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STUDENT INNOVATION COMPETENCY MODEL EXAMINATION: STUDENTS OF UNIVERSITAS TERBUKA, IPB UNIVERSITY, AND UNIVERSITAS PAKUAN BOGOR 2020

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ABSTRACT

The Society 5.0 era has become an opportunity in the education industry to contribute optimally, especially for universities in Indonesia. Higher education institutions must provide human resources (HR) to compete in science and scientific practice. The research aims to identify the innovation competency development model on academic participants in universities and analyze factors that affect the innovation competencies of students at the college level. This study used a quantitative explanatory method to explain variables that significantly influence shaping student innovation competencies. Respondents were taken from three universities, conducted from May to October 2020. There were 162 students selected as research samples. The study findings suggest that not all research variables have significant influences on student innovation competencies. The research suggests two variables that have significant effects on shaping student innovation competencies. Both variables are critical thinking and social networking. In detail, critical thinking is reflected best by estimating the risks and variables of social networks reflected strongest by building synergy with external parties.

Keywords: *Critical thinking, social networking, innovation competence, PLS-SEM.*

1. INTRODUCTION

Indonesia will soon be entering the Society 5.0 era. This condition becomes an opportunity and a challenge for the education world in Indonesia, including universities in Indonesia. Higher education institutions are required to provide human resources that can compete in science and scientific practice. In order to be able to produce student resources that can take part in the 5.0 era, it takes hard work and integration of all stakeholders within the higher education, notably in improving student innovation in facing the job market demands. Innovation, by definition, is something new or a change in doing or seeing something (Rubio, 2012). Innovation can be ideas, behaviors, knowledge, skills, products, services, and processes.

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Studies on innovation are found in management and agriculture, but not much in higher education environments. However, according to Jucevičius (2007), the culture of innovation is undoubtedly part of the organizational culture and management concept.

There are three cultural aspects of this concept: culture has many layers (i.e., values, norms, beliefs, and basic assumptions); this layer needs to be distributed among institutional members (students, faculty members/academics, support staff, administrators, and board members); Innovation has a vital position especially in eliminating problems related to educated unemployment. Currently, the problems faced by students and universities are the high rate of educated unemployment. The high educated unemployment number allows opportunities for universities to innovate in managing administrative and academic activities.

Student innovation competencies can be obtained in various ways, and one way is by building students' entrepreneurial spirit. It is necessary to develop a curriculum in enriching aspects of entrepreneurship to achieve this. This fact may be a solution in unraveling the educated unemployment number currently in Indonesia. Students are expected to acquire creative and innovative thinking skills from learning processes that stimulate their analytical and psychomotor skills. They can have more experience through practices conducted in learning that are expected to be implemented in the real world or after graduation (Harnani et al., 2020).

Through innovation and skilled human resources, Indonesia will have the competitiveness in the industry, both domestic and overseas, to support the National Economy development.

This study will focus on picturing the innovation competency model in universities viewed from a vital perspective on skill position and innovation. Innovation competencies referred to in this study are innovation competencies for students and students. Innovation competency is needed in shaping the quality of education. Therefore, the importance of innovation competencies needs to be internalized by all academic communities in universities. Five main variables assumed to affect innovation competencies based on the terms of reference of the Turku University of Applied Science, Finland is (1) Creativity, (2) Critical Thinking, (3) Initiatives, (4) Teamwork,

(5) Social Networking. This variable is theoretically a factor that can drive the innovation competence of a college. Based on the description above, this study aims to: (1) identify the model of innovation competency development of academic participants in universities and (2) analyze the variation of factors that affect the innovation competencies of students in universities.

2. LITERATURE REVIEW

- Innovation

  One's innovativeness is defined as a behavior that demonstrates the level of innovation that a person has done. In this research, innovation competency is defined as the level of capacity of students in innovating in the context of learning

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activities and activities of student organizations. According to Schermerhorn et al. (2010), innovation is also defined as generating new ideas and applying those ideas in real action. In addition, innovation is also defined as creative thinking and can be applied in daily activities to make better administrative services.

- Innovative Learning

  Students involved in innovative classroom learning activities must have unique skills and competencies (Kivunja, 2014; Quintana et al., 2016; Vila et al., 2012). Kivunja (2014) states that the key to teaching creativity and innovation lies in creating a learning environment where students can solve problems in the "real world" and be open to change. Meanwhile, Vila et al. (2012) described that solution-focused learning could improve the innovation competence for college students. Furthermore, Hu et al. (2016) explained that an innovative curriculum could improve students' innovative competencies. Developing an innovative curriculum will require prerequisites such as attitudes and behaviors, methods, perspectives, enthusiasm, and a supportive learning environment. An alternative paradigm of pedagogic learning is required to develop competence in innovating that makes learning closer to daily practice.

- Innovation Competency

  Several previous studies have discussed innovation (e.g., Hu et al., 2016; lesson material skills by Suharyati et al., 2016). For example, in previous research, innovation competency is only narrowly defined as focusing only on creativity skills, measuring teacher competence, or as a perspective of students' self-perception and not based on action. or behavior. Innovation competencies should also be targeted to build a technical learning environment, such as examining teaching or general perception of training or education. In general, attributes that can shape innovation competencies are related to transversal competencies. However, according to Suharyati et al. (2016), there is currently no valid and completed framework for studying student behaviors or actions required at different stages of learning. The innovation process also developed in an educational context. Furthermore, Marin-Garcia et al. (2013) pointed out a research gap between academic literature around its innovation competence and measuring and developing the concept.

  Competency is a holistic concept that describes one's ability to manage in a particular context (Mulder, 2012). According to Marin-Garcia et al. (2013), competency, skills, and abilities can be considered three categories of contextual knowledge complexity. First, competencies consist of a set of skills, and these are, in turn, shaped by different skills, all of which are prerequisites for increasingly complex professional performance. Second, competence can be described as a complex knowledge of acting through effective mobilization and combining different internal and external resources in one situation (Marin-Garcia et al., 2013). Edwards-Schachter et al.

  2015 in Suharyati (Learning Perspective et al., 2016) added one competency-based approach. They emphasize that all skills can be learned and taught as part of an integrated personal development process in an educational environment.

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3. ORIENTATION AND RESEARCH APPROACH

- Research Design

  This study of student innovation competency uses an explanatory quantitative method to explain which variables have the most substantial influence in shaping student innovation competencies. According to Singarimbun and Efendi (2008), exploratory research is research aimed at testing hypotheses to look at causality and between variables that have been built. This study will examine students' perceptions of three universities representing the main and independent clusters: innovation competencies, critical thinking, creativity, initiative, teamwork, and networking skills, which will be portrayed on student innovation competency and students from research sites.

- Research Location and Time

  This research was located in three universities: Open University (UT), IPB-University, and Pakuan University. The research site selection was conducted purposively based on consideration of universities with distance learning systems – remote and face-to-face, and universities that come from the primary and independent clusters. This research has been conducted since April-October 2020.

- Observed Modifiers

  This study aims to answer two questions; identifying the development of the student innovation competency model and analyzing factors that can improve innovation competencies. Based on both research objectives, several variables were developed as follows: (1) Student innovation competency, (2) student teamwork ability level, (3) Student networking ability, (4) Student Initiative, (5) Student creativity level, (6) Student critical thinking ability.

- Population and Research Samples

  The population in the study was students from three universities, i.e., Open University, IPB- University, and Pakuan University. Estimating parameters with the Maximum Likelihood method requires critical assumptions such as a sample size of at least 10-15 times multiplied by many indicators, or at least 100 observation units. The data spread following the average spread (Ulum et al., 2014). Sampling techniques used in this study were non-proportionate simple random sampling. There were 160 students as respondents in this study. The study used a survey approach by sharing questionnaires to respondents at three sample universities.

- Research Design

  The research was designed using quantitative methods with an explanatory approach to explain which dominant variables shape innovation competencies. According to Singarimbun and Efendi (2008), explanatory studies are hypothesis testing that aims to explain the causal relationship between research variables and test hypotheses formulated before. The dependent variables in this study are the lecturer's innovation competency (Y). In addition, there are three independent variables and two intervening variables in this study, which are theoretically assumed to affect the lecturer's innovation competency.

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This study will examine lecturers' perceptions of three universities representing both main and independent clusters on innovation competency, critical thinking, creativity, initiative, teamwork, and networking skills. This way, the level of innovation competency will be drawn from lecturers and students from the research site.

- Research Location and Time

  The first- and second-year research will be conducted at three universities: Open University (UT) (which represents State Universities with distance education system), IPB University (representing State Universities with non-remote education system), and Pakuan University (representing Private Universities). These three universities are purposively selected to represent public and private universities, with conventional education systems and distance education systems, and significant and independent cluster universities. The first-year research was conducted from January 2020 to December 2020.

Observed Modifiers

- Observed Variables

  This research intended to answer two fundamental issues related to innovation competency; what model of innovation competency development of lecturers and students is, and a comparison of lecturers and students' innovation competencies from Open University, IPB-University, and Pakuan University. Should these two research questions derived into several variables, they would be as follows: (1) Lecturers' innovation competency, (2) Lecturers team's ability level to cooperate, (3) Lecturers' ability to network, (4) Lecturers' initiative, (5) Lecturers' creativity level, (6) Lecturers' critical thinking ability.
- Population Definition and Research Samples

  The population in the study were lecturers and students from Open University, IPB-University, and Pakuan University. Methodology-wise, SEM-PLS has several roles as a system of simultaneous equations, linear causal analysis, path analysis, covariance structures analysis, and structural equations models. Estimating parameters in SEM or commonly known as SEM-based Covariance (CBSEM), usually use the Maximum Likelihood approach method. In evaluating the model, this Maximum Likelihood method requires a large sample, and the data should be normal multivariate. Estimating parameters with the Maximum Likelihood method requires some critical assumptions, such as a sample size of at least 10 – 15 times the number of indicators or more than 100 observation units. The data spread following the average spread (Ulum et al., 2014).

  Sampling techniques used in this study were non-proportionate simple random sampling. There was a total of 150 students. The study used (1) a survey approach by sharing questionnaires against which to be shared across three sample universities.

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4. FINDINGS AND DISCUSSIONS

Characteristics of Respondents

Table 1.
Distribution of Respondent Data Based on Faculty Origin

Faculty Origin	Frequency (People)	Percentage (%)
Nature, Math and Science, and Engineering	35	21.61
Economics Management and Business	18	11.11
Social, Cultural, and Human Ecology	60	37.03
Teaching and Education Science	16	9.88
Vocational Schools/Diploma	33	20.37
Total	**162**	**100**

In Table 1, respondents of this study were from several faculties, such as nature, economic, social, teaching, and vocational schools. Most research respondents were from faculties related to social sciences (Social, Cultural, Law, and Human Ecology) at 37.03 percent, followed by students from the faculty of nature, Math and science, and engineering, with 21.6%. The least respondents were from vocational/diploma schools with 9.88 percent.

Table 2.
Distribution of Respondent Data by Semester

Learning Semester	Frequency (People)	Percentage (%)
1-2	30	18.52
3-4	40	24.69
5-6	43	26.54
7-8	44	27.16
≥ 9	5	3.09
Total	**162**	**100.00**

A learning semester in this research is defined as an active semester of students during this research. Table 2 shows that the respondents of this study were from nearly all semesters, ranging from the first semester to the 9th semester and above. Students from semesters 7-8 have the highest percentage with 27.16%, followed by

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semesters 5-6 and 3-4 with 26.54% and 24.69%. Meanwhile, a minor percentage is from students above semester 9, 3.09%.

Table 3.
Distribution of Data Based on Student Activity in Internal Campus Organizations

Internal Campus Organisation	***Frequency (Orang)***	***Percentage (%)***
Active as Members	*69*	*42.6*
Active as Caretakers	*24*	*14.8*
Inactive	*69*	*42.6*
Total	***162***	***100***

Student activity in the internal campus organization is defined as the student activities in intra- campus organizational activities at the department, faculty, and university levels. Table 3 shows that the percentage among active students as members has the same percentage as students who are not active in student activities, with a percentage score of 42.6%. Nevertheless, when compared directly between students who are active in the organization with students who are not active in the organization, it is seen that a total of 57.4 percent of students are active in student activities both as members and caretakers.

Table 4.
Distribution of Data Based on Student Activity in Internal Campus Organizations

Off Campus Organisation	***Frequency (People)***	**Percentage (%)**
Member	*51*	31.5
Caretakers	*15*	9.3
Inactive	*96*	59.3
Total	***162***	**100**

Off-campus student organization activities are defined as organizational activities that students participate in off-campus. Although from the table, 59.3% of students are not active in off- campus activities, only 40.7% of students are active in student activities either as caretakers or members.

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Student Innovation Competency Model

- Validity and Reliability of Indicators

  The variables in this model consist of six latent variables consisting of five independent variables and one dependent variable. The dependent variables in this model consist of five dimensions where each dimension has five indicators. Model completion can use two approaches, i.e., the repeated indicators approach and the disjoint two-stage approach. When using the repeated indicators approach, calculation of validity, reliability, and discriminant validity is manually calculated, while using two-stage disjoint, there are several processing steps.

  The first phase of testing uses the repeated indicators approach to determine the loading factor, validity, and reliability of independent variables and the dimensions of dependent variables.

  Next, the latent variable value (Y11-Y15) from the repeated indicators approach results is used to test dependent variables' validity, reliability, and discriminant validity in the second stage.

  Next is the two-stage disjoint analysis. The PLS Algorithm testing results show that the indicator's validity is valid as the loading factors value is more significant than 0.5 (Figure1).

  The analysis was continued with the repeated indicators approach, whose model results can be seen in Figure 2. The results of the variable validity test are described with an Average Variance Extracted (AVE) value, which is already larger than 0.5. The reliability per variable described from Cronbach's Alpha, rho A, and composite reliability values have been fulfilled with values greater than 0.6 (Table 5). The discriminant validity value is also quite good because it is less than 0.85 (Table 6).

Table 5.
Reliability and Validity

Variable	*Cronbach's Alpha*	*Rho A*	*Composite Reliability*	*Average Variance Extracted (AVE)*
X1	*0,825*	*0,825*	*0,877*	*0,589*
X2	*0,875*	*0,877*	*0,909*	*0,667*
X3	*0,851*	*0,854*	*0,894*	*0,629*
X4	*0,881*	*0,909*	*0,911*	*0,673*
X5	*0,893*	*0,895*	*0,921*	*0,700*
*Y1**	*0,923*	*0,925*	*0,942*	*0,764*

Note: Italics used for higher-order construct values

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Figure 1.
Early Outer Model

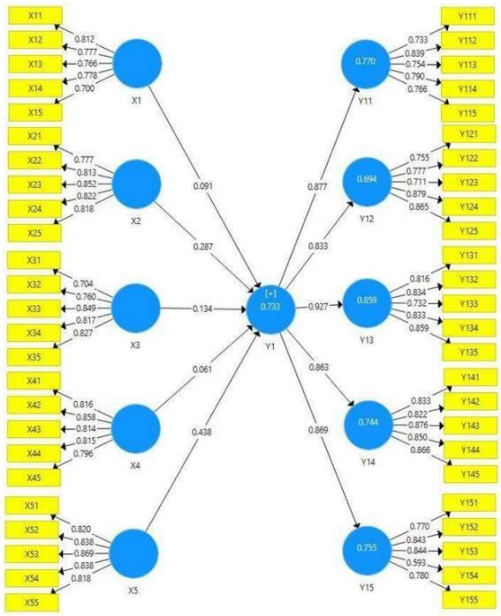

Table 6.
Final Discriminant Validity

	X1	X2	X3	X4	X5	Y1	Y11	Y12	Y13	Y14	Y15
X1											
X2	0,723										
X3	0,723	0,728									
X4	0,581	0,402	0,540								
X5	0,692	0,532	0,625	0,495							
Y1*	0,736	0,710	0,721	0,525	0,768						
Y11	0,702	0,647	0,704	0,530	0,667	-					
Y12	0,619	0,588	0,611	0,551	0,617	-	0,772				
Y13	0,640	0,640	0,668	0,409	0,704	-	0,766	0,712			
Y14	0,596	0,578	0,505	0,340	0,657	-	0,641	0,561	0,787		
Y15	0,656	0,644	0,653	0,461	0,708	-	0,674	0,627	0,763	0,743	

Note: Italics used for higher-order construct values

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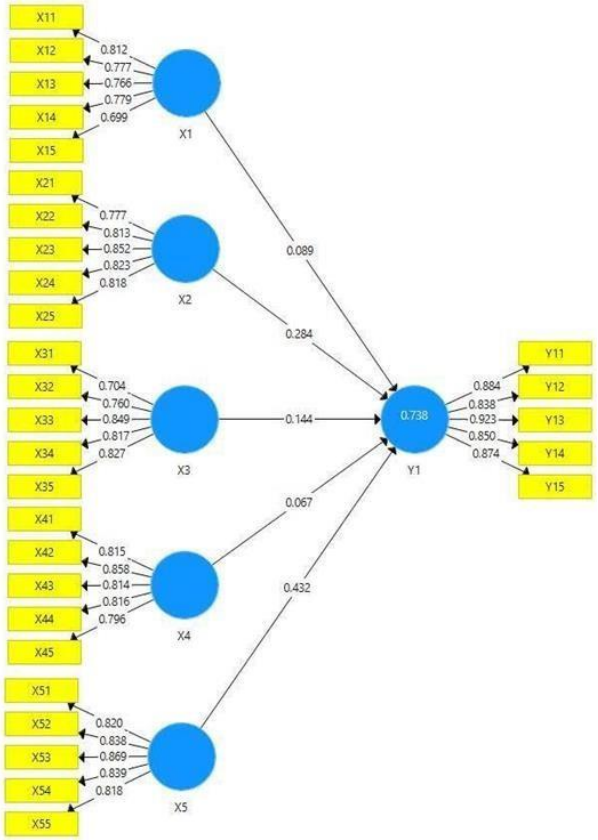
Figure 2.
Disjoint two-stage Outer Model



Based on Figure 1 and Figure 2 above, it appears that:

a. The indicator that best reflects Creativity (X1) is the Diversity of Ideas (X11) indicator, with the most considerable loading factor value (0.812).
b. The best indicator for reflecting Critical Thinking (X2) is the Risk Estimating indicator (X23), with the most considerable loading factor value (0.852).
c. The indicator that is best at reflecting Initiation (X3) is the Convincing Other Party (X33) indicator with the most considerable loading factor value (0.849).
d. The indicator that best reflects Teamwork (X4) is the Accepting Difference (X42) indicator with the most considerable loading factor value (0.858).
e. The best indicator in reflecting Social Networking (X5) is the Indicator of Building Synergy with External Parties (X53), with the most considerable loading factor value (0.869).
f. The best indicator in reflecting student innovation competence (Y1) is the decision-making indicator (Y13), with the most considerable loading factor value (0.923).

Adjusted R2 in this study is 0.730, revealing that the five independent variables can explain the Y1 by 73 %, and other variables beyond the study explain the remaining 27%.

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Table 7.
R Square Student Innovation Competencies

	R Square	R Square Adjusted
Y1	0,738	0,730

Inner Model

The original sample value on the results of the inner model test indicates that the direction of influence of the independent variable on the dependent variable. If the value is positive, then the effect is also positive, and vice versa. The T statistics and P values are seen to determine the significance of independent variables' effect on dependent variables. T statistics greater than 1.96 and p-values is less than 0.05 indicate a significant influence between independent and dependent variables. Table 8 explains that:

a. The Creativity Variable (X1) has no significant positive effect on Student Innovation Competence (Y1).
b. The Critical Thinking Variable (X2) significantly affects student innovation competence (Y1). When X2 is increased 100%, it will increase Y1 by 28.4% significantly.
c. The Initiation Variable (X3) has an insignificant positive effect on Student Innovation Competence (Y1), while
d. The Teamwork Variable (X4) also has no significant positive effect on Student Innovation Competence (Y1).

Table 8.
Mean, STDEV, T-Values, P-Values Student Innovation Competencies

Relation	***Original Sample (O)***	***Sample Mean (M)***	***Standard Deviation (STDEV)***	***T Statistics (|O/STDEV|)***	***P Values***
X1 -> Y1	*0,089*	*0,089*	*0,094*	*0,949*	*0,343*
X2 -> Y1	*0,284*	*0,286*	*0,062*	*4,557*	*0,000**
X3 -> Y1	*0,144*	*0,143*	*0,079*	*1,822*	*0,069*
X4 -> Y1	*0,067*	*0,071*	*0,056*	*1,195*	*0,233*
X5 -> Y1	*0,432*	*0,428*	*0,061*	*7,089*	*0,000**

*Significant at the level of 0.05 with 95% CI

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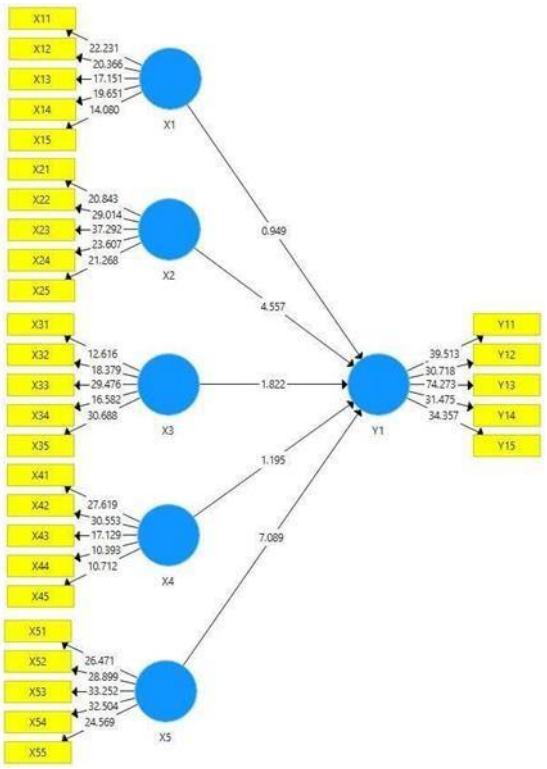
Figure 3.
Disjoint two-stage Outer Model



Not all variables have a strong and significant influence on student innovation competencies. This study observed 2 (two) variables that are strong and significant influences in shaping student innovation competencies: critical thinking variables (X2) and social networks (X5). In a more detailed description, (1) *for student innovation competency models*, critical thinking variables (X2) are reflected strongest by estimating risk (X23), and *social networking variables* (X5) are reflected strongest by building synergies with external parties indicators (X53).

Based on this research results, it is stated in table 7 that student innovation competency has an R- Square value (model goodness) of 0.730, meaning variables in the model can justify student innovation competence by 73 percent. In comparison, other variables beyond our research variables explain 27 percent.

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5. REMARKS

- Conclusion

  Based on the previous discussions, the study revealed two main conclusions, consisting of:

  1. The outer model results of the student innovation development model show that all constructed variables and indicators are reliable and valid. From the inner model result, it is recognized that the model is considered the best since it has an r-square value of 0.730.
  2. Based on the inner model result, two main variables have been identified to have affected the development of student innovation competencies, i.e., critical thinking variables and social networking variables. These variables have significant and strong influence values in driving the improvement of student innovation competencies.

- Suggestion

  The question that should be considered is: what happened that caused only two of the five main variables to have significantly influenced student innovation competency? The following question is: is there a connection with the misalignment between the conceptual, operational frameworks, instruments, and methods used?

  Further research is needed to determine whether only two significant variables with a significant effect are inconsistent results. In the follow-up research, it is necessary to review aspects related to the building of the skeleton based on previous related studies. Then, it is also necessary to look at how to develop the instrument used. Another part to note is the orientation that using PLS-SEM is adequate with the number of respondents included in this study. Alternatively, it could also consider the possibility of increasing the number of respondents and the number of sample universities.

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