Testing the Mediation Effect Using Covariance Based Structural Equation Modeling with AMOS

Abstract: Nowadays, most of the researchers prefer to perform their research using Structural Equation Modeling (SEM). Further, this application has been extended to enhance the powerful and momentous of the empirical study in order to let the scholars build probe in deeper. Previously, the introduction to mediator variable in statistical analysis already ensure the scholars to provide their research to enlighten concerning on selected variables besides to create a new phenomenon for researchers. However, most of them are rare to take into account on the type of mediator effect once complete the final stage of analysis. In reality, this application manages to determine the strength of mediator variable in analysis by following step by step approach suggested. Hence, this paper intends to illuminate the conditions of type mediator effect whereby Barrier, Benefit, and Challenges factors as well as steps to perform it on Sobel test prevail. The findings suggest Benefits factor to be a partially mediator effect whereas Barrier and Challenges factors to be non-mediation effect.

Keyword: Structural Equation Modeling (SEM), Mediator Variable, Type of Mediator Effect, Sobel Test

I. INTRODUCTION

Structural Equation Modeling (SEM) is the one of the prominent method to fulfill the requirement of the necessary for most of the researchers nowadays. This method is performed to overcome the limitation of the previous method whereby are old version that initially are false assumption. According to (Afthanorhan, 2013) this application is the integrating of regression analysis and exploratory factor analysis to ascertain scholar provide surveys in a factual assumption. For an example, some of the scholars often use the computation of mean for each variable to analyze their empirical research and of course totally violate the assumption in which the mean of error should be zero.

In the nature of social science, the type of mediation effect is able to let the scholars identify the strength of each mediator variables and competent to capture an attention of scholars to implement particular method for their empirical study. In other words, type of mediator has become enjoyed for some researchers nowadays since this skill probable to expand the contribution of the research paper to present a good knowledge to the readers from a variety of fields and countries across the whole region. The founder namely Cohen (1998) allegation the strength of mediator variable is relies on correlation of coefficient or square multiple correlation \(R^2\) in the model developed. A square multiple correlation is exist once this variable has been exerted by other variables whereby independent or exogenous variables. In particular, the result provided in mediator variable comes upon the independent variable has a causal effect on the particular variables. In the accordance of Daniel Soper (2010), square multiple correlations \(R^2\) higher than 0.80 consider high total variation. In addition, there are three types concerning on testing mediated effect beginning by Aronian (1944) followed of Goodman (1960) and has been improve by Sobel test (1982). All of these types use the z-score or z-test to indicate the significant level for their theory. Apparently, the researchers currently interest to perform their mediated effect on the Sobel test that has been supposed a best and precise according to discover of decline error associated with product distribution problem. In furthers, this work paper practice of the volunteerism subject to execute the testing mediating effect using Sobel test whereby comprise of five variables including of three mediator variables. The three mediators variables is emanating from the discovery of previous empirical research wherein these particular variables is conformity to take account the double explanation in such events. Unambiguously, three mediators variable presume Benefits, Challenges and Barrier.

Dingle (2001) ordains the Governments is better informed about the people who volunteer, it is likely to become more aware of how policy legislation it introduces can affect, both directly and indirectly, people giving of their time. Of this report prove to justify Benefits factor should be treat as a mediator variable due competency to elucidate two vital roles in one time event. Moreover, the same author which expertise on this area of Dingle (2001) also describe three factors that challenges volunteering which can be indirectly among people to involve the volunteerism program and eventually this particular variable should be implement for the required research. In the accordance of Marlene Wilson (1976) and Eva Schindler-Rainman (1987) explores the barrier is the early
mainstream (i.e. not about supported volunteering specifically) volunteer program management literature contains encouraging messages about broadening the base of volunteering. To be reasoning that three mediators variables drive to fulfill the proposing paper to justify the statistical power test using Sobel test regardless of whether these three mediators variable are full, partial or non-mediation.

In specifically, this objective paper is stress on the testing mediated effect using covariance based structural equation modeling with Amos graphic 18.0. Thus, the author skips of regression coefficient to the subsequent step as the aforementioned. This step approach is quietly effortless to provide a better understanding and meant to the readers as well arouse awareness pertaining to mediation effect.

II. MODELLING MEDIATING EFFECT/ INTERVENING EFFECT

Mediation effect can be called as an intervening effect. A mediator is a predictor link in the relationships between two other variables. Normally, a mediator variable can become an exogenous and endogenous variable at same time. By testing for mediational effects, a researcher can explore to examine the influences between these variables. According to (Zainudin Awang, 2010) the mediation have three types mediator which is full mediation, partial mediation, and non-mediation.

For full mediation:
1) The regression coefficient of $X_1$ on $Y$ (or $B_1$) is not significant.
2) The regression coefficient of $X_1$ on $X_2$ (or $B_2$) is significant.
3) The regression coefficient of $X_2$ on $Y$ (or $B_3$) is significant.

For partial mediation:
1) The regression coefficient of $X_1$ on $Y$ (or $B_1$) is significant.
2) The regression coefficient of $X_1$ on $X_2$ (or $B_2$) is significant.
3) The regression coefficient of $X_2$ on $Y$ (or $B_3$) is significant.
4) The value $B_1$ is lower than the product of ($B_2$ multiply $B_3$)

For non-mediation:
1) The regression coefficient of $X_1$ on $Y$ (or $B_1$) is not significant.
2) The regression coefficient of $X_1$ on $X_2$ (or $B_2$) is not significant.
3) Both regression coefficient ($B_1$ and $B_2$) are significant but $B_1$ is higher than $B_1 \times B_2$.

III. MEDIATORS

Mediation analysis or intervening effect permits examination process, allowing the researcher to examine by what means $X$ exerts its effect on $Y$ (MacKinnon, 2000). These hypothesized structural effects led to a proposal of a partially mediated model in which barrier, challenges, and benefits were modeled as the mediator between the predictor variable and the ultimate dependent variable. This partially mediated model was proposed based on Baron and Kenny’s (1986) three required conditions are required for mediation effects. The independent variable must affect the mediating variable. In this instance, the government support predictor must affect the barrier, challenges, and benefits.

1. The independent variable must affect the dependent variable. In this model, government support constructs must have effect on the outcome variable (i.e., motivation)
2. The mediator must have effect on the dependent variable. In this case, the barrier, benefits, and challenges must affect motivation.
3. When these conditions for mediation proposed by Baron and Kenny (1986) were examined, it appeared that the three conditions were met. Testing mediation effect using SEM requires significant correlations between independent variable, mediating variable, and the ultimate dependent variable (Hair et al. 2006).

IV. FINDINGS

This study interest to identify the types of mediator variable based on structural model of Structural Equation Modeling (SEM). We have discussed that this study apply for three mediators which is Barrier, Benefits, and Challenges. There are several steps that should be address to test the mediating effect using structural equation modeling.

1. Construct for each variable with latent construct grounded on the number of items. [e.g.: Benefits factor have 14 items, thus the latent construct should consists of 14 manifest variable (enclosed on rectangular shape)]
2. The first part ensure of each variable endures Confirmatory Factor Analysis [To delete insignificant items (usually lower than 0.60 of items should be drop)]
3. The deletion items should be drop at a one time in order to obtain the minimize loadings. The deletion items at simultaneously prone to gain inaccurate result
4. The required level likely Root Mean Square Error Approximation (RMSEA), Baseline comparison, and parsimonious fit should be achieved. Unfit of measurement model fail to proceed the subsequent analysis
5. Confirmatory Factor Analysis (CFA) can be performed in the pattern of multidimensionality (whole measurement in one default diagram) or unidimensionality (one measurement model) practice.

6. Afterwards, probing the required level of reliability, validity and fitness of measurement model likely Cronbach Alpha, Composite reliability and Average Variance Extracted (AVE). The process of confirmatory factor analysis can be view by Afthanorhan (2013).

7. Then, reframe the path of each variable regarding on pedagogical theoretical framework. In this case, five variables are performed including three mediators variable.

8. As usual, execute the structural model. In this case, this paper liking to use maximum likelihood estimator that has been recognizes as a best formal estimator.

9. Ultimately, obtain the standardized regression weight and the probability values which indicate the significant path.

Exhibit 1: The Procedure for Testing Mediation in a Complex Model

Figure 1 present the structural model with fitness indexes at the edge of image to prove the fitness that required in structural equation model has been triumph as the laid out. Now, the findings is emphasized once achieve the required level for Confirmatory Factor Analysis (CFA) using covariance based structural equation modeling. Exhibit 1 demonstrates the path coefficient of standardized regression weight for causal effect of exogenous variables on endogenous variables perpetrated in AMOS report. Standardized regression weight is the correlation between variables and has been used for scholars to execute comparison for each group. By inspecting through for each row, the Benefits factor is expected to be the highest correlation on Motivation. On the other hands, the Challenge factor is defined as the lowest correlation on Motivation. Means that, Challenge factor has less correlation on Motivation though primarily this particular factor has a tremendous relationship for the previous empirical research. This result might be suspicious due to the vary perception or view of respondents across distinct the targeted population.

Nevertheless, the main objective paper is not to argue the proficiency of each mediator variables but to ascertain the readers learn on how to extend their analysis to be more remarkable aside avert to apply the cumbersome technique that totally amended the wish of scholars to resulting of worth research. The first things are certify which one of the mediator variables is to be interested to apply for the subsequent analysis. In this case, Benefits factor is to be selected first to proceed of testing the statistical power analysis using Sobel test technique. Next, the author reframe for each construct using the findings appear once execute the maximum likelihood estimator as presented in Figure 2, Figure 3, and Figure 4. All of these figures are designed to strengthen the explanation of Sobel test technique for the readers in a modest way.
Our findings of standardised regression weight and probability values (P-value) will be implemented in a new framework as a laid out. Firstly, the indirect effect should be taking into account of Independent variable→ Mediator variable→ Dependent variable of which value of standardized regression weight for both path should be multiplied (e.g.: value of Independent and Mediator * value of Mediator and Dependent). In the accordance of Baron & Kenny (1986) which inherits the Sobel (1982) technique, indirect effect should be higher than direct effect to indicate the mediation effect is occurs in a structural modeling. Means that, anything value related on mediator variable should be higher than causal effect. Logically, the mediation variable is deemed has an influenced to increase or decrease the causal effect of independent on dependent variable. However, if some of the sort cases judges the presence of mediator variable (P-value > 0.05) does not give any shift to affect on the main factor can be defined as non-mediation occurs. Thus, this variables probable might be appropriate to perform as independent variable since does not give any contribution that can give a tremendous advantages in analysis. Of overwhelming techniques has been spread among researchers recently, the non-mediation effect suppose to preserve for the future research. Indeed, we should drawing the deduction based on our findings but it does not mean we should neglect the significant of this variable. Verily, the researchers should be more knowledgeable to form a good presentation to let the outsider interest to apply this technique though non mediation is attained. In other words, the researchers should address the probability value as a first step followed on value of Independent and Mediator * value of Mediator and Dependent calculated. In order to fulfill the requirement of the mediation effect occurs, probability value should be significant (P-value < 0.05) or confidence interval 95%. If either one or both path is insignificant presented stating that the mediation effect is not supposed to be occurs. Subsequently, we press on the calculation between indirect and direct effect as aforementioned. Figure 2, Figure 3 and Figure 4 explained deeper understanding to let the scholar comprehend the flow or process of procedure that has been conducted.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Benefits</th>
<th>Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Figure 2" /></td>
<td><img src="image2" alt="Figure 3" /></td>
<td><img src="image3" alt="Figure 4" /></td>
</tr>
<tr>
<td>✓ The indirect effect = 0.260 x 0.069 = 0.01794</td>
<td>✓ The indirect effect = 0.400 x 0.658 = 0.2632</td>
<td>✓ The indirect effect = 0.286 x 0.015 = 0.00429</td>
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<tr>
<td>✓ The direct effect = 0.115</td>
<td>✓ The direct effect = 0.115</td>
<td>✓ The direct effect = 0.115</td>
</tr>
<tr>
<td>(Government to Barrier) is significant and (Barrier to Motivation) is no significant</td>
<td>Both indirect effect (Government to Benefit) and (Benefit to Motivation) is significant</td>
<td>(Government to Challenge) is significant and (Challenge to Motivation) is no significant</td>
</tr>
<tr>
<td>✓ Non mediation occurs</td>
<td>Since indirect effect &gt; direct effect, the mediation occurs</td>
<td>✓ Non mediation occurs</td>
</tr>
<tr>
<td>✓ In this case, the findings suggest the Benefits factors plays a fundamental character as a mediator effect since achieve the assumption of statistical power proposed</td>
<td>Type of mediation here is Partial Mediation since the direct effect is still significant after mediator enters the model</td>
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V. CONCLUSION AND RECOMMENDATION

To be drawing the conclusion based on the findings revealed, Benefits factor is the only one of mediator variable that meet the requirement to have an influential on Motivation factor using the Sobel technique. The procedure applied in this paper is ease to proper understanding in order to help the scholars probing their...
research with more comprehensive. In the nature of social sciences, the explanation should be easier to understanding without the use of the conceptual of mathematics theory. Initially, this proposing works paper was to identify the type of mediator in a structural model using the particular technique. To date, the researchers could know when to use this factor since the mediator variable is also crucial to examine the contribution of Government Support towards the level of involvement in volunteerism program. In this case, Benefits are the only one could give an impact on Motivation. Thus, we can conclude that this factor tends to increase or decrease an impact of research subject and of course this factor can be used for the future research.

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