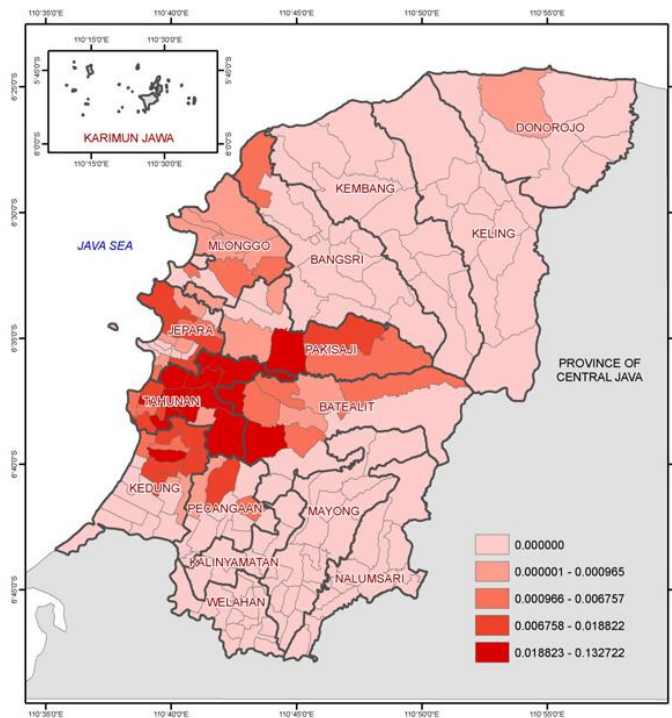


4(c) Retailers

Figure 4 Distribution of (a) Workshops, (b) Suppliers, and (c) Retailers in Jepara Wooden Furniture Industry

Source: Andriani et al, 2011.

Marshallian small-medium cluster model that has appeared in the case of Jepara and in many other areas in developing countries is different with other types of cluster typically appeared in developed countries. Most clustering approaches in developed countries involve large companies and even large multinational companies. As clearly illustrated by Roda et al (2007), the Marshallian cluster in developing countries emerges along with typical dispersed spatial pattern and particular local embedding, and therefore does not necessarily accommodate particular location principles. High influence of local value, tacit knowledge, open structures of ties and mostly, a very important role (location) of individual founders appears as important characteristics that have shaped the activity and eventually reflected into the spatial pattern. Indeed, as has been also stated by Nooteboom and Woolthuis (2005) as well as Taylor (2005), the local embedding emerges as influential factors with regard to spatial development pattern of the cluster.

**Conclusion**

Spatial pattern of industrial cluster in developing countries including in Indonesia appears in a distinctive pattern, in which it has different characteristics from that of developed countries. Based on the case of Jepara, the differentiation can be seen from at least two aspects. First, it is likely to ignore such important location principle -distance and transportation cost- to achieve optimum benefit of agglomeration. Secondly, the spatial pattern is likely to be dispersed following the pattern of human settlement area mixed with other types of build area, rather than compact in a kind of particular industrial zone. Thus, there are tendencies that both upstream and downstream efficiency will hardly meet the maximum revenue.

Indeed, local embedding appears as more significant in comparison to locational principle that has been shaping the emerged spatial pattern. The role of individuals as local informal leaders embedded with their tacit knowledge particularly location in addition to local values are in fact critical to drive the spatial pattern of industrial activities.

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