Knowledge Management in Small and Medium Industry: A Cluster Analysis in Kampoeng Batik Laweyan

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***Abstract*—Managing knowledge in the small and medium industry needs a different approach from the larger organization. The unique way of small and medium industry in implementing knowledge management encourages many studies in this field. The purpose of this study is to identify the implementation of knowledge management in small and medium industry, especially in Kampoeng Batik Laweyan. The knowledge management explored in this study is in term of Knowledge identification, knowledge creation and acquisition, knowledge storage and retrieval, knowledge dissemination, knowledge application, and knowledge evaluation. Related to the implementation of knowledge management, the 53 batik small and medium industries in Kampoeng Batik Laweyan are distributed in 3 clusters. The first, second, and third cluster consists of 34, 14, and 5 small and medium industries consecutively. Cluster I is the most active cluster in implementing all of the six knowledge management processes. The best practice of knowledge creation and acquisition process and knowledge storage and retrieval process can be identified from Cluster I. The best practice of knowledge application process can be identified from Cluster III.**

***Index Terms*—Cluster analysis, knowledge management, small and medium industry.**

I. Introduction

Knowledge is a critical resource for small and medium industry, so it must be well managed. Managing knowledge in the small and medium industry needs a different approach from the larger organization, because of the resource constraints [1]. The limited resource makes the small and medium industry lack of investment in formal knowledge management system. Because of that, the small and medium industry emphasizes its knowledge management process on people, such as the socialization [2]. In the socialization process, tacit knowledge is exchanged between two persons.

The unique way of small and medium industry in implementing knowledge management encourages many studies in this field. Nevertheless, studies on knowledge identification, knowledge storage/retention, and knowledge utilization in the small and medium industry are still limited [3]. The main knowledge management processes adopted by small and medium industry need to be further investigate [4].

The small and medium industry specifically discussed in this study is the batik industry. Batik is a traditional culture industry which has a high contribution to Indonesia's creative economy and also gives an indirect impact on trade and tourism sectors [5]. As a traditional culture industry, the knowledge related to batik industry is transferred from one generation to the other generation through informal education and working experience [6]. The examples of the transferred knowledge are related to product quality and partner selection [7]. The continuous knowledge transfer supports the knowledge creation process in batik small and medium industry [6]. The knowledge creation in batik small and medium industry is dominated by tacit knowledge because the explicit knowledge is not well organized due to the lack of storage media [8]. Therefore, the way batik small and medium industry manages its tacit and explicit knowledge needs to be captured.

Based on the capture result, the best practice of knowledge management implementation in batik small and medium industry can be identified. In order to capture the knowledge management implementation in batik small and medium industry, this study aims to identify the implementation of knowledge management in small and medium industry, especially in Kampoeng Batik Laweyan.

This paper is structured in four sections. In the next section, the methodology in conducting this study is explained. After that, the result and discussion are presented in the third section. The result of this study is the clusters of the small and medium industry in Kampoeng Batik Laweyan related to its implementation of knowledge management. Finally, the findings are summarized in the conclusion section.

II. Methodology

The purpose of this study is to identify the implementation of knowledge management in small and medium industry, especially in Kampoeng Batik Laweyan. To achieve the purpose, this study conducted in five main steps.

The first step is exploring the existing literature to identify the types of knowledge management processes adopted in the small and medium industry. The exploration can be focused on several articles which done a systematic literature review on knowledge management in small and medium industry. The main literature review articles used in this study are [3], and [4]. These articles also supported by other articles which discussed knowledge management processes in small and medium industry such as [9]-[15].

The second step is developing indicators for each knowledge management process. The indicators are mainly adopted from [2] which already developed indicators for five knowledge management process in small and medium enterprises. Several more indicators then added to measure the process of knowledge application and knowledge evaluation. The total number of indicators are 34 statements. The number of indicators measuring knowledge identification (A), knowledge creation and acquisition (B),

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knowledge storage and retrieval (C), knowledge dissemination (D), knowledge application (E), and knowledge evaluation (F) are 6, 9, 5, 6, 5, and 3 consecutively. The 34 indicators are represented in a questionnaire using four points of scale which describe the frequency of implementing the indicators.

The third step is identifying the implementation of knowledge management in the small and medium industry in Kampoeng Batik Laweyan using the indicators developed in step two. The identification is done by distributing the questionnaire to 53 small and medium industries in Kampoeng Batik Laweyan.

The fourth step is clustering the small and medium industries based on its knowledge management implementation. The clustering approach used in this study is hierarchical clustering using Ward's method. Ward's method is applied to the aggregate measures of the six knowledge management processes. The aggregate measure is determined using the median of the indicators. The fifth step is exploring the characteristics of each cluster.

III. Result and Discussion

A. Knowledge Management Processes in the Small and Medium Industry

The knowledge management processes which have an impact on the survival of the small and medium industry are knowledge identification, knowledge creation, knowledge storage, knowledge dissemination, and knowledge application [3]. The impact on survival can be achieved because the knowledge management processes improve economic, market, technical, human, and organizational performance of the small and medium industry [4]. The five knowledge management processes discussed in [3] are similar to the processes identified in [2]. The knowledge management processes identified in [2] are the result of elaboration process from the previous studies which are [9]-[15]. Based on [2], the knowledge management processes adopted in the small and medium industry are knowledge identification, knowledge creation and acquisition, knowledge storage and retrieval, knowledge dissemination, and knowledge application.

Besides the five knowledge management processes, there is an important process which has never been discussed in the previous studies related to the small and medium industry. The important process is knowledge evaluation, as explained in [16]. In the evaluation process, the knowledge is checked whether it needs to be revised or not, based on the experience of the organization while applying the knowledge. Because of that, the organization will always have useful and up to date knowledge. Therefore, there are six knowledge management processes which discuss in this study, which are knowledge identification, knowledge creation and acquisition, knowledge storage and retrieval, knowledge dissemination, knowledge application, and knowledge evaluation.

B. Implementation of Knowledge Management in Kampoeng Batik Laweyan

Kampoeng Batik Laweyan is a village in Indonesia which has been producing batik since the 15th century. This village has more than fifty batik small and medium industries. These industries have been survived for a very long time, so it is interesting to explore the way these industries manage their knowledge.

The implementation of knowledge management in Kampoeng Batik Laweyan is identified using the questionnaire explained in the methodology section. Based on the questionnaire result, the three most often practices implemented in Kampoeng Batik Laweyan are as follow.

a) Identify knowledge from the customers (A5)

b) Apply knowledge to improve relationship with customers (E4)

c) Apply knowledge to improve relationship with suppliers (E5)

On the other hand, the three least often practices implemented in Kampoeng Batik Laweyan are as follow.

a) Transfer knowledge to the new employees through the formal meeting (D1)

b) Share knowledge to the employees through the formal meeting (D3)

c) Acquire tacit knowledge through the mentoring program (B1)

The detail percentage of respondent which selecting each scale for the six indicators discussed above can be seen in Table I. For example, for the indicator code A5, 13.21% (7 of 53 respondents) of the small and medium industry in Kampoeng Batik Laweyan often identify knowledge from the customers, while the other 86.79% (46 of 53 respondents) always identify knowledge from the customers. This table shows that identifying knowledge from the customers is the most often practice implemented in Kampoeng Batik Laweyan.

TABLE I: The Three Most and Least Often Practices

Indicator Code	Percentage (%)			
	1	2	3	4
A5	0.00	0.00	13.21	86.79
E4	0.00	0.00	20.75	79.25
E5	0.00	0.00	24.53	75.47
D1	13.21	71.70	15.09	0.00
D3	9.43	73.59	16.98	0.00
B1	9.43	56.61	33.96	0.00

The three most often practices show that relationship with customers and suppliers is important for the batik small and medium industry in Kampoeng Batik Laweyan. Because of that, certain knowledge needed to improve the relation becomes a highlight. This finding is in line with [7] which stated that the knowledge related to partner selection is one of the important knowledge which is transferred within the batik small and medium industry.

The three least often practices indicate that the knowledge dissemination among the employees through the formal meeting is not a common practice. The knowledge dissemination among the employees usually happens in an informal situation. This statement is supported by the measurement result of indicator D4 which is higher than indicator D1 and D3. Indicator D4 identifies the support from the organization in facilitating the informal meeting for knowledge dissemination. Through the informal meeting, the organization also gain tacit knowledge (indicator B2) more often than using the mentoring program (B1). This finding is in line with [6] which described the role of informal education in disseminating knowledge among the batik small and medium industry craftsmen.

On the aggregate level, knowledge dissemination is the least often process implemented in Kampoeng Batik Laweyan. This finding indicates that the batik small and medium industries have not found the immediate benefits from the knowledge dissemination process. On the other hand, knowledge application is the most often process implemented in Kampoeng Batik Laweyan. Applying knowledge to improve the product, the production process, the managerial process, and relation with customers and suppliers can improve the organizational performance which is important for the survival of the organization. The detail percentage of respondent which selecting each scale for the six knowledge management processes discussed above can be seen in Table II. For example, there are 6 indicators for measuring knowledge identification, so the total number of responses from 53 small and medium industries is 318 responses. From the 318 responses, 50% of the responses (159 responses) choose '4' which indicates the highest frequency of knowledge management implementation.

TABLE II: SIX KNOWLEDGE MANAGEMENT PROCESSES

Knowledge Management Process	Percentage (%)			
	1	2	3	4
Knowledge identification	2.20	14.15	33.65	50.00
Knowledge creation and acquisition	1.68	24.11	44.86	29.35
Knowledge storage and retrieval	2.26	20.38	49.81	27.55
Knowledge dissemination	7.23	55.35	37.11	0.31
Knowledge application	0.00	1.89	26.41	71.70
Knowledge evaluation	0.00	3.14	47.17	49.69

C. Clusters Related to the Implementation of Knowledge Management in Kampoeng Batik Laweyan

Based on the hierarchical clustering using Ward's method on the aggregate measures of the six knowledge management process, three clusters are identified. The first, second, and third cluster consists of 34, 14, and 5 small and medium industries consecutively. Therefore, the distribution of for the batik small and medium industry in Kampoeng Batik Laweyan is 64.15% in Cluster I, 26.42% in Cluster II, and 9.43% in Cluster III.

Cluster I is the most active cluster in implementing all of the six knowledge management processes. The two most often processes implemented by Cluster I are knowledge application and knowledge identification. The detail percentage of Cluster I respondent which selecting each scale for the six knowledge management processes can be seen in Table III. The calculation in Table III is similar to Table II, but the respondents used in the calculation is only the member of Cluster I, which consists of 34 respondents. The big difference compared to the two other clusters is seen in the knowledge storage and retrieval process. The practices which make the difference especially are the utilization of the digital storage and the organization of stored knowledge.

TABLE III: KNOWLEDGE MANAGEMENT PROCESSES OF CLUSTER I

Knowledge Management Process	Percentage (%)			
	1	2	3	4
Knowledge identification	1.96	8.82	28.92	60.29
Knowledge creation and acquisition	1.31	14.05	46.41	38.24
Knowledge storage and retrieval	0.00	2.35	55.88	41.76
Knowledge dissemination	3.92	50.98	44.61	0.49
Knowledge application	0.00	0.00	5.88	94.12
Knowledge evaluation	0.00	0.00	37.25	62.75

Cluster II implements knowledge identification, knowledge application, and knowledge evaluation with almost equal frequency. Nevertheless, Cluster II implements knowledge application less frequent compared to Cluster I and Cluster III. The least implemented knowledge application practice is applying knowledge to improve the managerial process. The detail percentage of Cluster II respondent which selecting each scale for the six knowledge management processes can be seen in Table IV. The calculation in Table IV is similar to Table II, but the respondents used in the calculation is only the member of Cluster II, which consists of 14 respondents.

TABLE IV: KNOWLEDGE MANAGEMENT PROCESSES OF CLUSTER II

Knowledge Management Process	Percentage (%)			
	1	2	3	4
Knowledge identification	2.38	22.62	46.43	28.57
Knowledge creation and acquisition	3.17	36.51	46.03	14.29
Knowledge storage and retrieval	5.71	51.43	40.00	2.86
Knowledge dissemination	9.52	66.67	23.81	0.00
Knowledge application	0.00	7.14	81.43	11.43
Knowledge evaluation	0.00	7.14	80.95	11.90

Cluster III implements knowledge storage and retrieval and knowledge dissemination in a low frequency, especially the practice which utilizes the use of information and communication technology. The most often process implemented by Cluster III is the knowledge application, which is the highest among the three clusters. The detail percentage of Cluster III respondent which selecting each scale for the six knowledge management processes can be seen in Table V. The calculation in Table V is similar to Table II, but the respondents used in the calculation is only the member of Cluster III, which consists of 5 respondents.

TABLE V: KNOWLEDGE MANAGEMENT PROCESSES OF CLUSTER III

Knowledge Management Process	Percentage (%)			
	1	2	3	4
Knowledge identification	3.33	26.67	30.00	40.00
Knowledge creation and acquisition	0.00	57.78	31.11	11.11
Knowledge storage and retrieval	8.00	56.00	36.00	0.00
Knowledge dissemination	23.33	53.33	23.33	0.00
Knowledge application	0.00	0.00	12.00	88.00
Knowledge evaluation	0.00	13.33	20.00	66.67

The three clusters implement knowledge identification, knowledge application, and knowledge evaluation relatively more often than knowledge creation and acquisition, knowledge storage and retrieval, and knowledge dissemination. The knowledge dissemination process is implemented in low frequency by all of the three clusters. Meanwhile, the best practice of knowledge creation and acquisition process and knowledge storage and retrieval process can be identified from Cluster I.

IV. CONCLUSION

Knowledge identification, knowledge creation and acquisition, knowledge storage and retrieval, knowledge dissemination, knowledge application, and knowledge evaluation are implemented in Kampoeng Batik Laweyan. The most often process implemented is knowledge application, especially applying knowledge to improve the relationship with customers and suppliers. On the other hand, the least often is knowledge dissemination, especially through a formal meeting.

Related to the implementation of knowledge management, the 53 batik small and medium industries in Kampoeng Batik Laweyan are distributed in 3 clusters. The first, second, and third cluster consists of 34, 14, and 5 small and medium industries consecutively. Cluster I is the most active cluster in implementing all of the six knowledge management processes. The best practice of knowledge creation and acquisition process and knowledge storage and retrieval process can be identified from Cluster I. The best practice of knowledge application process can be identified from Cluster III.

For future research, the implementation of knowledge management in Kampoeng Batik Laweyan can be compared with the result from other batik small and medium industry districts. The comparison result can give more complete insight related to the implementation of knowledge management in batik small and medium industry.

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