

Measurement of Technology Capability with Technometric Methods: Case Study at Batik Anugerah, Bangkalan, Madura Island

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Abstract

Tanjung Bumi is a village located in Tanjung Bumi subdistrict, Bangkalan. District where most of the population has a small and medium industry producing Madura's batik. The object of research was carried out at Batik Anugerah. The study was conducted to determine the level of technological sophistication carried out during the production process. The study was conducted on four components, including technoware, humanware, software and infoware. Based on the data, the technology coefficient value or TCC of Batik Anugerah is obtained at 0.316 which means that it has sufficient qualifications and belongs to the semi-modern technology group.

1. INTRODUCTION

There is no doubt that batik is an Indonesian masterpiece that is the pride of the wearer. Various attempts have been made by the Indonesian people in preserving batik. This can be proven by the development of batik in various regions that have a history in the creation of his work. In addition, batik originating from various regions always has distinctive characteristics although sometimes its creation gets influence from other regions, but it still seems that there are unique motifs that can distinguish batik from one region to another.

Batik is a very great Indonesian cultural heritage, this can be proven by the award of batik as one of the world cultural heritages produced by the Indonesian people by UNESCO on September 28, 2009. The recognition and award was officially presented by the United Nations Educational, Scientific, and Culture Organization (UNESCO) and official awards on October 2 in Abu Dhabi.

Madura is one of the islands in Indonesia with 90% of its business actors coming from micro, small and medium enterprises (MSMEs) capable of contributing 11% of total production in East Java. Nearly 17,666 creative industry units out of a total of 68,733 business units in Madura based in Bangkalan (Pradana, 2013). Tanjung Bumi is a village in Bangkalan where most residents work as batik artisans. From the many creative industries of written batik, Tanjung Bumi is known as the batik craftsman village. Motives and bright color patterns

make Madura batik from Tanjung Bumi have its own characteristics as a cultural product.

Batik Anugerah is a small and medium industry that produces Madura's batik, located on Jl. Kp. Batik Desa Paseseh, Tanjung Bumi, Bangkalan. The voter of Batik Anugerah himself is Mr. Anugerah who has been in business with the Batik Anugerah brand for approximately 15 years. Pak Anugerah's last education was elementary school graduates. As an owner of a small and medium industry with a background in elementary school, Mr. Anugerah said he was very interested in doing business in Batik Anugerah. This is because Mr. Anugerah can use creativity very well in the production process and marketing of products from Batik Anugerah. In his business, Pak Anugerah is assisted by as many as 20 people, most of whom are his own neighbors, so that the process of drawing batik can be done in each employee's house while the colouring process until it is ready for sale is carried out in the production house. During the production process Mr. Anugerah engages employees in creating the latest innovations for their batik designs. The marketing system at Batik Anugerah has been used online and offline, in addition Batik Anugerah also includes the results of his work in batik exhibitions.

The small Batik industry in Tanjung Bumi, especially Batik Anugerah, does not pay much attention to the technology used in its business. In fact, with the development of the era of technology plays an important role in improving a business

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(Indriartiningtias, 2019). Therefore, this research was conducted on IKM Batik Anugerah using technometric methods to determine the existing technology standards in their business. The technology level studied consists of four technology components, namely technoware, humanware, infoware and orgaware. By knowing the level of technology available in small industries, owners will be able to design strategies to further increase their productivity.

2. RESEARCH METHODOLOGY

The type of research used is quantitative research. It is said to be a quantitative study because the researchers distributed questionnaires to obtain numbers or data which would later be processed and analyzed using technometric methods. The output of the technometric method is in the form of the technological contribution coefficient of Batik Anugerah.

The types of data used are primary data and secondary data. Primary data is data obtained from direct observations where researchers conduct interviews and distribute questionnaires to the owner in each MSME. Secondary data is data obtained from previous records and documents in Batik Anugerah. Techniques for collecting data and various information, the researchers did in the following way.

1. Interview

Interviews were conducted by researchers by conducting questions and answers directly to the respondents. Interviews conducted by researchers were conducted in an unstructured manner where researchers were free to conduct interviews that did not prepare the previous format and collect complete data.

2. Questionnaire

The distribution of questionnaires conducted by researchers is to expert respondents where the owner in each MSME. The questionnaire used by the researcher is closed, where the list of questions is compiled by providing answer choices so that the filler only needs to put a mark on the selected answer choice.

3. Literature Study

Literature study is carried out to find references and theories that will be used in this research by reading and studying from books and journals to solve problems.

The assessment of technology components in Batik Anugerah uses the technometric method where the output produced is the TCC value or the coefficient of technology contribution where there are five steps as follows (Indriartiningtias et al, 2014 and Soleh, 2018).

1. Estimation of the degree of sophistication to determine the level of sophistication of the

four technology components in Batik Anugerah. There are several steps including the following.

- a. Conduct qualitative observations for each technology component by collecting relevant technology information.
 - b. Identify all items on the four technology components based on qualitative research.
 - c. Determine the upper and lower limits on the degree of sophistication of each technology component. The degree of sophistication of the technology component by giving a score ranges from 1-9.
2. Determination of the sophistication of the technological component (State of the Art), the approach that will be used to determine the SOTA of the technological component, namely the criteria developed with the SOTA system where a score of 0 is given which has the lowest specification and a score of 10 which has the best specification.
 3. Determine the contribution of technology components, using the value of the degree of sophistication limit and the SOTA rating.
 4. Calculation of the intensity of component contributions, is carried out using the help of an analytical hierarchy process.

Calculation of technology contribution coefficient (TCC), TCC calculation is based on the contribution of 4 technology components

3. RESULTS AND ANALYSIS

3.1 Three levels of manufacturing Batik Anugerah

3.1.1 Level 1 Process management at Batik Anugerah

Operations management includes the process of input, process, output. Most of the materials used for the batik process use Mori cloth. The batik production process consists of several stages. The first step is drawing the basic batik on the fabric before making batik using wax. Motives created are the result of brainstorming between owners and employees. The difference between Batik Anugerah and other batik SMIs lies in the motif of the product. Batik Anugerah retains Madura's traditional batik motifs, followed by the latest innovations. After drawing the basic batik, the process of making batik using candles is done by the employees and the work is taken home to their respective homes. After the candle is finished, it is continued with the process of coloring and the evening discoloration which is done at the production site which is located not far from the owner's house.

3.1.2 Level 2 Operation management at Batik Anugrah

Operations management activities include the use of management functions consisting of planning, marketing, environment and human resources. Production planning is carried out by the owner of Batik Anugrah based on consumer demand in the previous period. Human resources at work are neighbors of the provided that they are able to make batik and have good batik skills. This is done so that there is no need to pay for training specifically for workers but it also speeds up the production process and produces guaranteed quality batik. As for organizing the Batik Anugrah, it is done by Mr. Anugrah with his wife as an accountant and his child helping in the marketing process. In the marketing process, Batik Anugrah serves consumers who come directly to the place, via online and also participate in batik exhibition exhibitions so that many people recognize Batik Anugrah.

3.1.3 Level 3 Strategic management at Batik Anugrah

Strategic management in Anugrah Batik SMEs is to maintain existing batik models and to develop a kind of small research conducted by the owner to find out the motives that are in great demand by consumers. For now the process of making batik is still using traditional methods. In the marketing process, Batik Anugrah serves consumers who come directly to the place, via online and also participate in batik exhibition exhibitions so that many people recognize Batik Anugrah.

3.2 Measurement of technological level aspect of Batik Anugrah

Tabel 1-4 present the sophistication level of technoware, humanware, infoware and orgaware. Based on the Table 1 to 4, each component of technology has different degrees of sophistication, the range of lower limit and upper limit values there are also different variations, the largest range of values is the organizational component, this value range indicates the company's ability to motivate employees, run vision, and compete in marketing high products.

3.3 Intensity and contribution of each technology's components

Tabel 5 presents contribution of each technology's components. Based on Table 5, it can be seen that the STi value of technoware is 0.23 or it is still classified as low or traditional, the type of machine with 2 shoals because in this gift batik SMEs the process of making batik is still using traditional tools. The value of SHj of 0.33, creativity and innovation with a score of 5 because the owner is classified as creative in determining the batik design. SI value of 0.28, the company informs the problem of internal conditions on employees with a score of 3 because it has not been going well with information. SO value of 0.48 or can be interpreted as high, the company's ability to work with other networks with skor 5 because Batik Anugrah is able to market its products and compete well.

Table 1.
Sophistication level of technoware

Component of Technoware	Level of sophistication	
	Lower Limit (LL)	Upper Limit (UL)
Motive making	2	4
Giving a candle	2	3
Drying	1	4
Coloration	2	3
Degree of sophistication	1.75	3.50

Table 2.
Sophistication level of humanware

Component of Humanware	Level of sophistication	
	Lower Limit (LL)	Upper Limit (UL)
Owner	3	5
Employee of motive making	2	4
Employee of giving a candle	2	4
Employee of drying	2	4
Employee of coloration	4	3
Degree of sophistication	2.4	4.2

Table 3.
Sophistication level of infoware

Component of Infoware	Level of sophistication	
	Lower Limit (LL)	Upper Limit (UL)
The company informs employees of internal problems and conditions immediately	3	3
Information network on company	3	3
Procedure for communicating among members	3	3
information system to support company activities	2	2
Storage and retrieval of information	3	3
Degree of sophistication	2.80	2.80

Table 4.
Sophistication level of orgaware

Component of Orgaware	Level of sophistication	
	Lower Limit (LL)	Upper Limit (UL)
Company vision	4	4
The company's ability to motivate employees with effective leadership	4	4
The company's ability to adapt to a changing business environment and external demand	5	5
The ability of the company to work with suppliers	7	6
The ability of the company to maintain relationships with customers	5	4
The company's ability to create an environment conducive to making improvements and increasing productivity	5	5
The ability of the company to get sponsors from outside parties	3	3
Organizations began to have a growing network of cooperation, able to compete, able to expand new markets	5	5
Degree of sophistication	4.75	4.5

Table 5.
Contribution of each technology's components

Component	Lti	Uti	Sti
Technoware	1.75	3.50	0.23
Total contribution of technology		0.24	
Technological intensity (ahp)		0.24	
Humanware	2.40	4.20	0.33
Total contribution of technology		0.33	
Technological intensity (ahp)		0.50	
Infoware	2.8	2.8	0.28
Total contribution of technology		0.31	
Technological intensity (ahp)		0.17	
Orgaware	4.75	4.50	0.48
Total contribution of technology		0.51	
Technological intensity (ahp)		0.09	

3.4 Technological coefficient components (TCC)

Batik Anugerah have a TCC qualitative assessment of 0.316 which means that the qualification is average, and is included in the Semi-Modern Technology group (see Table 6 and Table 7). TCC was calculated by using Equation 1.

$$TCC = T^{\beta_t} \times H^{\beta_h} \times I^{\beta_i} \times O^{\beta_o} \quad (1)$$

$$TCC = 0.24^{0.24} \times 0.33^{0.50} \times 0.31^{0.17} \times 0.51^{0.09}$$

$$TCC = 0.316$$

Batik Anugerah have a TCC qualitative assessment of 0.316 which means that the qualification is average, and is included in the Semi-Modern Technology group. The connection map of the contribution of technoware, humanware, infoware, and orgaware components to Batik Anugerah is presented in Figure 1.

Table 6.

TCC rating scale

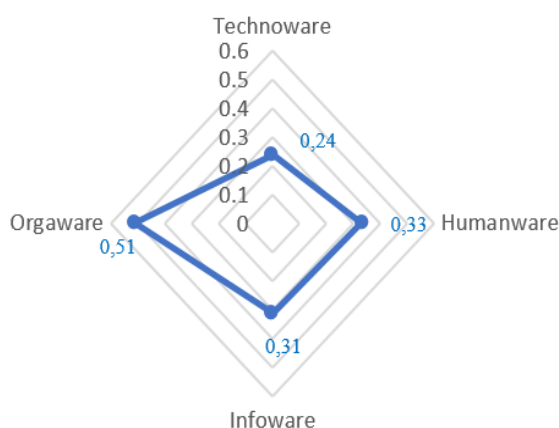
TCC Value	Classify
$0 < TCC \leq 0.1$	Very low
$0.1 < TCC \leq 0.3$	Low
$0.3 < TCC \leq 0.5$	Average
$0.5 < TCC \leq 0.7$	Good
$0.7 < TCC \leq 0.9$	Very Good
$0.9 < TCC \leq 1.0$	Modern

Table 7.

Level of technology

TCC Value	Classify
$0 < TCC \leq 0.3$	Traditional
$0.3 < TCC \leq 0.7$	Semi-Modern
$0.7 < TCC \leq 1.0$	Modern

Connection of Each Component

**Figure 1.**

Contribution of Technology of Batik Anugerah

5. CONCLUSION

The conclusions based on the research objectives are as follows:

1. Calculation of the level of technological sophistication at Batik Anugerah by using technometrics starting from counting each component of technoware, humanware, infoware, and orgaware, so that the state of the art (SOTA) value of each component is obtained.
2. The technology coefficient value or TCC of Batik Anugerah is obtained at 0.316 which means that it has sufficient qualifications, and belongs to the semi-modern technology group.
3. Suggestions aimed at batik Anugerah owners in the future to develop more advanced by paying attention to the production process by involving modern tools and human resources used more attention.

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