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## USING BINARY LOGISTICS TO ANALYZE FACTORS AFFECTING THE VALUE OF GREEN PERFORMANCE : SMI BATIK IN PEKALONGAN CITY

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### ABSTRACT:

Green industry is now in the spotlight. The government encourages industries to apply green industry principles, especially SMI batik in Pekalongan City. One of the first steps in encouraging the application of green industry is to measure the value of green performance in accordance with the referring to the Appendix of the 2018 Green Industry Award Assessment Guidelines on matrix of production process, then determine the factors that affect the value of green performance using binary logistic regression analysis. Binary logistic regression is a statistical analysis method to describe the relationship between dependent variables with two or more categories with one or more independent variables. The purpose of this study is to analyse the factors affecting the green performance value of SMI batik in Pekalongan city. From this study, it was found that the average green performance value of SMI batik in Pekalongan city was 52% and the factor that significantly influenced the value of green performance was craftspeople awareness of environmental impacts with an odds ratio value is 22,815.

**Keywords:** Binary logistic analysis, Green Industry, SMI Batik, The Value of Green Performance.

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### INTRODUCTION

Green industry is increasingly in the spotlight of the world market, as one of the industry's sustainability efforts in preserving the environment without affecting and even increasing the effectiveness and efficiency of production (Hennig et al., 2023; Mallik, 2023; Squadrito et al., 2023). Green industry has the principle of minimising the use of resources and minimising the acquisition of negative impacts on the environment, by maximising product acquisition.

Batik is one of the cultural heritages that has unique characteristics and philosophy and is recognised by UNESCO (Indrayani & Triwiswara, 2020). One of the centres of the batik-producing industry is Pekalongan City. According to Pekalongan Industry Office in 2023 that Pekalongan City is recorded to have 1805 SMIs batik that produce batik cloth either as their own products or as makloon. From 1805 SMIs batik, only 65 SMIs batik have single business number

in end of 2023. All SMIs batik in Pekalongan city are categorised as small-scale industries based on the number of employess included craftman and invesment value (Kozlowski et al., 2012).

Indonesian government have made efforts to encourage the implementation of green industry, one of which is conducting a green performance assesment to give appreciation to industries that have implemented green industry principles (Tseng et al., 2013). Green performance assessment is carried out referring to the Appendix of the 2018 Green Industry Award Assessment Guidelines on matrix of production process, where the weight of the production process matrix is 70% of the overall assessment (Agbajor & Mewomo, 2024; Ramakrishnan et al., 2023; Rasmussen et al., 2023; Yang et al., 2023). This assessment is carried out as an initial stage in measuring the commitment of the industry, especially SMI batik, in applying green industry principles.

Each SMI batik has its own assessment, to find out the factors that significantly affect the value of green performance is done through binary logistic regression analysis using SPSS.

Binary logistic regression is a statistical analysis method to describe the relationship between independent variable that have two or more categories with one or more dependent variables (Ali et al., 2024; Domarchi & Cherchi, 2024; Jerebine et al., 2024; Martinello et al., 2024; Van der Stricht et al., 2024).

Logistic regression analysis produces binary and dichotomous variables. The binary logistic regression model is used if the dependent variable produces two categories, namely 0 and 1, so that it follows the Bernaulli distribution as follows (Phillips et al., 2024; Rashmi & Marisamynathan, 2024):

$$f(y_i) = \pi_i^{y_i} (1 - \pi_i)^{1-y_i}$$

Where :

$\pi_i$  = probability of the i-th event

$y_i$  = i-th random variable consisting of 0  
and 1

The steps of logistics regression analysis are as follows :

### Simultaneous Test

Simultaneous test is conducted to determine all independent variables in the model together (Alahmer et al., 2023; Maemunah et al., 2023; Pata & Kartal, 2023; Raihan, 2023; Veza et al., 2023). The hypothesis in the simultaneous test is to reject  $H_0$  if the significant value is less than  $\alpha=0,05$  or  $G^2$  value  $>$  *chisquare* as  $\chi^2_{\alpha,p}$  then it is concluded that at least one of the independent variables affects the value of green performance as variable dependent.

### Partial Test

Partial test is conducted to determine whether each independent variable in the model has a significant effect on the dependent variable. The hypothesis in the partial test is to reject  $H_0$  if Wald test value  $< chi\ square\ as\ \chi^2_{a,p}$  or the significant value is less than  $\alpha=0,05$ . So it is concluded that independent variabel affects the value of green performance as dependent variable. The goodness of fit test is conducted to evaluate the model suitability of the binary logistic regression model formed using the *Hosmer and Lemeshow Test*.

### Data Interpretation

Data interpretation is done to see the magnitude of tendency of the independent dependent variable to the dependent variable through a measure, namely the odds ratio. The odds ratio values, which is the value of  $\exp(\beta)$  on the independent variable that significantly affects the value of green performance. The greater  $\exp(\beta)$  value indicates that the tendency of the independent variable to the value of green performance is also higher ( Wulandari et al, 2017).

## RESEARCH METHODS

This research was conducted using field observations, interviews, questionnaires, and data verification. The location of this research is in Pekalongan City, Central Java-Indonesia. SMI batik chosen by stratified random sampling with the margin of error is 80% from 65 SMI batik which has Single Business Number. The quantity samples of SMI batik are 18 SMIs batik.

The first step of the research was carried out by measuring the value of green performance whose assessment refers to the Appendix of Green Industry Assessment Award Guidelines 2018 by Ministry of Industry which includes a matrix of production processes on a small industrial scale consisting of : Aspect of the Production Efficiency Programme, Aspect of Raw Material, Aspect of Energy, Aspect of Water, Aspect of Process Technology, Aspect of Human Resources

Then process the data obtained from the results of the questionnaire of 18 SMIs batik to carry out binary logistic regression analysis. Using binary logistic regression to analyze the factors that influence the value of green performance at SMIs batik in Pekalogan City.

The following variables are used in the binary logistic regression of this research as follows :

**Tabel 1. Variable Analyst of Factors Affecting Green Performance Value**

Variabel	Indikator
Value of Green Performance (Y)	0 = Below Average 1 = Above

	Average
Number of Craftspeople ( $X_1$ )	Quantity of Craftspeople
Average Education of Craftspeople ( $X_2$ )	0 = Elementary – Junior High School  1 = Senior High School  2 = Associate’s Degree or Bachelor
Competence Level of Craftspeople ( $X_3$ )	0 = Not Good  1 = Good
Craftspeople Awareness of Environmental Impacts ( $X_4$ )	0 = Not Good  1 = Good

## RESULTS AND DISCUSSION

### Green Performance Assessment

Green performance assessment was carried out on 18 SMIs batik located in a distribution of 4 sub-districts of Pekalongan, namely West of Pekalongan, South of Pekalongan, East of Pekalongan, and North of Pekalongan. The value of green performance averaged across 18 SMIs batik for the matrix of production process is as follows :

**Tabel 2. Result of Green Performance Assessment**

Sub-District	Code	Value of Green Performance
West of Pekalongan	S1	62%
	S2	59%
	S3	51%
	S4	49%
	S5	48%
	S6	40%
	S7	51%
South of Pekalongan	S8	51%
	S9	51%
	S10	49%

	S11	52%
East of Pekalongan	S12	55%
	S13	51%
	S14	49%
	S15	51%
North of Pekalongan	S16	53%
	S17	58%
	S18	59%

Source: Research Results

Based on table 2, the average green performance value of 18 SMIs batik in Pekalongan City is 52%, which means above 50% that SMIs batik in Pekalongan City has committed to implementing green industry principles in batik production.

### Analysis of Factors Affecting Green Performance Value

In determining the factors that have an influence on the value of green performance, the following results are obtained : The simultaneous test results show the significance value of the parameters of the model simultaneously as in table 3 below :

**Tabel 3. The Result of Simultaneous Test**

		Chi- square	Df	Sig.
Step 1	Step	10,311	4	0,035
	Block	10,311	4	0,035
	Model	10,311	4	0,035

Source : Data Output SPSS

Based on table 3 shows that the simultaneous test results on the *Omnibus Test* is the p-value is  $0,035 < \alpha=0,05$  or the value of  $G^2 ( 10,311 ) > \chi^2_{0,05,4} = 9,4877$ . So it is concluded that the simultaneous test results are  $H_0$  is rejected or the model shows that there is an influence between the independent variables on the value of green performance.

### The Result of Partial Test

The partial test results show the significance value of the each variables independent the model as in table 4 below :

**Tabel 4. The Result of Partial Test**

	Variable Independent	Wald	dF	Sig
Step 1	$(X_1)$	0,258	1	0,612
	$(X_2)$	0,17	1	0,897

$(X_3)$	1,765	1	0,184
$(X_4)$	3,85	1	0,047

Source : Data Output SPSS

Based on table 4 shows that the partial test results are as follows with value  $\alpha = 0,05$  and  $\chi^2_{0,05,1} = 3.841$  :Number of Craftspeople ( $X_1$ ) The wald test obtained  $0,258 < 3,841$  which is greater than the *chi-square* value or significance test obtained  $0,612 > 0,05$  then  $H_0$  accepted or has no significant effect on green performance value.

Average Education of Craftspeople ( $X_2$ )The wald test obtained  $0,17 < 3,841$  which is greater than the *chi-square* value or significance test obtained  $0,897 > 0,05$  then  $H_0$  accepted or has no significant effect on green performance value.

Competence Level of Craftspeople ( $X_3$ )The wald test obtained  $1,765 < 3,841$  which is greater than the *chi-square* value or significance test obtained  $0,184 > 0,05$  then  $H_0$  accepted or has no significant effect on green performance value.

Craftspeople Awareness of Environmental Impacts ( $X_4$ )The wald test obtained  $3,85 > 3,841$  which is less than *chi-square* value or significance test obtained si diperoleh  $0,047 > 0,05$  then  $H_0$  rejected or has significant effect on green performance value.

**Tabel 5. The Result of Partial Test**

	Variabel Independent	B	dF	Exp(B)	Sig
Step 1	$(X_1)$	-0,164	1	0,848	0,612
	$(X_2)$	0,25	1	1,284	0,897
	$(X_3)$	2,352	1	10,507	0,184
	$(X_4)$	3,127	1	22,815	0,047

Source : Data Output SPSS

Based on the estimated value of the parameter (B) in table 4. The binary regression logistic model is obtained as follows :

$$\ln\left(\frac{\pi(x)}{\pi(1-x)}\right) = -3,175 - 0,164X_1 + 0,25X_2 + 2,352X_3 + 3,127X_4$$

The logistic regression model is obtained as in the equation above and the model shows the coefficient values of most of the variables are positive such as Average Education of Craftspeople ( $X_2$ ), Competence Level of Craftspeople ( $X_3$ ), and Craftspeople Awareness of Environmental Impacts ( $X_4$ ) thus indicating the opportunity to influence the Value of Green Performance (Y).

### The Result of Goodness of Fit Test

The result of *Goodness of Fit* test to evaluate the suitability of the binary logistic regression model that has been formed.

**Tabel 6. Result of Hosmer and Lemeshow Test**

Step	Hosmer and Lemeshow Test	df	Sig
1	4,997	6	0,544

Source : Data Output SPSS

Based on table 6, it shows that the partial test results are as follows with a value of  $\alpha=0,05$  dan  $\chi^2_{0.05,6} = 12,592$  and the significance value of  $0,554 > \alpha=0,05$  or the coefficient value of the *Hosmer and Lemeshow Test* ( $4,997 < \chi^2_{0.05,6} = 12,592$ ) so that model formed is appropriate or the model was FIT.

### Interpretasi Data

Based on the partial test results that the independent variable on Craftspeople Awareness of Environmental Impacts ( $X_4$ ) has significant influence on the value of green performance with the odds ratio value obtained from Table 5 on Exp(B), it shows that value of Craftspeople Awareness of Environmental Impacts ( $X_4$ ) odds ratio is 22,815 has an influence on the value of green performance.

### CONCLUSION

The implementation of green industry is an opportunity for the industry, especially Batik in fashion, to compete in the world. Apart from being able to maintain and introduce heritage to the world, through the SMI batik if the green industry applied, it can also increase economic growth and preserve the environment. The green performance assessment obtained from SMI batik in Pekalongan city averages 52% which means that the SMI batik is committed to implementing green industry principles, but there are several factors that need to be encouraged in implementing the green industry. Through binary logistic regression analysis, it is found that the factor has a significant affect on the value of green performance is Craftspeople Awareness of Environmental Impacts. The odds ratio on craftspeople awareness of environmental impacts is 22,815. The suggestion from this research is that it is necessary to conduct another research with a smaller margin of error and refer to the latest regulation by the Minister of Industry Regulation No. 10 of 2023 that concern in Green Industry Standards for Batik.

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