

## Information Technology Resources and Innovation Performance in Higher Education

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**Abstract**—Information technology encourages various forms of organizations to always adapt to changes so that they can sustain their business for a long time. Higher education institutions are organizational entities required to use information technology to support existing business processes. This study aims to examine the extent to which information technology resources have an influence on innovation performance in higher education. Quantitative research methods are used to determine this influence by involving 97 respondents who work in higher education institutions in Garut, Indonesia, besides processing and modeling research using SmartPLS. The results of the analysis show that information technology resources have an essential role in creating innovation performance improvement in higher education institutions, especially in terms of product innovation. The research was conducted only at private universities in Garut Regency. Therefore, further research involving universities in a nationwide scope is recommended. The results of this study imply that it is necessary for universities, which are expected to be ready for changes, to involve information technology in the creation of innovation in order for them to survive. The effect of information technology resources on the performance of innovation in private universities in Garut Regency has never been studied before; therefore, we consider that our study provides a novel contribution to the field.

**Keywords**—Information Technology Resources, Innovation Performance, Higher Education Institutions

### 1 Introduction

Every organization is expected to maintain its existence in the competitive business environment [1]. The current global conditions require every organization of all types, including universities, to be able to adapt to dynamic environmental changes (Maulani & Hamdani, 2019). It takes innovative endeavors for universities to face global competition [3]–[5]. In this regard, information technology becomes indispensable and contributes to the current development of globalization [6], [7]. Technology is part of a good business strategy for organizations, including universities, to maintain their existence in global competition [8]–[10].

Higher Education Institutions in Indonesia currently have the largest number in the Southeast Asian region. Every year, the number of universities in Indonesia continues to grow. This indicates that quality competition is there between them. [2]. Therefore, several universities, especially those that are private, must have a business strategy in their organization [5], [7], and it is necessary to be equipped with sufficient resources for this strategy to run optimally. At present, the total number of higher education institutions in Indonesia registered with ministries, both public and private, is 3,276. Higher education institutions (HEI) are spread throughout Indonesia but geographically most concentrated in Java (Maulani & Hamdani, 2019).

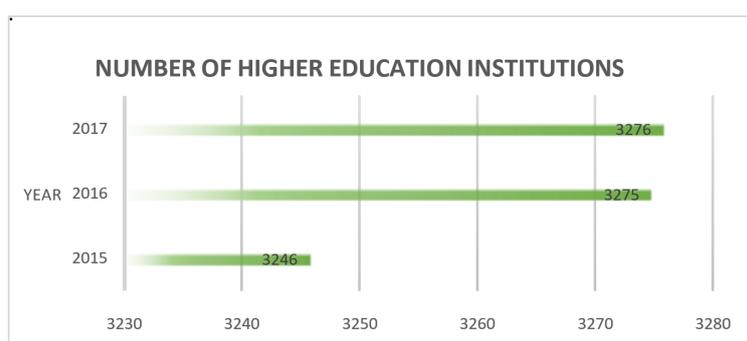


Fig. 1. Growth in the number of universities in Indonesia in 2015 - 2017 (12)

Given the increasingly fierce competitive environment, innovation becomes one of the many factors important in creating a competitive advantage [12]. Information technology can be one of the competitive applied in higher education institutions. However, private universities are built upon independent resources with limited innovation creation value. Private universities are characterized by their dependency on tuition payments. This dependency restricts their innovation performance that requires investment in information technology [5], [13]. This study seeks to examine the influence of information technology resources on the innovation performance of universities.

## 2 Literature Review

Previous studies suggest that innovation performance refers to the achievement of innovation by an organization that carries out organizational activities in fulfilling their desired and measurable targets [14], [15]. Universities can encourage innovation performance by using a variety of technologies from which they gain benefits [16]. Innovation performance can be seen from the way organizations introduce new technologies to encourage the development of new services. This can create a dynamic and flexible environment that can improve innovation performance [17], [18]. Innovation performance can be measured through product Innovation [16], [19] and process innovation [14], [20], [21].

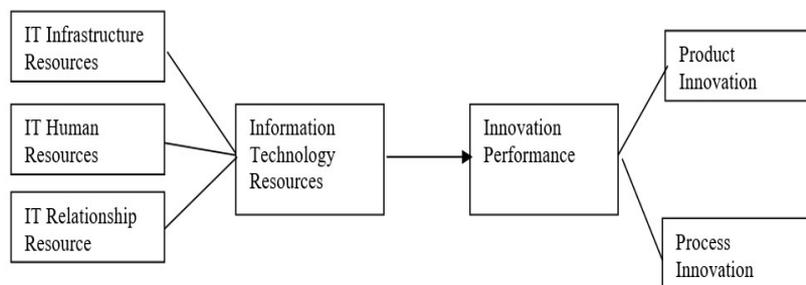
Information technology has an important role and strategic position in the success of achieving the competitive advantage of private universities in Indonesia (Maulani & Hamdani, 2019). The role of information technology becomes strategic, and it becomes a resource of universities in maintaining its existence. Information technology can be optimal provided that its resources are well managed. These resources include information technology relations resources, information technology human resources and information technology infrastructure [22], [23].

### 3 Methodology

This study was conducted using a verification approach. Data were collected from 97 respondents working in higher education institutions located in Garut, Indonesia. These respondents were selected using a non-probability sampling technique. Data analysis was performed using PLS-SEM. Table 1 present the studied variables.

**Table 1.** Research Variables

Variables	Indicators
Information Technology Resources (X)	IT infrastructure Resource (X1)
	IT human resource (X2)
	IT relationship resource (X3)
Innovation Performance (Y)	Product Innovation (Y1)
	Process Innovation (Y2)



**Fig. 2.** Research Model

### 4 Results and Findings

The impact of information technology resources on innovation performance in private higher education institutions is calculated and analyzed using SmartPLS. Fig. 3 presents the resulting modeling.

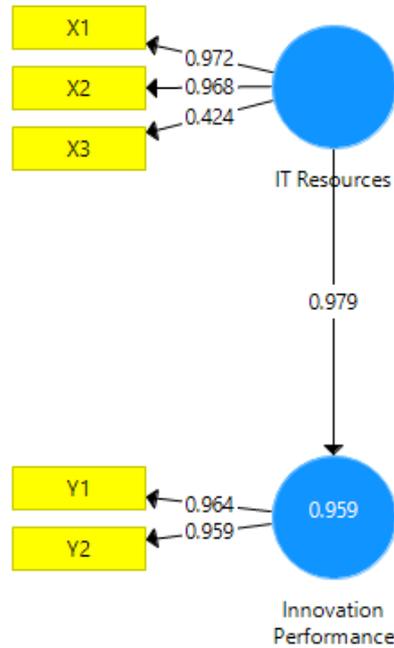


Fig. 3. PLS Modelling

Fig.3 shows that the coefficient value between information technology resources and innovation performance is 0.979, meaning that the influence of information technology resources on innovation performance of private universities is 0.979. In addition, Fig. 3 shows the following:

1. The factor loading values of indicators of information technology resources (X) are as follows: the factor loading value of information resources (X1) is 0.972, of information human resources (X2) is 0.968, and of information technology relationship resources (X3) is 0.434.
2. The factor loading values of indicators of innovation performance (Y) are as follows: the factor loading value of product innovation (Y1) is 0.964 and of process innovation (Y2) is 0.959.

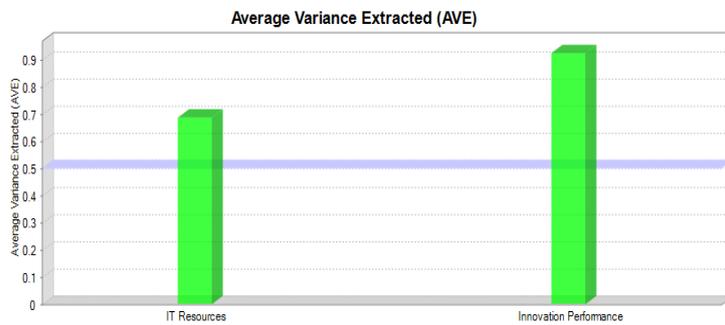
An indicator is stated reliable if its factor loading value is above the suggested value of 0.50. Since the variable information relationship resources (X3) does not meet this requirement, this indicator is removed from the PLS modeling. SmartPLS also showed the following results.

**Construct Reliability and Validity**

Matrix	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted ...	Copy to Clipboard
	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)	
IT Resources	0.749	0.947	0.856	0.687	
Innovation Performance	0.918	0.921	0.961	0.924	

**Fig. 4.** Construct Reliability and Validity Matrix

A variable is said to be valid if its Average Variance Extracted (AVE) value is above the suggested value of 0.50.



**Fig. 5.** Average Variance Extracted (AVE)

The results of the SmartPLS calculation show that all studied variables are valid. The variable information resources has an AVE value of 0.687, and the variable innovation performance has an AVE value of 0.924. A variable is also stated reliable if its composite reliability and Cronbach’s alpha values are above 0.7. Fig. 4 shows that the composite reliability value of innovation performance is 0.961 and of information technology resources is 0.856. The Cronbach’s alpha value of innovation performance is 0.918 and of information technology resources is 0.749. It could be concluded that both variables are valid and meet the research requirement.

Then the analysis continues with testing the structural model (inner model). This is done by looking at the R Square, which is a goodness of fit test.

**R Square**

Matrix	R Square	R Square Adjusted
Innovation Performance	0.959	0.958

**Fig. 6.** R Square

Fig. 6 shows that the R-Square value is 0.959, meaning that information technology resources contribute to innovation performance as much as 95%, and the other 5% is influenced by factors other than the studied variable.

To find out how significant the influence of information technology resources on innovation performance is, the bootstrapping was performed and the results are as follows.

**Path Coefficients**

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
IT Resources -> Innovation Performance	0.990	0.991	0.004	220.867	0.000

Fig. 7. Patch Coefficients

The original sample value of 0.990 in Fig. 7 shows that the relationship between information technology resources and innovation performance is positive, indicating that an optimal use of information technology resources can encourage innovation performance in universities. The T statistics value of 220.867 is higher than the critical value of 1.96, meaning that the influence of information technology resources on the innovation performance of private universities in Indonesia is very significant.

These results confirm that IT Resources has a strategic role in improving Innovation performance, as well as the findings of previous studies [24], [25]. IT Resources can move business unit entities or work units in organizations where components such as IT Human Resources relating to the ability of staff or leaders in using IT, IT Infrastructure Resources that play a role in the availability of IT supporting facilities and IT Resources Relationships refers to the relationship between IT and business units or work units, which reflects the level of mutual trust and commitment in sharing risks and responsibilities [22].

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