Using Social Network Analysis to Analyze Collaboration in Batik Smes

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As a creative industry, batik industry should always create a breakthrough in the form of innovative batik motifs to attract buyers. Manufacturers of batik in Indonesia are batik SMEs with very simple organization and management. However, they are in a competitive business environment that threatens their survival.

In order to continue to create innovative products, collaboration of employees in batik SMEs is absolutely important. Collaboration between individuals is more likely to occur in the patterns of informal relationships rather than in formal ways.

This article examines and analyses the patterns of informal relations in Winda Sari batik. Winda Sari batik SME is one of big SMEs in Sragen. Using Social Network Analysis (SNA) for analysis, the results of this study indicate that the relationships between individuals are highly dependent and focused on the specific individuals as intermediaries.

In addition, there are patterns of relationships in the subgroups, or cliques, which have only a few numbers of members. In addition, the relationships appear to be one-way relationships than reciprocal relationships. This kind of relationships is less support to collaboration.

Keywords: social network analysis; batik; collaboration; informal relations.
Introduction

Batik industry in Indonesia has a strategic position, since the industry absorbs a large number of labors. There are many regions in Indonesia that produce batik; however, the largest is in Java. According to the Ministry of Industry and Trade, in the year 2011 there were 39,600 batik business units absorbing 165,000 workers. While total export reached Rp 4 trillion and supplies of batik raw materials valued at Rp 1.8 trillion [1]. Moreover, people can wear batik clothes in formal and informal occasion.

Batik strategic position not only represents the business, but also reflects the struggle of local cultural richness in the middle of global cultural expansion. Batik expresses local cultural identities, which are not motif expressions solely, but also ethos, spirit, service, and sincerity to serve. When family members are involved in completing the work of other family members, they actually put aside their personal interests to serve the interests of the company [2].

The strategic position of batik is incompatible with the industrial structure of SMEs and the ability of their management and production. The main problem with the structure of the batik industry is that it is a home industry done by the traditional SMEs. As a creative industry, batik SMEs should always create a breakthrough in the form of innovative batik motifs to attract buyers and to compete with other garment industries. However, such structures do not exist in the structure of batik SMEs. In addition to inadequate human resources, there are also some other issues such as capital, raw materials, marketing, partnerships, and technology [3] [4].

Some studies also show that the performance of the batik industry is still unstable. Batik industry requires long production time, and economically less attractive to investors who need quick return [5]. The same has been raised by [6] who refers to the slow development of batik in Lasem, the Sub-District of Pancur in Rembang Regency. However, in fact, beyond estimation of many people, batik industry is able to make breakthroughs in the design and survive. The breakthrough is not only in terms of design, but also in color and coloring materials. In terms of colors, there is a shift in the pattern early batik toward a more varied pattern. Such changes indicate the presence of innovations in batik design.

The key to success in the face of any changes is innovation and entrepreneurship. Entrepreneurial companies always have strong
commitment to innovation [7]. Innovation is not only a deliberate action to generate new ideas, but also the introduction and implementation of new ideas, all aimed at improving organizational performance. In batik industry, innovation includes what they do to make a new technique, motive and coloring on batik cloth [8].

Innovation and collaboration are the two mutually support one another. The extent to which members of the organization is integrated in a network of personal relationships affect organizational innovation. Formal and informal collaborations in the organization reveal the structure of innovation in organizations and provide opportunities for leaders of organizations to conduct formal intervention in order to affect the network structure of employees in the innovation network [9]. The leader of an organization who is able to exploit the structure of formal and informal organizations can reduce costs, improve efficiency and create innovation. In addition, the disclosure of network characteristics of high performing employees can provide an opportunity to identify other employees who have the similar role in the network and at the same time encouraging their contribution to the company [10]. Though the development of innovative behavior of employees contribute to improving the efficiency and effectiveness of the organization, little is known about the innovative behavior in the context of small and medium enterprises (SMEs). Human resource managers who are able to develop innovative behavior of employees will create opportunities to align employee behavior with organizational goals [11].

The purpose of this article is to explain the behavior of informal relationships in Winda Sari batik SMEs in Sragen. Using Social Network Analysis (SNA) this research analyzed and plotted patterns of informal relationships.

**Literature review**

**Batik**

Although there are many manufacturers of batik almost all over Indonesia, but the biggest production number is in Java, especially in Central Java and West Java. One of the biggest batik centers in Central Java is in Sragen, especially in Sub-districts of Masaran, Plupuh and Kalijambe. According to
data in 2011, there were 4,702 batik business units in Sragen, which
employed 8,524 workers. While the number of batik production in 2011 was
950,000 meters [12].

Beside the issue of capital, other biggest challenge in batik industry
is human resources regeneration. Interests of young workers who want to
work in this sector continually decreased [13]. In addition, there is
competition from the apparel industry, and batik imports from ASEAN
countries and China. Apparel industry (garment) has an advantage in the
form of production speed and dynamically adaptability to the global trend.
On the other, batik is a handcrafted industry with traditional local motifs.
The greater challenge will come from the implementation of AFTA-China
2015. Invasion of batik imports from ASEAN countries and China will
increase the intensity of competition [14].

Social network analysis (SNA)

Currently a social network analysis tool is increasingly important for
organizations to understand the relationship between the patterns of
employee interactions with business outputs, such as job performance, job
satisfaction, adoption of new ideas or technologies [15] [16] [17][18].

A social network is a social structure consisting of individuals. In a
social context, a network composed of nodes in the form of individual,
organization, or equipment such as computers. A node can have one or
more connections. The connections can represents, such as friendship,
kinship, common interest, or belief. The social network analysis examines
the structure of social relations within a group to uncover the informal
relationships between people. In mathematical terms, the network refers to
a graph structure to represent people or objects as nodes and relationships
as edges that can be directed or undirected relationships.

The main goal of social network analysis is to identify the patterns
of social ties among actors in social networks. Such patterns are often more
informal than formal. For example, if one wants to understand how an
organization works, one can find it in the formal structure of the
organization chart. However, in line with the development of the
organization, this chart may no longer be a sufficient guide to
understanding how the organization really works [19].
To analyze a social network, SNA provides some measurement tools include:

- **Degree centrality.** This centrality measures the number of direct relationships possessed by an actor in a network. If the network is a directed network (relationships have a direction), then the degree centrality has two separate measures, namely in degree and out degree. In degree is the number of incoming connections to the node, and out degree is the number of relationships that come out of the node.

- **Closeness centrality.** This centrality indicates the speed of information or knowledge transferred. Closeness centrality is the most important measurements in the network [20]. This measure calculates the average number of steps required by an actor to reach others in the network. An actor who has a high closeness centrality is the most efficient actor to make contact with others in the network [21] [22]. In other words, the higher the closeness centrality of an actor, the better the position of the actors in the dissemination of information to other actors [23].

- **Betweenness centrality.** This centrality measures the number of shortest paths from all nodes to all other nodes that pass through the node. In other words, this measure shows the ability of an actor to control the information, due to his/her position in the network [23] [21].

**Methodology**

This study uses the saturation sampling technique to collect data. This method is very useful because the data were collected from all individuals along with their relationship. The advantage of this method is to allow a detailed analysis of all individuals and their location in the network as well as the accompanying attributes. This method has limitations in terms of just used to examine the small-sized organizations [24].

The data in this study consists of 59 employees of Winda Sari batik SMEs in Sub-district Masaran, Sragen. The selection of Winda Sari batik SMEs is because it is one of the big batik SMEs in Sragen.
Results of the questionnaire were tabulated into two matrices, relationships and attributes. The data then were analyzed using UCINET 6 program and NetDraw. Both of these applications are developed by Borgatti, SP, Everett, MG and Freeman, LC 2002 at Harvard University as an Analytic Technology.

**Results and Discussion**

**Degree Centrality**

*Most Influential actors (out-degree)*

Figure 1 shows the results using UCINET. The result indicates that Actor # 13 has the highest out-degree. Regardless of what information was given and to whom the information was given, this actor can be considered as the most influential actors in the entire network.

*Recognition of Actor Position (in-degree)*

In Figure 1, actor # 38 is the most known and recognized in the network seen from the number of in-degree. This indicates the willingness of sharing information from other actors in the network with this actor. Their willingness indicates an act of recognition or respect for the position of the actor.

NrmDegOut and NrmInDeg indicate the normalization of degree centralities, that is degree centrality divided by the number of actors in the network minus one (59-1 = 58). OutDegree normalization (NrmOutDeg) of Actor # 13 is 24%, while InDegree normalization (NrmInDeg) of actor # 38 is 31%.
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Vol. III, Issue 6
December 2013

Figure 1: Degree centrality scores for several actors

| Figure 2: Distribution of actor’s degree centrality scores |

The following analyzes distribution of degree centrality in the network (Figure 2):

- **Mean**: The average degree of actors in the network is 3.051, which is quite low. This figure means that on average each actor only had three relationships with others.
- **Max-Min**: Max and Min values show the largest and smallest number of relationships. The maximum number of connection to the outside (OutDegree) in this network is 14, which is possessed by...
actor # 13, while the minimum number of connection to the outside is zero. This means that there are actors who have absolutely no connection to the outside, only receiving without giving information to another party. For incoming relationship (InDegree), the maximum value is 18, while the minimum value is zero. This means that there are actors who only give information but do not receive information from the other party. From OutDegree and InDegree, the range of minimum and maximum values for InDegree is somewhat higher than the range of the minimum and maximum values for OutDegree. This suggests that in this network, actors prefer to receive rather than give information. In other words, the number of actors who receive information is more than the number of actors who give information.

- Standard Deviation and Mean: Standard deviation and mean indicate whether the population is homogeneous or heterogeneous in terms of their variability. To determine the variability (or the coefficient of variation), the standard deviation is divided by the mean value and multiplied by 100. The coefficient of variation for out-degree is 119, while for in-degree is 102. From these two figures, it is clear that the population is very heterogeneous both for out-degree (influence) as well as for in-degree (recognition).

- Graph centralization measures. Graph centralization describes the population as a whole. It describes whether there is a centralization of actors in the network. In a network with a star topology, actors are centralized to a particular actor. In other words, all the actors, but one, have degree centrality 1, while the actor at the center of the network has a degree centrality in accordance with the number of actors minus one. From the Figure 2, Out-degree graph centralization is 20% and in-degree graph centralization is 27% of the theoretical maximum.

- Thus, we can conclude from the analysis above that there is some amount of concentration or centralization across the network, that is, the power of actors varies rather substantially. Figure 3 shows the sociogram based on the degree centrality. Sizes of the nodes are proportional to their degree centrality values.
Closeness Centrality Measures

Closeness centrality measures the speed of information transfer in the network. Measurement of closeness is different from the measurement of degree centrality. Degree centrality takes into account only the direct relationships an actor has, and ignores the indirect ties to all other actors. Closeness centrality calculates the distance from an actor to all other actors in the network.

In Figure 4, Incloseness indicates distance from other actors in the network to an actor. While Outcloseness shows the proximity of an actor to other actors in the network. Incloseness and Outcloseness differ because there are asymmetrical relationships in sending and receiving information. From Figure 4, actor # 38 has the greatest Incloseness and Outcloseness, 25.167 and 13.333 respectively. These figures indicate that the actor # 38 has a close proximity to other actors in the network, as well as the proximity of other actors to his (her) position. In other words, actor # 38 has a favored position in the network, because he (she) can reach other actors, or other actors can reach him (her), more quickly.

From the statistical results (Figure 5), the distribution of out-closeness has nearly the same as the distribution of in-closeness as indicated
by the network in-centralization (62.35%) and network out-centralization (62.94%). This means that the distance of an actor to other actors is almost the same as the distance of the other actors to the relevant actors in the network. Figure 6 shows the sociogram based on the closeness centrality. Sizes of the nodes are proportional to their closeness centrality values.

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<th>Method: Reciprocal Geodesic Distances</th>
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**Figure 4**: Closeness centrality scores for several actors

**Figure 5**: Distribution of actor's closeness centrality scores

<table>
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<tr>
<th>Statistics</th>
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<td>9 Maximum</td>
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Network in-centralization = 62.35%
Network out-Centralization = 62.94%
Figure 6: Relationships between actors based on their closeness centrality

Betweenness

Betweenness centrality considers the position of an actor as being in a favored position to the extent that the actor falls on the paths between other pairs of actors in the network. In other words, the more people depend on an actor to make connections with other people, the more power the actor has.

In Figure 7, actor # 38 has the highest betweenness centrality, followed by actor # 32 and # 21. From descriptive statistics (Figure 8), it can be seen that the values of betweenness centrality in the network vary from 0 to 233.128 with a coefficient of variation (standard deviation divided by the mean) equals to 2.054. Despite the large variations in the values of betweenness centrality, the value of the overall network centralization is very low (6.25%). This makes sense, since more than half of ties occur without the help of mediation. Figure 9 shows the sociogram based on
betweenness centrality. Sizes of the nodes are proportional to their centrality values.

Figure 7: Betweenness centrality scores for several actors

Figure 8: Distribution of actor’s betweenness centrality scores
**Reciprocity**

Reciprocity shows the interrelationships between pairs of actors. In the network, the double-headed arrow indicates the existence of a reciprocal relationship where people give and receive information at the same time. This type of relationship is closer to the information (knowledge) sharing between actors. On the other hand, one-way relationship, showed by single-headed arrows in the network, indicates a transfer of information or knowledge from an actor to another actor. To improve collaboration among employees, the reciprocal relationship is more preferable than the one-way relationship.

Figure 9 shows a reciprocal relationship in Winda Sari employees. Actors who do not have a reciprocal relationship are intentionally removed.
to simplify the diagram. As shown in this picture, the reciprocal relationships are focused on a few actors, namely actors # 7, # 35, and # 38.

Figure 10: Diagram shows reciprocal relationships (thick lines) between actors

Cohesive Subgroups

A network often has one or more subgroups or cliques. A clique on a network has members who have a closer relationship to each other than their relationships with other actors who are not members of the group. A clique can have different norms of the overall network.

Figure 11 shows four cliques in Winda Sari employees. The clique participation score (Figure 11) indicates the proximity of an actor to a clique. An actor who has clique participation score equal to one means that the actor is the member of the clique, while a score less than one indicates that the actor is not the member.

In Figure 11, actor # 2 has clique participation score of one in cliques 1 and 2, which means that the actor belongs to clique 1 and 2. The same thing happened to actor #7 who has a score of one in cliques 1 and 2. Actor #3 has a score of one in clique 1, but only has a score of 0.667 in clique 2. Thus, actor # 3 belongs to clique 1, but not in clique 2.
Interesting to note that of the four cliques, only clique 4 contains actor #38 who is the actor with the highest centrality. Clique 4 has other members, namely actors #9, #51 and #53. This means that though actor #38 has a good position in the network, however the actor prefers to have closer relationships with actors #9, #51 and #53. In addition, the four cliques do not include the owners, namely actor #12, #6, and #4, except actor #35. Similarly, actor #21 (the quality control manager) also is not a member of the cliques.

**Figure 11:** Calculation indicates four cliques in the network

### Conclusions

The above analysis has showed the use of SNA in analyzing and mapping the patterns hidden in informal interactions. The management of organization very often does not know the presence of the patterns.

Analysis using SNA concluded that the relationship between actors in Winda Sari is weak. Several factors support to this conclusion.

First, relationships in the network are heavily relying on to particular actors. Second, one-way relationships are more dominant than
the reciprocal relationships. Finally, there is the presence of some clique or subgroup with a limited number of members. The patterns of relationships like that, of course, less support to better collaboration.

Acknowledgment

I would like to thank for the help the Ministry of Education and Culture, the Coordinator of Private Higher Education Region VI. This research is part of my doctoral research that is funded through a research grant no 001/K6/KL/SP/2013.

References


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