

## PATH ANALYSIS TO ASSESS INTERACTION AMONG TRACER STUDY FACTORS

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### ABSTRACT

*This paper is intended to analyze the relationships among variables in tracer study using Path Analysis. Tracer study is activity to trace situation of alumni, especially to know how the learning process in university affect alumni's success. Alumni success is measured by Using 7 variables from National Accreditation Bureau for Higher Education (BAN –PT); it is found that all predicted relationship among the 7 variables has significant value. However, only one variable (English Language) that shows significant relationship to alumni's success. From the analysis, the result occurs because alumni's success is measured using salary rate and period to get first job (has been converted to certain interval scale). From rough data, it is found that salary rate for first time job is almost the same for every company.*

**Key words:** *Tracer Study, Alumni's success, Path Analysis*

### 1. INTRODUCTION

Alumni performance is something importance that should be known. One indicator of institution success is society acceptance for the alumni. Alumni performance is influenced by many educational aspects during their studying period

Alumni performance is assessed by using tracer study activity. Tracer study is study about education institution's graduate. Tracer study provides information for evaluating education process and results, and later could be used for improving quality assurance of educational process in the institution.

According to National Accreditation Bureau for Higher Education (BAN –PT, tracer study activities has 7 aspects that should be assessed, including professionalism, team work, ICT knowledge, self development, integrity, communication, and English language.

From previous research, tracer study has been done to assess performance of alumni from Industrial Engineering Department, Atma Jaya Catholic University of Indonesia

by using those 7 aspects from BAN-PT. In these previous research, House of Quality (HOQ) method is used to analyze the result (Carolin, 2010),(Juliana, 2010),(Yuhanes, 2012). The main result of this research is user requirement and learning process that are prioritized to improved, both from alumni and user's (company where alumni works) point of views.

These research further continued by developing relationship model among the 7 BAN-PT aspects (Imayanti, 2012). The aspects are related to aspect of alumni's success after graduate. Alumni Success is assessed by grading first salary and time to get first job. The main results are identification of aspects and factors that strongly effect alumni performance.

Using the same model from previous research (Imayanti, 2012), this paper will discuss the relationship among 7 BAN-PT aspects and alumni's success using path analysis method. Based on calculation and analysis, it will be assessed whether these two approaches will give similar recommendation.

Therefore, the objectives of this paper is to analysis relationship among tracer study

aspects and alumni's success using Path Analysis method

## 2. THEORITICAL BACKGROUND

### 2.1. Path Analysis

Path analysis was developed as a method of decomposing correlations into different pieces for interpretation of effects (e.g., how does parental education influence children's income 40 years later?). Path analysis is closely related to multiple regressions; it could be said that regression is a special case of path analysis.

There are customs about displays and names of things in path analysis.

- Arrows show assumed causal relations.
- A single-headed arrow points from cause to effect.
- A double-headed, curved arrow indicates that variables are merely correlated; no causal relations are assumed.
- A *path coefficient* indicates the direct effect of a variable assumed to be a cause on another variable assumed to be an effect.

Path coefficients are standardized because they are estimated from correlations (a *path regression coefficient* is unstandardized). Path coefficients are written with two subscripts. The path from 1 to 2 is written  $p_{21}$ , the path to 2 from 1. Note that the effect is listed first. A path analysis in which the causal flow is unidirectional (no loops or reciprocal causes) is called *recursive*.

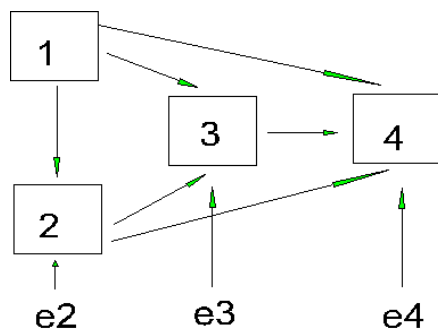


Figure 1. Example of Path Analysis

Points to notice:

1. All possible paths from earlier to later variables are included in this particular graph (1 to 2, 3, & 4; 2 to 3, 4, and 3 to 4). There are no backward paths (e.g. 4 to 1).

2. The only exogenous variable is 1 (it has no arrows pointing to it).
3. There are 3 endogenous variables here (2, 3, and 4). Each endogenous variable is explained by 1 or more variables in the model, plus an error term (e2 - e4). An endogenous variable can be a cause of another endogenous variable, but not of an exogenous variable.

### 2.2. Path Analysis and Structural Equation Modeling

In Path Analysis and SEM, we don't talk about "independent" and "dependent" variables. Instead, we talk about exogenous variables and endogenous variables. To avoid confusion, we say that *an exogenous variable has paths coming from it and none leading to it* (we don't count the curved arrows because they're simply describing correlations among the variables and aren't considered to be paths). Hence, the three H's are exogenous variables. Similarly, *an endogenous variable has at least one path leading to it*. Note also that all endogenous variables have an error term tacked on, which corresponds to the assumption in multiple regressions that the dependent variable is measured with some degree of error.

The assumptions for the type of path analysis we will be doing are as follows:

1. All relations are linear and additive. The causal assumptions (what causes what) are shown in the path diagram.
2. The residuals (error terms) are uncorrelated with the variables in the model and with each other.
3. The causal flow is one-way
4. The variables are measured on interval scales or better. The variables are measured without error (perfect reliability).

Path Analysis with SEM is similar to traditional methods like correlation and regression in many ways. First, both regression and path analysis are based on linear statistical models. Second, statistical tests associated with both methods are valid if certain assumptions are met. Regression methods assume a normal distribution and Path

Analysis assumes multivariate normality. Third, neither approach offers a test of causality.

### 3. METHODOLOGY

#### 3.1. Initial Model Identification

Initial model that is used in this paper was taken from Structural Equation Model (SEM) (Imayanti, 2012). This model consists of 7 interrelated variables (variables A-G) according to BAN-PT guideline book (BAN-PT, 2009). These variables then are related to alumni's success (variable H). The variables are:

1. Professionalism (A)
2. Team work (B)
3. ICT knowledge (C)
4. Self development (D)
5. Integrity (E)
6. Communication (F)
7. English language (G)
8. Alumni's success (H)

Basic assumption of SEM model are: there are some variables which value can not directly assessed (named laten variables), but are assessed based on its exogen variables. However in path analysis, all variables are assumed can be assessed directly. Since initial model in this paper is used model from SEM, then initial path analysis model will only used laten variables from SEM model. The values are calculated using average of related exogen variables.

To assess relation between exogen and latent variables in SEM model, Latent Variables Coefficients (LVC) are used. LVC value is used to assess the strength of correlation between exogen and endogen construct. From previous model, all relations has enough LVC values (0.6 – 0.9). Therefore, all exogen variables are feasible to be used to assess the value of its latent variables. Further, in this paper, average of variables exogen values in SEM model will be used to assess the latent variable. Consequently, there are no more latent variables in path analysis model.

Initial model of path analysis can be seen in figure 2. In this model, term exogen variables are not used as variable that

assessed the value of their latent (endogen) variables, but exogen variable means variable that has no predecessor. Otherwise, endogen variable means variable that has predecessor, the value is influenced (but not directly assessed) by exogen variables. It is also possible that endogen variable is related to other endogen variable.

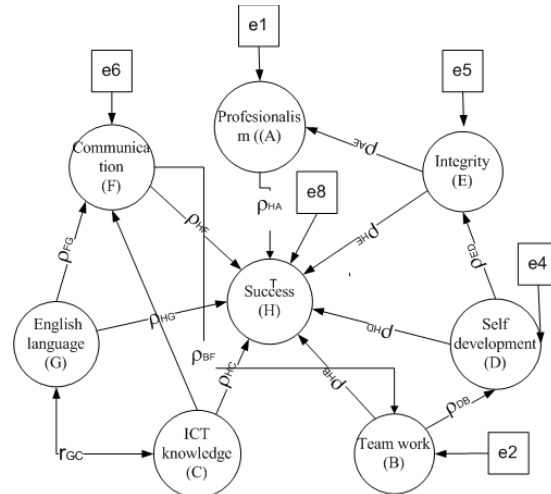


Figure 2 . Initial model of Path Analysis

In this model there are 2 exogen variables (has no predecessor), they are variable ICT knowledge (C) and English Language (G). All other variables are considered as endogen variables.  $\rho$  represents path coefficient between 2 variables and  $r$  represent correlation (two ways) between 2 variables

#### 3.2. Hypothesis Test

The initial path model is analysis using path analysis method, where the calculation is facilitated by using regression analysis and Pearson correlation analysis in software SPSS 13.

##### a. Correlation between variables

Before path calculation, correlation strength between two variables will be calculated. Since the data is assumed to be interval data, correlation value is assessed using Pearson correlation. Correlation coefficient has value between -1 until 1. The closer to value 1 (or -1 for negative correlation), the stronger two ways relationship between those 2 variables. The correlation coefficient is

used to assess indirect relationship between two variables in path model.

**b. Path Coefficient**

Path coefficient is calculated using linear regression approach. Using this calculation, it can be analyzed which path that has significant effect. The hypothesis is

$$\begin{aligned} H_0 &= \rho_{yx} = 0 \\ H_1 &= \rho_{yx} \neq 0 \end{aligned} \quad (1)$$

We used 2 tail hypothesis as H1 because hypothetical proposition does not prerequisite whether effect of variable x to variable y should be positive or negative. Each relation in path model has hypothesis (Ho and H1). Some hypothesis can be seen in table 2. Basically hypothesis is made for all relationship between 2 variables.

Table 1 Hypothesis

No	Hipo tesis	Pernyataan
1	H.1	Faktor kerjasama tim tidak berpengaruh terhadap faktor pengembangan diri
	H1:1	Faktor kerjasama tim berpengaruh terhadap faktor pengembangan diri
2	H.2	Faktor penguasaan teknologi informasi tidak berpengaruh terhadap faktor komunikasi
	H1:2	Faktor penguasaan teknologi informasi berpengaruh terhadap faktor komunikasi
8	H.8	Faktor kerjasama tim tidak berpengaruh terhadap kesuksesan alumni
	H1:8	Faktor kerjasama tim berpengaruh terhadap kesuksesan alumni
	H1:12	Faktor komunikasi berpengaruh terhadap kesuksesan alumni

Significance value (.sig value) in SPSS value indicates probability t-table is greater than t-value. Meanwhile the significance level mean maximum probability allowed that t-table is greater than t-value. Since this research used significance level of 5 percent, we will accept H1 if the significance value is less than 5%. It means the relationship between the 2 variables is significant. Or in other words, it can be said that probability that value difference (as an effect of relationship between variable x and y) is only coincidence has value less than 5 %.

**c. Error**

Based on total correlation value (R), R-square value can be calculated. R-square value shows percentage of diversity in endogen variable that can be explained by its related predecessor variables. High

value of R-square indicates that diversity in endogen variables could be explained by related predecessor variables using linear regression method.

On the other, error value may be adjusted based on R-square value. Error value shows diversity that cannot be explained by the the path. High error value (and small R-square) means it is possible that another variables or path should be included in the model. Error is adjusted using formula

$$e = \sqrt{1 - R^2} \quad (2)$$

**4. RESULT AND DISCUSSION**

**4.1. Result**

Based on initial model, there are 8 variables that related one each other. Using pearson correlation analysis in SPSS software, the correlation can be calculated (table 2).

Table 2. Pearson correlation among variables

	A	B	C	D	E	F	G	H
A	1	0.761	0.599	0.606	0.653	0.636	0.646	0.176*
B	0.761	1	0.657	0.686	0.64	0.607	0.657	0.179*
C	0.599	0.657	1	0.584	0.545	0.576	0.632	0.135*
D	0.606	0.686	0.584	1	0.734	0.739	0.658	0.177*
E	0.653	0.64	0.545	0.734	1	0.704	0.596	0.163*
F	0.636	0.607	0.576	0.739	0.704	1	0.65	0.105*
G	0.646	0.657	0.632	0.658	0.596	0.65	1	0.255
H	0.176*	0.179*	0.135*	0.177*	0.163*	0.105*	0.255	1

\*has no significant correlation in significance level 0.05

From the result it can be seen that variable H (alumni's success) has no significant correlation to other variables, except variable G (english language ability variable).

Still using SPSS software, path coefficient for each path then is calculated using linear regression method. From initial model, there are 6 regression method that can be analyzed.

Table 3. Significance value

Dependent	Independent	sig	Conclusion
Profesionalism (A)	Integrity (E)	0.000	Reject Ho
Team work (B)	Communication (F)	0.000	Reject Ho
Self development (D)	Team work (B)	0.000	Reject Ho
Integrity (E)	Self development (D)	0.000	Reject Ho
Communication (F)	English (G)	0.000	Reject Ho
	IT knowledge (C)	0.005	Reject Ho
Success *	Profesionalism (A)	0.780	Accept Ho
	Team work (B)	0.946	Accept Ho
	IT knowledge (C)	0.729	Accept Ho
	Self development (D)	0.651	Accept Ho
	Integrity (E)	0.738	Accept Ho
	Communication (F)	0.265	Accept Ho
	English (G)	0.070	Accept Ho
Success **	English (G)	0.010	Reject Ho

\* all variable A-G are included in model (using enter method)

\*\* Only var G is included in model (using stepwise method)

Table 3 shows that all relations among tracer study variables has significant value that smaller than 0.05. It means all the relationship are significant. However, different results are obtained for the relations between tracer study variables and alumni's success.

Using enter method (all variables are entered at the same time), all variables have no significant relation to alumni's success. However, if stepwise method is used (each variable is entered one by one), only english language variable (variable H) that has significant relation to alumni's success. Further, calculation is repeated once again by using only variabel english language (H) on path.

Table 4. Path coefficient and Total Correlation Value

Dependent	Independent	Path Coef.	R	R sqr	error = sqrt(1-R sqr)
Profesionalism (A)	Integrity (E)	0.653	0.653	0.43	0.758
Team work (B)	Communication (F)	0.607	0.607	0.37	0.795
Self development (D)	Team work (B)	0.686	0.686	0.470	0.728
Integrity (E)	Self development (D)	0.734	0.734	0.54	0.679
Communication (F)	English (G)	0.477	0.684	0.47	0.729
	IT knowledge (C)	0.244			
Success **	English (G)	0.255	0.255	0.07	0.967

\*\* Only var G is included in model (using stepwise method)

For all significant relations, path coefficients then are identified. From software SPSS, the coefficients are provided in standardized beta. Higher coefficient value means that the independent variables have stronger impact to the dependent variables. Looking at table 4, it is easily found that self development (var D) has the strongest impact to integrity (var E). Therefore, if

want to improve the integrity of student (and alumni), we have to improve the process and opportunity of self developing program.

From the R-square value, it also can be seen that self development variable has impact to 54% diversity occurs in integrity variable. On the contrary, error value shows variance in model that cannot be explained by the model (path).

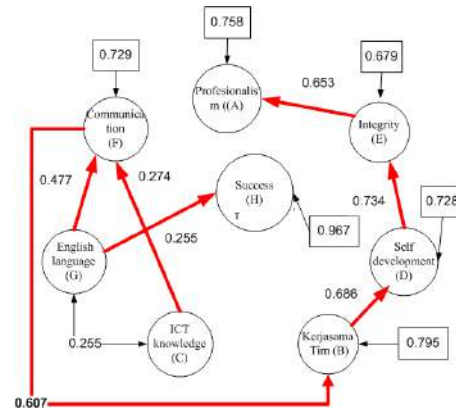


Figure 3. Final Model of Path Analysis

#### 4.2. Discussion

Based on calculation using path analysis as shown in figure 1, it is found that most predicted relationships show significant value, mostly among 7 tracer study variables. However, when the 7 variables are connected to success variable, it shows no significant value. This result is similar to the previous results using Structural Equation Modeling from previous research (Carolin, 2010)

To assess variable alumni's success, average of 2 variables is used, they are: salary rate and period to get first job (has been concerted to certain interval value). From rough data, it is found that salary rate for first timer (from fresh graduate) places on almost similar range, for all alumni. This fact occurs because standard salary in companies where most alumnae work, is almost the same

Beside, time to get first job is also not too different among alumni. This is because usually students in last semester has applied job while they were doing their final project. Hence, when they graduated, most of students already been accepted in a

company and could start work directly. So, time to get first job is very small or even negative, because some student has worked before graduation.

## 5. CONCLUSION

1. All predicted relationships among tracer study variables have significant value of relationship
2. All predicted relationships between each tracer study variables and alumni's success do not significant, This is mainly because first time salary and time to get first job are almost similar for all alumni

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