Analyzing Characteristics of Songket Palembang Weavers Productivity Using Path Analysis

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Abstract. Most of women in Desa Limbang Jaya work as songket weavers. Their products have good quality, but their level productivity is low, so it causes the income for them is low. There are characteristics that influence the level productivity of weaver. Path analysis is method that can be used to look for the characteristics that influence the productivity. In this paper, we use path analysis to find exogenous variables that effect directly and indirectly on endogenous variables. Exogenous variables in this paper consist of: age, education, work period, work motivation, work culture and business motivation. Endogenous variables consist of productivity and income. The obtained data by purposive sampling method consist of 104 songket weaver respondents. Characters that have a significant influence on the productivity of songket weavers in Limbang Jaya is education and business motivation. In the craftsman's income, either with alpha 5% or 10%, no variable has a direct and indirectly significant effect.
Keyword: path analysis, songket weaver, work culture, business motivation, productivity of weaver.

1. Introduction

Songket Palembang is one of the best traditional woven fabrics in Indonesia. The art of songket weaving is a cultural heritage that is used in certain traditions, customary activities, and other activities outside of traditional ceremonies. One of the producers of songket Palembang weaving is Kabupaten Ogan Ilir. One of the centers of songket weavers in Kabupaten Ogan Ilir is Desa Limbang Jaya in Kecamatan Tanjung Batu.

Based on descriptive analysis conducted by [1], weaving crafters in Kampoeng Tenun Indralaya require better performance in improving the quality of songket. Government and state-owned (especially Bank Negara Indonesia; BNI) supported for songket weaving crafters to expand their business.

The income and welfare of crafters are related to their productivities. According to [2], productivity was an improvement of the production process based on the comparison between the resources used (input) and the quantity of goods produced (output). [3] describe that the income of songket weavers in Desa Limbang Jaya was influenced by the amount of songket produced. The internal characters such as work motivation, work culture, and business motivation were not described in the paper. So, it is necessary to do research that includes the characters to know the productivity level of weavers.

[4] explained that the productivity of female labor in woven palm kernel industry in Desa Bona depends on age, education, work experience and marital status. [5] stated that the motivation consisting of individual needs, individual expectations, and fair treatment had significant effects on employee productivity in PT Permodalan Nasional Mandiri Banjarmasin. [6] explained that the work culture had a positive influence on employee productivity at Balai Pengkajian Teknologi Pertanian (BPTP) in North Sulawesi.

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One method that can be used to determine the factors that affect the productivity of crafters is by using path analysis. Path analysis is a method that can find the causal relationship and know the influence of exogenous variables on endogenous variables either directly or indirectly.

The problem discussed in this study is in order to determine the characters that affect the productivity of songket weavers in Desa Limbang Jaya. It includes 6 exogenous variables and 2 endogenous variables.

2. Materials and Methods

Primary data obtained by arranging questionnaires to the respondents. Sampling technique used was purposive sampling. Respondents were songket weavers who only weaved cloth. Weavers were doing their works when the questionnaires were distributed.

In this research, we used computer program that were SPSS 16.0, XLSTAT and MATLAB. The steps in this research as follows:

1. Determine the variables used. Exogenous variables consist of age (X_1), education (X_2), work period (X_3), work motivation (X_4), work culture (X_5), and business motivation (X_6). Endogenous variables consist of productivity (Y_1) and income (Y_2),
2. Designing the questionnaires.
3. Collecting data through questionnaires using purposive sampling technique. Samples taken in this research are 104 songket weavers.
   The results data from Step 1 to Step 3 have been performed on [3].
4. Testing the validity and reliability of X_1, X_2, dan X_3 data by using $\alpha = 10\%$.
5. Transformation of ordinal scale data to interval scale data using Successive Interval Method.
6. Perform data processing by using path analysis method:
6.1 Create a path diagram of the variables in Step 1.
6.2 Modeling path analysis:
   (i)   Determine correlation matrix **R**.
   (ii) Determine the inverse of correlation matrix.
   (iii) Determine the path coefficient value.
   (iv) Analyze the suitability of the path model using the coefficient of determination (R^2) and calculate the residual coefficient (ε).
   (v)   Test the path model simultaneously and partially by using $\alpha = 10\%$.
   (vi) Calculates direct and indirect influences.
7. Interpretation of results by analyzing characters that significantly influence both directly and indirectly to the productivity of songket weavers.

3. Results and Discussion

3.1 Data Description

Based on [3], songket weavers in Limbang Jaya were majority of 28 till 41 years old, married status with the majority of their husbands work as craftsman blacksmiths. Weavers are also mostly lowly educated and have undergone a weaving profession for 21 till 30 years. The average product yields are 3 to 4 pieces of songket per month with working hours per day of 3 till 8 hours and a processing time of 1 fabric averaging 7 till 10 days. Average net income per month is less than IDR 1,000,000. Weavers income is more influenced by the amount of fabric produced, and less influenced by skill or mastery of motive variation, age, work experience as a weaver, working hours, and education level. The length of work of a pabric has negatively affected the income.

In this research, the variables of work motivation, work culture, and business motivation are formed on an ordinal scale so that every variable consists of several questions that represent the dimensions of the variable. Each of the work motivation and work culture variables consists of 8 questions. While the business motivation variable consists of 5 questions. These three variables are ordinal scale, so they should be transformed into interval scale data. The transformation of data is by using the Successive Interval Method.

3.2 *Path Analysis*

The transformed variables are formed into a causal diagram. The path model formed is used to analyze the characters that affect the productivity of the weavers, namely:

$$Y_1 = \gamma_{Y_1 X_1} X_1 + \gamma_{Y_1 X_2} X_2 + \gamma_{Y_1 X_3} X_3 + \gamma_{Y_1 X_4} X_4 + \gamma_{Y_1 X_5} X_5 + \gamma_{Y_1 X_6} X_6 + \varepsilon_1 \qquad (1)$$

$$Y_2 = \gamma_{Y_2 X_1} X_1 + \gamma_{Y_2 X_2} X_2 + \gamma_{Y_2 X_3} X_3 + \gamma_{Y_2 X_4} X_4 + \gamma_{Y_2 X_5} X_5 + \gamma_{Y_2 X_6} X_6 + \gamma_{Y_2 Y_1} Y_1 + \varepsilon_2 \qquad (2)$$

Equation (1) and equation (2) is respectively called as path model 1 and path model 2.

3.2.1 *Path Model 1*

The values of correlation coefficient among exogenous variables can be calculated with SPSS 16.0 computer program, so they can be formed into the correlation matrix:

$$\mathbf{R} = \begin{bmatrix}
1 & -0.472 & 0.860 & -0.062 & 0.163 & -0.160 \\
-0.472 & 1 & -0.486 & -0.072 & -0.252 & 0.019 \\
0.860 & -0.486 & 1 & -0.074 & 0.135 & -0.187 \\
-0.062 & -0.072 & -0.074 & 1 & 0.318 & 0.526 \\
0.163 & -0.252 & 0.135 & 0.318 & 1 & 0.091 \\
-0.160 & 0.019 & -0.187 & 0.526 & 0.091 & 1
\end{bmatrix}$$

The inverse of the matrix $\mathbf{R}$ is find by using the MATLAB computer program. So, the values of the path coefficients in model 1 are

$$\begin{bmatrix} \gamma_{y_u x_1} \\ \gamma_{y_u x_2} \\ \vdots \\ \gamma_{y_u x_k} \end{bmatrix} = R^{-1} \begin{bmatrix} r_{y_u x_1} \\ r_{y_u x_2} \\ \vdots \\ r_{y_u x_k} \end{bmatrix}$$

$$\begin{bmatrix} \gamma_{y_1 x_1} \\ \gamma_{y_1 x_2} \\ \gamma_{y_1 x_3} \\ \gamma_{y_1 x_4} \\ \gamma_{y_1 x_5} \\ \gamma_{y_1 x_6} \end{bmatrix} = \begin{bmatrix} -0.209 \\ -0.221 \\ 0.015 \\ -0.082 \\ 0.023 \\ 0.250 \end{bmatrix}$$

Then, we calculate the value of the determination coefficient:

$$R^2_{y_u (x_1, x_2, \dots, x_k)} = \begin{bmatrix} \gamma_{y_u x_1} & \gamma_{y_u x_2} & \cdots & \gamma_{y_u x_k} \end{bmatrix} \begin{bmatrix} r_{y_u x_1} \\ r_{y_u x_2} \\ \vdots \\ r_{y_u x_k} \end{bmatrix}$$

so we obtained $R^2_{y_1 (x_1, x_2, \dots x_6)} = 0.105$.

The value of R^2 explains that all these exogenous variables simultaneously affect productivity by 10.5%. The magnitude of other influences is not impregnated into the model so that it is impregnated into the residual coefficient of 10.5%.

The influence of other variables that are not incorporated into the model becomes a residue. The residual coefficient is 89.5%, so that the model formed is:

$$Y_1 = -0.209 X_1 - 0.221 X_2 + 0.015 X_3 - 0.082 X_4 - 0.023 X_5 + 0.25 X_6 + 0.895 \qquad (3)$$

Path model testing simultaneously conducted with test F. Formulation of the hypothesis expressed as follows:

H_0 : The exogenous variables simultaneously have no significant effect on the productivity of songket weavers.

H_1 : Exogenous variables simultaneously have significant effect on the productivity of songket weavers

The value of $F_{count} = \dfrac{(n-m-1)R^2_{yu(x_1,x_2,...,x_k)}}{m(1-R^2_{yu(x_1,x_2,...,x_k)})} = \dfrac{(104-6-1)(0.105)}{(6)(1-0.105)} = 1.897$

The value of F_{table} for $\alpha = 10\%$ is equal to 1.84. Degrees of freedom respectively $df_1 = 7 - 1 = 6$ and $df_2 = 104\text{-}7 = 97$. The value of $F_{count} > F_{table}$, so that exogenous variables simultaneously have significant effect on the productivity of songket weavers (Y_1) .

To see the effect of exogenous variables partially can be done by t test. The formulation of the hypothesis is stated as follows:

H_0 : Exogenous variables have no significant effect on the productivity of songket weavers.

H_1 : Exogenous variables significantly influence to the productivity of songket weavers

The value of $t_{count} = \dfrac{\gamma_{yux_i}}{\sqrt{\dfrac{(1-R^2_{yu(x_1,x_2,...,x_k)})^{c_{ii}}}{n-m-1}}}$ are

$t_{count(X_1)} = \dfrac{-0.209}{\sqrt{\dfrac{(0.895)(3.921)}{104-6-1}}} = -1.099;\ t_{count(X_2)} = \dfrac{-0.221}{\sqrt{\dfrac{(0.895)(1.395)}{104-6-1}}} = -1.948$

$t_{count(X_3)} = \dfrac{0.015}{\sqrt{\dfrac{(0.895)(4.021)}{104-6-1}}} = 0.078,\ t_{count(X_4)} = \dfrac{-0.083}{\sqrt{\dfrac{(0.895)(1.543)}{104-6-1}}} = -0.696$

$t_{count(X_5)} = \dfrac{0.023}{\sqrt{\dfrac{(0.895)(1.199)}{104-6-1}}} = 0.219,\ t_{count(X_6)} = \dfrac{0.25}{\sqrt{\dfrac{(0.895)(1.434)}{104-6-1}}} = 2.173$

The value of t_{table} is compared to t_{count} with $\alpha = 10\%$ and $df = 104 - 7 = 97$, i. e. $t_{0.005:27} = 1.661$. Based on the comparison result, the variables that have values $t_{count} > t_{table}$ (reject H_0) are education (X_2) and business motivation (X_6) variables. This can be interpreted that education and business motivation variables partially influence to the productivity of songket weavers.

3.2.2 Path Model 2

Analog with path model 1, it is obtained the coefficients of path and coefficients of determination:

$$\begin{bmatrix} \gamma_{x_1y_2} \\ \gamma_{x_2y_2} \\ \gamma_{x_3y_2} \\ \gamma_{x_4y_2} \\ \gamma_{x_5y_2} \\ \gamma_{x_6y_2} \\ \gamma_{y_1y_2} \end{bmatrix} = \begin{bmatrix} -0.273 \\ -0.132 \\ 0.107 \\ -0.05 \\ 0.038 \\ -0.14 \\ 0.023 \end{bmatrix}$$

So we get $R^2_{y_2(x_1,x_2,..y_1)} = 0.055$.

The value of R^2 explains that simultaneously these exogenous variables affect productivity by 5.5%. The magnitude of other influences is not included in the model so that it is entered into the residual coefficient of $\varepsilon_{y_1} = 1 - 0.055 = 0.945$.

The magnitude of influence from other variables that are not observed and entered into residual coefficient of 94.5% so that the model formed is:

$$Y_2 = -0.273X_1 - 0.132X_2 + 0.107X_3 - 0.05X_4 - 0.038X_5 - 0.14X_6 + 0.023Y_1 + 0.945 \quad (4)$$

Then simultaneous path model testing is performed by F test:

H_0 : Exogenous variables simultaneously have no significant effect on songket weaver income

H_1 : Exogenous variables simultaneously have a significant effect on songket weaver income.

$$F_{count} = \frac{(104-7-1)(0.055)}{(7)(1-0.055)} = \frac{5.28}{6.615} = 0.798$$

F_{table} value for α = 10% with degrees of freedom respectively $df_1 = 8 - 1 = 7$ and $df_2 = 4$ $4 - 8 = 96$ is 1.78. The value of $F_{count} < F_{table}$ so that H_0 is accepted. This can be interpreted that exogenous variables simultaneously have no significant effect on income (Y_2).

Then partial path model testing is performed by t test:

H_0 : Exogenous variables partially have no significant effect on songket weaver income

H_1 : Exogenous variables partially have a significant effect on songket weaver income.

The values of t_{count} were obtained as follow:

$$t_{count(X_1)} = \frac{-0.273}{\sqrt{\frac{(0.945)(3.97)}{104-7-1}}} = -1.381, \quad t_{count(X_2)} = \frac{-0.132}{\sqrt{\frac{(0.945)(1.395)}{104-7-1}}} = -1.126$$

$$t_{count(X_3)} = \frac{0.107}{\sqrt{\frac{(0.945)(4.021)}{104-7-1}}} = 0.538 \quad t_{count(X_4)} = \frac{-0.05}{\sqrt{\frac{(0.945)(1.55)}{104-7-1}}} = -0.405$$

$$t_{count(X_5)} = \frac{0.038}{\sqrt{\frac{(0.945)(1.2)}{104-7-1}}} = 0.350 \quad t_{count(X_6)} = \frac{-0.14}{\sqrt{\frac{(0.945)(1.504)}{104-7-1}}} = -1.151$$

$$t_{count(Y_1)} = \frac{0.023}{\sqrt{\frac{(0.945)(1.117)}{104-7-1}}} = 0.2109.$$

The values of t_{table} were compared to t_{count} for α = 10% and $df = 104 - 7 = 97$, i.e. $t_{0.005:26} = 1.662$. From result of comparison, the value of $t_{count} > t_{table}$, so there is no variable that influence to songket weaver income.

3.3 Direct and Indirect Influences

In model 1, there are exogenous variables influence to endogenous variable. The magnitude of the direct effect is found in the magnitude of the path coefficient between exogenous variables and endogenous variables.

The magnitude of direct, indirect and total influences of exogenous variables on endogenous variables in model 2 is presented in Table 1.

Table 1. Influence of exogenous variables on endogen variables.

Variables	Direct Effect	Indirect Influence	Total Influence
Age (X_1)	-0.273	-0.0048	-0.2778
Education (X_2)	-0.132	-0.00509	-0.13709
Work period (X_3)	0.107	0.00034	0.10734
Work motivation (X_4)	-0.05	-0,0019	-0.0519
Work culture ($X_{5)}$)	0.038	0.00052	0.003852
Business motivation (X_6)	-0.14	0.00575	-0.13425

Based on Table 1, it is known that the work period variable (X_3) has the greatest positive influence compared to other variables. Age variable (X_1) has the greatest direct effect compared to other variables. Based on path and correlation coefficients found in the path models, they can be described in Figure 1.
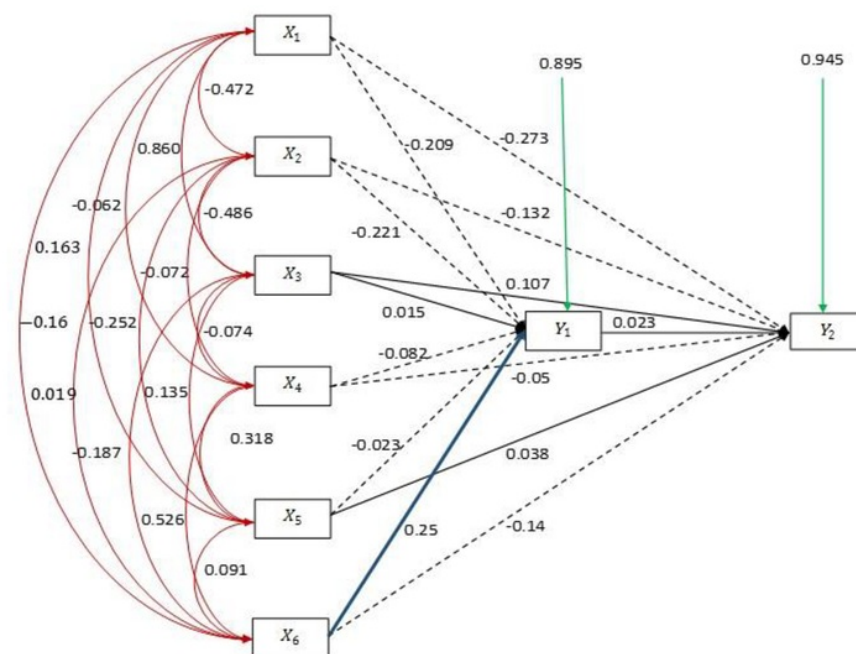
Description:
↔ : correlation among exogenous variables
→ : no significant effect
→ : have significant effect
- - → : have negative effect
→ : the effect of residu variable

Figure 1. Path diagram of productivity of songket weavers in Desa Limbang Jaya.

In Figure 1, exogenous variables X_3 and X_5 have no significant effect on endogenous variable Y_1. Exogenous variable X_3 has also no significant effect on endogenous variable Y_2. Exogenous variables X_1, X_2, X_4 and X_5 have negative effects and no significant effect on productivity variable Y_1.

The other side, X_1, X_2, X_4 and X_6 have negative effects and no significant effect on income variable Y_2. Business motivation variable X_6 has a significant effect on productivity (Y_1) Age variable X_2 has negatively significant effect on productivity variable Y_1.

4. Conclusion

Based on path analysis, the characters that have significant effect on productivity of songket weavers in Limbang Jaya are age and business motivation. For $\alpha = 10\%$, there is no variable that has significant effect on songket weavers income either directly or indirectly.

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