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To cite this article: S. Setyaningsih 2017 *IOP Conf. Ser.: Mater. Sci. Eng.* **166** 012004

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Causal relationship model between variables using linear regression to improve professional commitment of lecturer

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Abstract. The main element to build a leading university requires lecturer commitment in a professional manner. Commitment is measured through willpower, loyalty, pride, loyalty, and integrity as a professional lecturer. A total of 135 from 337 university lecturers were sampled to collect data. Data were analyzed using validity and reliability test and multiple linear regression. Many studies have found a link on the commitment of lecturers, but the basic cause of the causal relationship is generally neglected. These results indicate that the professional commitment of lecturers affected by variables empowerment, academic culture, and trust. The relationship model between variables is composed of three substructures. The first substructure consists of endogenous variables professional commitment and exogenous three variables, namely the academic culture, empowerment and trust, as well as residue variable ε_y . The second substructure consists of one endogenous variable that is trust and two exogenous variables, namely empowerment and academic culture and the residue variable ε_3 . The third substructure consists of one endogenous variable, namely the academic culture and exogenous variables, namely empowerment as well as residue variable ε_2 . Multiple linear regression was used in the path model for each substructure. The results showed that the hypothesis has been proved and these findings provide empirical evidence that increasing the variables will have an impact on increasing the professional commitment of the lecturers.

1. Introduction

An understanding of the lecturers as executors of University Tridharma need to be supported by a commitment to the profession. Lecturers are expected to serve as experts in their respective sectors in accordance with the progress of science and technology and development of society. Lecturers who have high professional commitment to be easily powered by its leaders. In addition, lecturers should be able to improve the qualifications and educational strata, applying academic culture, and willing to work to improve the welfare of lecturers as well as activities in the community. The parameters of the development of lecturers in carrying out its duties and functions not only can be seen from the productivity of the implementation of University Tridharma, but normatively can be seen from the level of education and the functional career of the lecturers. Lecturers who have high trust towards the organization will accept the values and goals of the organization, willing to work in earnest on behalf of the organization, and have a strong desire to maintain membership in the organization.

Determination of the sample has been proportionally based on the amount of scattered lecturer at each faculty. Target respondents were conducted with a random using proportional random sampling technique from Cochran formula that involves the determination of the sample size or enter the characteristics contained in the population. Therefore, the minimal sample size will be able to reflect the actual conditions of the population. Cochran formula in determining the sample size is not only expensive but also enter the alpha level of the characteristics contained in the population. Calibration

of the instrument in this study include instrument validity test and reliability test. Research instruments to be valid, therefore, before further research is held, each item of each variable instrument should be analyzed to see the relationship between the scores of each item with the total score or correlation in a variable. The type of validity used is internal validity or the validity of which was obtained using Pearson Product Moment Correlation. Reliability of the items to a valid instrument variables were analyzed through Cronbach Alpha.

2. Linear Regression

In this section, the hypotheses generated from the research framework defined by the model Path. In connection with this, the data analysis technique used is path analysis with correlation analysis method is done partially or jointly. Tests done after the data is collected using multiple linear regression analysis, the analysis used to determine the influence of empowerment, cultural, academic and trust to the professional commitment.

Model of the relationship between variables is composed of three substructures, namely:

Substructure-1: $Y = \beta_{y1}X_1 + \beta_{y2}X_2 + \beta_{y3}X_3 + \epsilon_y$,

Substructure-2: $X_3 = \beta_{31}X_1 + \beta_{32}X_2 + \epsilon_3$

Substructure-3: $X_2 = \beta_{21}X_1 + \epsilon_2$.

As for testing the assumptions used tests for normality and linearity test. Normality test aims to determine whether a data error estimates normal distribution or not. Good data is the data had normal or nearly normal distribution through the test Liliefors (L).

3. Statistical Hypothesis

Statistical hypothesis in this study is based on testing of empirical data obtained through a survey of respondents. Statistical hypothesis is formulated as follows:

- | | | |
|------------------------------|------------------------------|------------------------------|
| 1. $H_0 : \beta_{y1} \leq 0$ | 2. $H_0 : \beta_{y2} \leq 0$ | 3. $H_0 : \beta_{y3} \leq 0$ |
| $H_1 : \beta_{y1} > 0$ | $H_1 : \beta_{y2} > 0$ | $H_1 : \beta_{y3} > 0$ |
| 4. $H_0 : \beta_{31} \leq 0$ | 5. $H_0 : \beta_{32} \leq 0$ | 6. $H_0 : \beta_{21} \leq 0$ |
| $H_1 : \beta_{31} > 0$ | $H_1 : \beta_{32} > 0$ | $H_1 : \beta_{21} > 0$ |

4. Data Analysis and Discussion

The data in this study using primary data which obtained through questionnaires distributed directly to the lecturer as respondents in every faculty in Pakuan University. Questionnaire distributed is as much as 135 questionnaires. Using the formula for the proportion of the sample, the determination of sample size proportional to each work unit is determined as follows:

Table 1 The distribution of lecturer samples per-faculty

No.	Faculty	Academic level of Lecturer			Sum
		Expert assistant	Lector	Associate Professor	
1	Law	3	10	3	16
2	Economy	8	15	5	28
3	Math. & Nat. Sciences	13	15	7	35
4	Fac. Of Education	7	9	7	23
5	Letters	3	8	3	14
6	Technic	2	10	7	19
	Total	36	10	7	19

5. Calibration of Instruments

5.1. Validity Test

Research instruments to be valid, therefore, before being held for further research, every grain of variable instruments should be analyzed the relationship between the scores of each item with the total score (correlation in the variable). The validity of the type used is the internal validity or the validity of which was obtained using Pearson Product Moment correlation, using the test criteria.

From these calculations generated that grains are valid and not-valid (dropped). With a significance level of 5% and $n = 30$ with 0.361 correlation value. The validity of the instrument is determined by comparing with $r_{\text{calculated}}$ with r_{table} .

- a) If $r_{\text{calculated}} > r_{\text{table}}$, those items are declared as invalid, and will be used for data collection.
- b) If $r_{\text{calculated}} \leq r_{\text{table}}$, those items are declared as not valid.

5.2. Reliability Test

Test for reliability against the grain of the instrument from a valid professional commitment was analyzed using Alpha Cronbach, which determines the values of the variance of each item and then calculating Alpha Cronbach reliability coefficient. Instrument reliability coefficient calculation performed after an invalid item (drop) is not used in this calculation. By using references from Anderson and Hair, if the value of Alpha Cronbah coefficients greater than 0.70 ($r_{11} > 0.7$) means that reliability is sufficient (sufficient reliability).

5.3. Testing of Requirements Analysis

Before implementation the path analysis, data must meet several requirements for statistical tests, namely:

5.3.1 Normality Test for Errors

For the normality of the distribution of the error used Liliefors Test. Testing for normality error is performed to determine that the observed sample derived from normal distributed population. Conditions in the test of error is when H_0 is accepted in error estimates ($Y - \hat{Y}$) normal distribution, and if H_0 is rejected because of an error of estimate ($Y - \hat{Y}$) is not normal.

Testing for normality Liliefors (L), with the testing criteria at significance level $\alpha = 0.05$ as follows: H_0 accepted if $L_{\text{calculated}} < L_{\text{table}}$ and H_0 will be rejected if $L_{\text{calculated}} > L_{\text{table}}$.

Based on the results of the overall calculation error normality test, in this study can be seen in the summary in Table 2 below:

Table 2. Error Normality Test Summary

No	Error Estimation	n	$L_{\text{calculated}}$	L_{table}		Decision
				$\alpha = 0,05$	$\alpha = 0,01$	
1	Y to X_1	135	0.06	0.08	0.09	Normal
2	Y to X_2	135	0.07	0.08	0.09	Normal
3	Y to X_3	135	0.06	0.08	0.09	Normal
4	X_3 to X_1	135	0.04	0.08	0.09	Normal
5	X_3 to X_2	135	0.05	0.08	0.09	Normal
6	X_2 to X_1	135	0.07	0.08	0.09	Normal

5.3.2 Significance test and Linearity of Regression Coefficients

The last test is required prior to analysis is the significance test and linearity of regression models. Linearity test aims to test whether the regression line of the independent variable on the dependent variable has a linear relationship or not.

If two mentioned data is linearly related, it is predicted that these two variables have a unidirectional relationship. To test the linearity of the data used F-test, with the testing criteria as follows:

H_0 : Regression Model is figured as linear, if $F_{calculated} \leq F_{table}$

H_1 : Regression Model is figured as non linear, $F_{calculated} > F_{table}$

Testing the hypothesis of linearity test performed as follows:

Table 3 Results Summary of Linearity Test of Regression Model

No	Relationship Model between Variable	F- calculated	F- table ($\alpha = 0,05$)	F-able ($\alpha = 0,01$)	Test results of Linearity Pattern
1	Y to X_1	0.92	1.49	1.77	Linear
2	Y to X_2	1.69	1.49	1.77	Linear
3	Y to X_3	1.04	1.49	1.77	Linear
4	X_3 to X_1	1.45	1.49	1.77	Linear
5	X_3 to X_2	0.91	1.49	1.77	Linear
6	X_2 to X_1	1.65	1.49	1.77	Linear

6. Model Analysis

The model of the relationship between variables in the substructure-1 consists of an endogenous variable professional commitment (Y) and three exogenous variables, trust (X_3), academic culture (X_2) and empowerment (X_1), and one variable residue that ϵ_y . Based on statistical analysis using SPSS version 17.0 was obtained the following results:

Table 4. Value of Path Coeffisien at Substructure-1

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	β	Std Error	Beta		
(constant)	39.324	6.875		5.720	0.000
Empowerment (X_1)	0.261	0.060	0.343	4.353	0.000
Academic Culture (X_2)	0.138	0.069	0.171	2.003	0.047
Trust (X_3)	0.157	0.074	0.185	2.124	0.036

Multiple linear regression analysis is used to determine the effect of independent variables, namely empowerment, cultural, academic and trust on the dependent variable professional commitment. The results of multiple linear regression analysis model of the relationship between variables in the substructure-1 of this study are shown in Table 4.

The results of the data analysis are used to create multiple linear regression equation and its interpretation as follows: multiple linear regression equations on the substructure -1 that has been done so that we get the regression equation $Y = 0,343X_1 + 0.171X_2 + 0.185X_3$. In the above table shows that all path coefficients are significant. The results of the analysis proved that for all path coefficients are significant, the model does not need to be fixed. Interpretation of multiple regression equation that occur can be interpreted as follows: a = 39.324 is constant, meaning that if empowerment, academic culture, and trust is equal to zero, then the professional commitment of lecturers amounted to 39.324. Beta = 0.343 is the regression coefficient of empowerment, meaning that with the increasing empowerment of the lecturer, it will further enhance the professional commitment of lecturers with the assumption that academic culture and trust are held as constant.

Beta = 0.185 is the regression coefficient of trusts, meaning that with the increasing trust of a lecturer will further enhance the professional commitment of lecturers with assuming that empowerment and academic culture variables are held as constant.

The relationship model between variables in the substructure-2 consists of the endogenous variables, namely trust (Y) and two exogenous variables, namely academic culture (X2) and empowerment (X1), as well as a residual variable ϵ_4 . Based on this relationship, then the path model on the substructure-2 are as follows: $X_3 = \beta_{31}X_1 + \beta_{32}X_2 + \epsilon_3$.

The result of the calculation through SPSS-17 obtained by the path coefficients or standardized coefficients (beta) on the substructure -2 can be written in Table 5

Table 5 The value of path coeffisien on Substructure-1

Model	Unstandardized Coefficients		Standartized Coefficientsf	T	Sig
	β	Std Error	Beta		
(constant)	43,724	7.141		6.123	0.000
Empowerment (X ₁)	0.350	0.062	0.391	5.615	0.000
Academic Culture (X ₂)	0.472	0.066	0.496	7.127	0.000

From Table 5 above it can be shown that the path model on substructure-2 is $\hat{X}_3 = 0.39X_1 + 0.50X_2$. The coefficient of determination (R²), which is an analysis used to determine how large the contribution of independent variables between empowerment, academic culture, and trust simultaneously to the professional commitment of lecturers, shown in percentages. The value of the coefficient of determination R^2_{X321} amounted to 0.67 (67%).

Table 6. Result Summary of Empirical Model on Substructural-2

Model 1	R	R square	Adjustd R Square	Std Error of the Estimate
	0.817 ^a	0.668	0.663	10.39020

- a. Predictors: (constant), empowerment, academic culture
- b. Dependent variable: trust.

The magnitude of the effect of other variables outside X₁, X₂ to X₃ are:

$$R = \begin{matrix} & X_1 & X_2 \\ & 1 & 0,693879 \\ 0,693879 & & 1 \end{matrix}$$

Inverse Matrix:

$$R^{-1} = \begin{bmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{bmatrix} = \begin{bmatrix} 1,928519 & -1,133816 \\ -1,33816 & 1,928519 \end{bmatrix} \begin{bmatrix} r_{41} \\ r_{42} \end{bmatrix} = \begin{bmatrix} \rho_{41} \\ \rho_{42} \end{bmatrix}$$

$$\rho_{yi} X_i = (R^{-1})(r_{yixk}) = \begin{bmatrix} \rho_{41} \\ \rho_{42} \end{bmatrix} = \begin{bmatrix} 1,928519 & -1,133816 \\ -1,33816 & 1,928519 \end{bmatrix} = \begin{bmatrix} 0,735232 \\ 0,767444 \end{bmatrix} = \begin{bmatrix} 0,390 \\ 0,496 \end{bmatrix}$$

$$\epsilon_i = \sqrt{1 - R^2_{yixk}} \text{ , so } \epsilon_3 = \sqrt{1 - 0,668} = 0,576$$

The relationship model between variables in the substructure-3 consists of the endogenous variable, namely academic culture and the exogenous variable, namely empowerment (X1), as well as a residual variable namely ε_2 . Based on this relationship, the path model on substructure-3 is as follows: $X_2 = \beta_{21}X_1 + \varepsilon_2$. The result of the calculation through SPSS-17 obtained by the path coefficients or standardized coefficients (beta) on the substructure-3 are presented in Table 7.

Table 7. Value of Path Coefficient on Substructure-3

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	β	Std Error	Beta		
(constant)	48.268	8.368		5.768	0.000
Empowerment (X ₁)	0.654	0.059	0.694	11.113	0.000

Path model on substructure-3, $\hat{X}_2 = 0.69 X_1$. The coefficient value of determination $R^2_{X_2|X_1}$ amount 0.48% .

Table 8. Summary of Empirical Model Results on Substructure-3

Model 1	R	R Square	Adjust R Square	Std Error of the Estimation
	0.694	0.481	0.478	13.614

Dependent variable: academic culture

The magnitude of the effect of other variables outside X₁, X₂ to X₃ are:

$$R = \begin{bmatrix} X_1 & X_2 \\ 1 & 0,693879 \\ 0,693879 & 1 \end{bmatrix}$$

$\rho_{21} = r_{21} = 0,693$ dan $R^2 = 0,481467$

$$\varepsilon_i = \sqrt{1 - R^2_{yixk}} \text{ , so } \varepsilon_2 = \sqrt{1 - 0,4811467} = 0,72$$

Path Diagram of the Research:

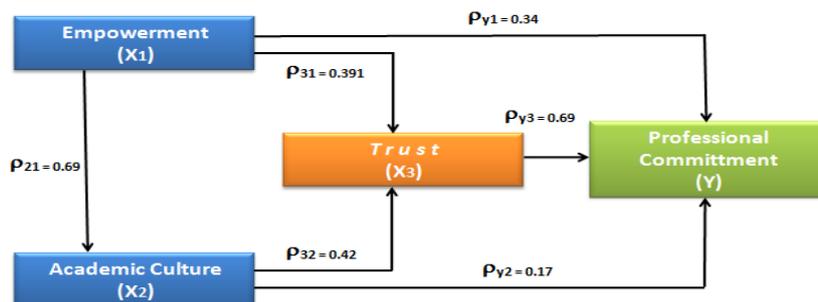


Figure 1. Path Diagram of the Research

7. Hypothesis Test

After analysis of the structural model has been done, the final result obtained is used to test the hypothesis in order to determine the direct and indirect effect between variables. The proposed hypothesis inferred through path coefficient value calculation, recapitulation hypothesis testing, and significance for each stream studied.

Level of significance = 0,05 or 5%, degrees of freedom (dk)= n-1-k. Table Value = $t_{\frac{\alpha}{2}}(n - 1 - k) = (0,05/2;34-1-3) = 0,025; 30=1,97$.

Table 9. Recapitulation of Hypothesis Test

Variable	Path Coefficient	T _{calc.}	t _{table}	Test Decision
X ₁ to Y	$\rho_{y1} = 0.34$	4.35	1.97	H ₀ rejected, H ₁ accepted. There is a direct positive influence between professional commitment and empowerment
X ₂ to Y	$\rho_{y2} = 0,17$	2.00	1.97	H ₀ rejected,H ₁ accepted. There is a direct positive influence between academic culture and professional committment
X ₃ to Y	$\rho_{y4} = 0,19$	2.12	1.97	H ₀ rejected, H ₁ accepted. There is a direct positive influence between trust and professional committment
X ₁ to X ₃	$\rho_{41} = 0,39$	5.62	1.97	H ₀ rejected, H ₁ accepted. There is a direct positive influence between empowerment and trust
X ₂ to X ₃	$\rho_{42} = 0,50$	7.13	1.97	H ₀ rejected, H ₁ accepted. There is a direct positive influence between academic culture and trust
X ₁ to X ₂	$\rho_{21} = 0,69$	5.77	1.97	H ₀ rejected, H ₁ accepted. There is a direct positive influence between academic culture and professional committment

8. Conclusions

Variables: empowerment, academic culture, and trust have a positive direct impact toward professional commitment of lecturers, this result proved through the following test:

1. Multiple linear regression analysis through three models of the substructure. The results of multiple regression analysis equation is: Substructure-1 $\hat{Y} = 0,343X_1 + 0.171X_2 + 0.185X_3$. Substructure-2 $\hat{X}_3 = 0.39X_1 + 0.50X_2$. substructure-3, $\hat{X}_2 = \beta_{21}X_1$. Multiple linear regression above proves that the variables empowerment, academic culture, and trust has a positive direct effect toward professional commitment, among the most dominant variable is empowerment.
2. T-test is a simple test of significance correlation between variables, indicate that variables empowerment, academic culture, and trust has a significant influence toward professional commitment because of the value t_{count} is greater than the value t_{table}.
3. F_{test} is testing the significance of regression between variables. Results of the F_{test} proved that empowerment, academic culture, and trust affect the professional commitment of lecturer since F_{count} is greater than the value of F_{table}.
4. The results of the test coefficient of determination (R²) proves that empowerment, academic culture, and trusts have positive influence toward professional commitment of 67.4%, and the remaining 32.6% is influenced by the other variables that are not used in this study, such as career development for lecturers and the performance appraisal system of lecturers.

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