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Optimizing the Productivity of Traditional Textile Artisans through Education and Training for a Sustainable Cultural Industry

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Abstract. Lasem handmade batik is part of a cultural heritage that has significant economic potential, but the productivity of its artisans is still low due to limited skills and access to innovation. This problem poses a challenge to cultural preservation efforts in line with sustainable development. This study aims to examine the role of education and training in improving the productivity of Lasem handmade batik artisans. The method used is quantitative, with a sample of 100 artisans purposively selected based on work experience and participation in training. Data were collected through questionnaires and relevant documents, and analyzed using SPSS through validity, reliability, normality, t-test, and F-test. The results showed that education and training have a positive and significant influence, both partially and simultaneously, on the productivity of artisans. The findings confirm that improving access to education and training can strengthen the skills, efficiency and production output of Lasem handmade batik artisans. The implications of this research support the achievement of SDG 8 (Decent Work and Economic Growth) by encouraging capacity building of the cultural sector workforce, as well as SDG 12 (Responsible Consumption and Production) through the preservation of environmentally friendly and sustainable batik production processes. This research contributes to the development of sustainability science by underscoring the importance of empowering traditional communities through education and sustainable innovation.

Keywords: human resources, artisan productivity, capacity building, education and training, cultural industries.

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1. Introduction

Batik, as an Indonesian cultural heritage, contains very valuable values, is not just a beautiful patterned cloth, but also reflects rich culture and deep philosophical meaning. The development of Indonesian batik began rapidly during the Mataram Sultanate, where certain motifs were initially only reserved for royal circles. Over time, the art of batik spread to various regions, especially in coastal areas. One of the batik centers on the coast of Java is Lasem, which is known for its distinctive motifs which are full of meaning and philosophy of life for the local community [1]. Lasem Batik is one of the oldest batiks in Indonesia, which is influenced by Javanese and Chinese culture, characterized by motifs such as sekar universe, latohan, hong birds, and dragons. However, the existence of Lasem batik faces challenges, especially due to marketing limitations, so that its batik products are not widely known. Apart from that, the limited workforce willing to work on batik is a major challenge for craftsmen in Lasem, so efforts to preserve and promote batik are very necessary.

Reported by Antarafoto.com, currently there are hundreds of hand-written batik craftsmen in Lasem with more than 12 thousand batik makers registered or members of batik cooperatives. As it develops, batik craft has not only become part of cultural heritage, but has also become the main source of livelihood for the people of Lasem to this day. Therefore, support for craftsmen, whether in the form of guidance, promotion or economic policy, is very important to ensure that Lasem hand-written batik remains a cultural heritage of high value as well as a source of prosperity for its people.

However, this sector still faces major problems in terms of productivity. Low productivity impacts the welfare of batik makers and reduces the competitiveness of Lasem batik products in the global market, hindering sustainable local economic development. In line with the Sustainable Development Goals (SDGs), especially SDG 8 on decent work and economic growth and SDG 12 on responsible consumption and production, improving the skills and work efficiency of artisans is a crucial issue. Craftsmen as human resource assets need to be optimally empowered. As stated by [2], the quality of human resources plays an important role in running company operations in accordance with the vision and mission. Therefore, efforts to increase the effectiveness of human resources through education and training are key. In this approach, continuous education and training is considered as the right strategy to overcome competency gaps, increase adaptability to technological changes, while maintaining and preserving local cultural values in an inclusive and sustainable manner.

Education and training are very important in attempts to raise the standard of human resources, including in the hand-written batik industry. Through appropriate training programs, craftsmen can acquire new skills in batik techniques, business management, marketing, and utilizing technology that can accelerate the production process without reducing the value of batik art [3]. In addition, ongoing education can help craftsmen understand the importance of using environmentally friendly materials, in line with the concept of sustainable development, which prioritizes harmony between the economy, society and nature [4].

Previous research from [5] stated that education and training act as efforts made by companies to improve and cultivate the attitudes, behaviors, abilities, and knowledge of employees. This activity is designed to ensure that employees work according to company standards, which will lead to increased overall work effectiveness and productivity.

Apart from that, research conducted by [6] explains that in order to adapt to market developments and increase the number of consumers, Bakaran batik MSMEs need to implement various new innovations in their strategies. The increasingly competitive development of the batik industry requires business actors to adapt to changes in consumer tastes, technology and more modern marketing strategies. Internal factors, such as improving product quality, production efficiency and creativity in design, must be strengthened so that MSMEs remain competitive. To achieve innovation that is able to maintain the competitiveness of Bakaran batik MSMEs, education and training are key factors that must be considered. Through education, business actors can understand developments in market trends, effective business strategies, and the importance of innovation in design and production.

The novelty of this research is that there has been no previous study that specifically analyzes the impact of education and training on the productivity of Lasem batik craftsmen within the framework of

sustainable development. Most of the existing research focuses more on aspects of cultural preservation, batik techniques, or the creative economy in general, without highlighting how education and training can increase the productivity of craftsmen and support the sustainability of the batik industry. The aim of this research is to analyze the impact of education and training on the productivity of Lasem batik craftsmen within the framework of sustainable development.

In relation to sustainable development, Efforts to improve the work output of batik craftsmen through education and training bring dual benefits, namely improving the community's economy and preserving culture and the environment [7]. By increasing productivity, craftsmen can produce quality batik more efficiently, increasing income and opening up opportunities for market expansion (Ratnawati et al., 2024). In addition, using ecological principles in making batik can minimize environmental damage, for example by using natural dyes and managing waste better [8]. Therefore, it is hoped that the research results will be contribute ideas regarding how education and training can be key factors in increasing the productivity of Lasem batik craftsmen in a sustainable manner.

2. Methods

This research uses an explanatory quantitative approach to analyze the impact of education and training on the productivity of Lasem hand-written batik artisans within the framework of sustainable development. The quantitative approach was chosen because it helps test causal relationships between variables through systematic statistical analysis. The population in this study were all hand-written batik artisans in Lasem. A sample of 100 respondents was determined based on the minimum sample calculation for multiple regression analysis with a confidence level of 95%, a margin of error of 10%, and considering limited resources and field access. The sampling technique used was simple random sampling to ensure even representation and avoid selection bias. The selection of respondents was done without the use of specific criteria to ensure that each artisan had an equal chance of being selected. Furthermore, it was important for the research to follow the ethical principles of social research, including voluntary consent from respondents, assurance of identity confidentiality, and use of data for academic purposes only. Participation was anonymous and no pressure or financial incentives were applied.

The main instrument in this study is a closed questionnaire based on a 1-5 Likert scale developed from theoretical indicators to measure the variables of education, training, and work productivity. Referring to [9], the education variable in this study is elaborated through five main indicators, namely the last level of education, the educational objectives to be achieved, the abilities obtained during the education process, the relevance of the field of study to the type of work, and the suitability of the position with the educational qualifications possessed. Training variables are measured based on training objectives, the content of the material provided, implementation methods, participant profiles, and instructor competencies. Meanwhile, work productivity is identified through indicators such as individual ability to work, increase in output produced, work motivation, initiative in self-development, quality of work results, and efficiency in carrying out tasks.

This study used two types of data sources, namely main data and supporting data. The main data was collected through surveys filled out directly by the research participants, while supporting data was collected from related documents, reports, and literature, such as data from the industry office or previous research results.

Data analysis was conducted using the SPSS application, starting with validity and reliability tests to ensure the accuracy and consistency of the research instruments. Normality test was used to assess data distribution. Furthermore, the t-test was used to assess how much influence each independent variable has on the dependent variable separately and the F-test was used to assess the overall impact of the independent variables on the work of craftsmen. Meanwhile, the magnitude of the influence of the independent variable on the dependent variable is measured by the coefficient of determination (R^2). The results of this analysis show empirically the effectiveness of education and training in improving the productivity of Lasem hand-written batik craftsmen.

3. Results and Discussion

Result

Validity Test

The measurement procedure of data validity establishes how well a research tool captures the idea under investigation. This test is very necessary to ensure that the data collected is correct and related to the research target. If the research instrument is valid, the results obtained can be relied on and used to make appropriate conclusions. Determining the validity of an item in the research instrument uses "significance value less than 0.05" as a reference. This means that if the validity test results show a "significance value (p-value) below 0.05", the item is considered valid and does not need to be removed from the research.

Table 1. Validity Test Results

Correlations

		Education	Training	Productivity of Batik Craftsmen	Total
Education	Pearson Correlation	1	.740**	.808**	.902**
	Sig. (2-tailed)		.000	.000	.000
	N	100	100	100	100
Training	Pearson Correlation	.740**	1	.874**	.941**
	Sig. (2-tailed)	.000		.000	.000
	N	100	100	100	100
Productivity of Batik Craftsmen	Pearson Correlation	.808**	.874**	1	.958**
	Sig. (2-tailed)	.000	.000		.000
	N	100	100	100	100
Total	Pearson Correlation	.902**	.941**	.958**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	100	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

According to the table analysis's findings, every variable in the research has a significance level of 0.000. The significance criterion of 0.05, a standard reference in validity testing, is below this number. As a result, every item or query in the research tool is regarded as legitimate.

Reliability Test

Reliability testing is a method used to assess the consistency of a research instrument in generating stable and precise data. This test aims to ensure that the measuring instrument can provide the same results when used repeatedly under the same conditions. A Cronbach's Alpha value of 0.6 is still acceptable, but it must be higher than 0.7. The results of the consistency test of the variables that will be used in the ensuing analysis are shown in the table below.

Table 2. Reliability Test Results

Reliability Statistics

Cronbach's Alpha	N of Items
.924	3

From the reliability test results table displayed, the Cronbach's Alpha value of 0.924 indicates that the research measuring instrument has a very good level of consistency. Considering that this value is higher than the general standard of 0.70, it can be interpreted that the three items in the instrument have

consistency in measuring the variable that is the focus of the research.

Normality Test

Assessment of the normal distribution of research data is carried out using a statistical procedure called the normality test. Many parametric statistical analysis methods rely on the assumption of normally distributed data. One commonly used test is the One Sample Kolmogorov-Smirnov Test. Data is considered to follow a normal distribution if the "significance value (p-value) is above 0.05", this suggests that the sample data and the normal distribution do not differ significantly.

Table 3. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

			Unstandardized Residual
N			100
Normal Parameters[a,b]	Mean		.0000000
	Std. Deviation		1.41370201
Most Extreme Differences	Absolute		.088
	Positive		.088
	Negative		-.048
Test Statistic			.088
Asymp. Sig. (2-tailed)[c]			.055
Monte Carlo Sig. (2-tailed)[d]	Say.		.060
	99% Confidence Interval	Lower Bound	.054
		Upper Bound	.066

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 926214481.

The residual data in this study is found to be normally distributed, because the Monte Carlo Sig. (2-tailed) of 0.060 and the Asymptotic Sig. (2-tailed) of 0.055 are both over the significance level of 0.05, this conclusion was reached. The normality conditions are satisfied since the significance value is greater than 0.05, indicating that there is no discernible difference between the data distribution and the normal distribution.

Partial Significant Test (t-test)

In regression analysis, the purpose of the t-test is to determine if each independent variable's coefficient deviates substantially from zero. The independent variable is thought to have a genuine impact on the dependent variable if the t-test findings indicate a significant value (p-value <0.05). On the other hand, the variable is thought to have insufficient influence if it is not significant. This test is crucial for assessing each variable's contribution to the model and guaranteeing the validity and dependability of the analysis results.

Table 4. T Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Say.
1	(Constant)	2.028	1.015		1.997	.049
	Education	.376	.067	.357	5.595	.000
	Training	.543	.057	.610	9.574	.000

a. Dependent Variable: Productivity of Batik Craftsmen

Based on the results of the analysis presented in the table, several findings can be concluded, as follows:

1. The regression coefficient for the education variable is 0.376, and the significance level is 0.000. This figure indicates that, assuming all other factors stay the same, batik artisans' productivity will rise by 0.376 units for every unit increase in the schooling variable. Education has a considerable impact on productivity because the significance value is less than 0.05. This indicates that the research's hypothesis is accepted.
2. The training variable has a significance value of 0.000 and a regression coefficient of 0.543. This means that, assuming all other factors stay the same, a one-unit increase in the training variable will result in a 0.543-unit increase in the productivity of batik artisans. The significance value is also smaller than 0.05, indicating that the effect of training on productivity is significant. This value indicates that the more frequently or the better the quality of training attended by craftsmen, the more their productivity will increase significantly. This means that the hypothesis proposed by this research is accepted.

Simultaneous Test (f-Test)

The F-test is used to examine how all independent variables simultaneously affect the dependent variable in a linear regression model. The statistical F value and the significance value (p-value) are used to make decisions. The null hypothesis is rejected when the significance value is 0.05 or less than the significance level.

Table 5. F Test Results

ANOVA[a]

Model Squares		Sum of	df	Mean Square	F	Say.
1	Regression	717.869	2	358.934	223.871	.000[b]
	Residual	155.521	97	1.603		
	Total	873.390	99			

a. Dependent Variable: Productivity of Batik Craftsmen

b. Predictors: (Constant), Training, Education

The "significance value (Sig.) is 0.000" from the joint test results shown in the ANOVA table above denotes a very low risk of mistake in rejecting the null hypothesis (below 0.05). This number leads to the approval of the alternative hypothesis and the rejection of the null hypothesis, which asserts that there is no meaningful effect. In conclusion, the factors of education and training taken together significantly impact batik artisans' production.

Coefficient of Determination Test

Through this test, it is evaluated how precise the regression model is in explaining variations in the variables affected. If the R^2 value almost reaches 1 (or 100%), it means that the independent variable has a strong ability to explain most of the variation in the dependent variable, so the model is considered to have strong predictive power.

Table 6. Coefficient of Determination Test Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.907[a]	.822	.818	1.266

a. Predictors: (Constant), Training, Education

The R Square (R^2) value of 0.822, which can be seen in the results table, indicates that 82.2% of changes in batik craftsmen's productivity can be explained by education and training variables simultaneously. Meanwhile, the remaining 17.8% is influenced by other factors outside the model.

4. Discussion

The Influence of Education on Increasing the Productivity of Lasem Handwritten Batik Craftsmen

This study shows that education has a positive and significant effect on increasing the productivity of Lasem hand-written batik craftsmen. These results indicate that the effectiveness of employee education will have an impact on better ability to adopt new knowledge, improve technical skills, and understand the production process more efficiently [10]. Education not only improves technical skills, but also equips employees with insights into business management, marketing, and design innovation [11] These insights, in turn, contribute directly to improving the quality and quantity of Lasem batik production.

This finding is consistent with a study conducted by [9], which shows that education has a significant positive impact on employee work productivity. Then, another study in [12] also corroborates this finding by stating that education has an important role in improving adaptability and work efficiency, which in turn contributes to higher productivity. In line with research findings in other sectors such as agriculture, education has also been shown to play a vital role in strengthening individuals' capacity by equipping them with important knowledge, insights and experiences for the future. Farmers with higher levels of education tend to have a better understanding of resource management, technological developments and market dynamics, and are better able to identify problems and design effective strategies. In addition, education also spurs innovation and openness to new ideas that can boost productivity and sustainability [13]

Thus, the practical implication of these findings is the importance of providing access to education for Lasem handmade batik artisans. Educational programs focused on technical skills development, business management and digital marketing can help artisans improve productivity and competitiveness in the market. The government, educational institutions and the batik community are expected to collaborate in providing relevant education and supporting innovation among artisans. As improving education can be an effective strategy to drive local economic growth through a more productive and sustainable hand-drawn batik industry.

The Effect of Training on Increasing the Productivity of Lasem Handwritten Batik Craftsmen

This study shows that training has a positive and significant effect on increasing the productivity of Lasem hand-written batik craftsmen. This finding indicates that the training provided was able to improve technical skills, deepen understanding of the production process, and increase the work efficiency of the artisans. Through training, artisans can learn more innovative batik techniques, understand effective time management, and adopt more efficient production methods [14] This improvement in skills has a direct impact on increasing the number and quality of hand-drawn batik products produced.

These positive results occur because training provides an opportunity for artisans to update their knowledge and master new skills in accordance with the development of the batik industry [15]. The impact of training encourages artisans to implement more systematic and professional work practices, thereby reducing the error rate in the production process and producing products with more consistent quality. Continuous training also opens up opportunities for artisans to understand market trends, marketing strategies, and design innovations. Increased knowledge of these aspects will help artisans to improve their ability to compete for Lasem handmade batik products in both domestic and foreign markets.

For broader issues, productivity is not only understood as an increase in the quantity of output per unit time, but also as an effort to integrate energy efficiency, reduction of material wastage, and improvement of product quality without adding to the environmental burden. Thus, technical training that improves skills in raw material management, natural dyeing, or the use of eco-friendly tools can directly contribute to reducing emissions and production waste generation [16]. This supports SDG 12 on Responsible Consumption and Production.

This finding is consistent with studies conducted by [9] and [12], which confirmed that training has a positive and significant effect on employee work productivity. Applicatively, the results of this study

have an impact on the need to provide training programs that are sustainable and in accordance with the needs of Lasem hand-written batik craftsmen. The government, educational institutions, and the batik community are expected to work together in organizing training that not only focuses on batik techniques, but also covers aspects of business management, digital marketing, and product innovation. From targeted and consistent training support, artisans can increase productivity, improve product quality, and expand market reach. This can also be an effective strategy to support the sustainability of Lasem's handmade batik industry and improve the welfare of its artisans.

The Influence of Education and Training on Increasing the Productivity of Lasem Handwritten Batik Craftsmen

This study shows that education and training together have a positive and significant influence on increasing the productivity of Lasem handmade batik artisans. This finding confirms that the combination of education and training can improve technical skills, understanding of the production process, and work efficiency more comprehensively. This finding is in line with the results of research conducted by [17], which states that education and training simultaneously have a positive and significant effect on employee productivity. The study confirms that the combination of increased knowledge and skills is a major factor in improving work performance and efficiency.

When compared to other craft production sectors such as woven bags in Brumbung Village, the challenges faced by Lasem artisans are relatively similar, namely limited access to ongoing training and low penetration of appropriate technology. However, targeted education and training-based interventions have proven effective in increasing productivity while strengthening local economic sustainability [18].

The synergy between these two aspects encourages artisans to adopt new technologies, reduce the error rate in production, and improve the quality and quantity of batik output. Craftsmen who have access to training on environmentally-friendly techniques show better efficiency in material and energy use, which in turn reduces production costs and carbon emissions. Theoretically, this finding is in line with the approach in sustainable engineering, where human capacity building is the foundation for creating more efficient, ethical, and less wasteful production systems [19].

The implications of these findings point to the importance of providing balanced access to both formal and non-formal education and relevant training programs for Lasem handmade batik artisans. Based on continued support through comprehensive education and training, Lasem handmade batik artisans can increase their productivity, maintain product quality and expand competitiveness in local and global markets.

Furthermore, this result has important implications for sustainability as increasing productivity does not solely aim to increase income, but also as a strategy to economically sustain cultural practices without damaging the environment. Thus, it is relevant that increasing productivity through education and training can support the achievement of SDG 8 on decent work and economic growth, but also contribute to the preservation of local culture and the reduction of ecological impacts of small and medium industries. As a recommendation, the need for clean technology integration, natural dye innovation, and circular production systems are important opportunities that can be acted upon by stakeholders to ensure that the batik industry is environmentally sustainable.

5. Conclusion

After considering the process of analysis and discussion, it can be concluded that education and training have a positive and significant influence on increasing the productivity of Lasem handmade batik craftsmen. This influence can be seen both partially and simultaneously, indicating that each factor has an important contribution in driving productivity. A good education provides the basic understanding and skills needed, while training improves technical ability and efficiency in the production process. As these two aspects improve, artisans are able to work more effectively and produce high-quality products, which has a direct impact on productivity. Therefore, referring to these findings, strengthening human resource capacity is a strategic step in supporting the achievement of the sustainable development framework, especially with regard to Sustainable Development Goal (SDG) 4

on Quality Education, SDG 8 on Decent Work and Economic Growth, and SDG 12 on Responsible Consumption and Production.

The practical implications of the research show that the government, training institutions and local communities need to develop sustainable education and training programs that are contextual and based on the needs of artisans. The integration of appropriate technology and creative industry 4.0-based training is also a strategic step to create a more adaptive and environmentally friendly production system. In addition, the strengthening of support ecosystems such as cooperatives, access to financing, and digital-based promotion needs to be optimized to strengthen the position of artisans in the cultural and economic value chain. However, while this study has provided an important insight into the contribution of education and training to productivity, there are some limitations. The study only covers the Lasem batik region and has also not considered other variables such as work experience, technology use, or institutional support that may also have an effect on productivity. Therefore, further research is recommended to develop a more comprehensive model with wider geographical coverage and consider the dimensions of environmental and social sustainability in an effort to preserve cultural heritage. Thus, the development of the hand-written batik industry can be directed not only for the economic welfare of artisans, but also for cultural preservation and environmental sustainability in a holistic manner.

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