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MAINTAINING HIGHER EDUCATION INSTITUTION PERFORMANCE AMID THE COVID-19 PANDEMIC: THE ROLE OF IT GOVERNANCE, IT CAPABILITY AND PROCESS AGILITY

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ABSTRACT

This study examines the effect of information technology (IT) governance and IT application orchestration capability (IT-AOC) on the performance of higher education institutions (HEIs) directly and indirectly using process agility as a mediating variable. The study took a developing country, i.e., Indonesia, and the COVID-19 pandemic as its context. The study design was based on quantitative research employing partial least squares (PLS). The data were gathered by distributing questionnaires directly to HEI management members at all levels (department, dean, head/director/rector). The study results revealed a positive direct effect of IT governance and IT-AOC on HEI performance during the COVID-19 pandemic. This research also found that process agility mediated the effect of IT governance and IT-AOC on HEI performance. Based on the findings, HEI management and policymakers should support and encourage HEIs to govern their IT effectively and improve IT-AOC and process agility, especially when HEI operations have to be conducted online during the pandemic.

Keywords: IT Governance, IT Application Orchestration Capability, Process Agility, Higher Education Institution, Performance

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INTRODUCTION

The COVID-19 pandemic has brought significant challenges for the Higher Education Institution (HEI) to maintain quality and performance. The spread of COVID-19 has also changed the pattern of social interaction on a massive scale globally and eventually influenced how the organisation operates, including HEIs. Precautionary measures such as 'physical distancing' or 'social distancing' have been regulated by the government to mitigate contact between individuals and thereby minimises community interactions as found in HEIs (Weeden & Cornwell, 2020). Following the logic of exception, one common trend in the response of education systems worldwide to the pandemic has been their switch to 'emergency e-learning' protocols, directing the fast transition of offline classes to online learning systems (Murphy, 2020). In fact, this type of online activity has been applied not only to learning but to almost all activities in HEIs, including services, research, meetings (seminars, conferences and viva voce) and community service. As a result, the situation has demanded the development of faster and more established Information Technology (IT) by the HEIs. As suggested by some research, IT development is vital to achieving competitive advantage and optimal performance (Chakravarty, Grewal, & Sambamurthy, 2013; Kim, Shin, Kim, & Lee, 2011; Queiroz, Tallon, Sharma, & Coltman, 2018).

However, HEIs have faced intense competition among individuals, countries and institutions. It has created multilevel competition and led to HEIs competing with each other (Musselin, 2018). Competition has been pushed by the development of both global HEI rankings (Bagley & Portnoi, 2014) and national HEI rankings by ministries of education. In Indonesia, this competition is intense despite the continued COVID-19 pandemic. In fact, the pandemic has been used as a tool by a handful of HEIs to promote their progress in IT. During the pandemic, HEIs that have established online teaching capabilities have potentially been better positioned to attract the attention of prospective students, while weaker competitors may be left out.

Since organisations use IT in line with their vision, mission and goals, the issue of IT governance has become a concern for many parties, including HEIs. IT governance is defined as a process for directing and controlling an organisation to achieve its goals (ITGI, 2003; Meyer, Zarnekow, & Kolbe, 2003). The issue emerged due to the extent of organisations' financial investment in IT and the fact that it can sometimes act as a burden instead of a source of value-added (Ali & Green, 2005; Sofyani, Riyadh, & Fahlevi, 2020). Technically, IT governance is developed to manage the implementation of IT strategy in the organisation (W Van Grembergen, 2005). The changing role of IT in the organisation requires various process management structures and mechanisms to ensure its adoption runs well and brings value-added (Ali, Green, & Robb, 2015). Thus, IT governance can maximise the potential of IT in terms of its contribution to organisations in achieving competitive advantage (Lunardi, Becker, Maçada, & Dolci, 2014). Although many studies have been undertaken on IT governance, the issue is rarely discussed in the context of HEIs (Scalabrin Bianchi, Dinis Sousa, & Pereira, 2021). In Indonesia, the Minister of Education has made firm recommendations regarding the advancement of IT and its governance since 2018.

Queiroz et al. (2018) identified another pivotal aspect of IT that can enhance organisational performance, namely IT application orchestration capability (IT-AOC). IT-AOC is conceptualised as an entity's ability to renew its IT application portfolio through IT purchase, development and replacement (Queiroz et al., 2018). An organisation's ability to achieve a competitive advantage relies on its IT resources management to support the business processes important to organisation goals (Tallon, Queiroz, Coltman, & Sharma, 2016). During the COVID-19 pandemic, HEIs have been induced to stand steady amid the competition while changes occur very rapidly. For this reason, IT-AOC is crucial in meeting the new demands arising from HEIs' online business processes. Agile software development is necessary to accelerate the growth of new applications and meet these demands.



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Moreover, process agility is another factor critical to survival, especially for HEIs during the COVID-19 pandemic. Process agility refers to an entity's ability to respond to threats and opportunities efficiently and quickly (Tallon & Pinsonneault, 2011). Tallon and Pinsonneault (2011) demonstrated that IT-AOC is manifested in the level of process agility, which relates to quick action in managing knowledge and responding to changing environmental conditions, including and especially during the COVID-19 pandemic.

Today, it is challenging to find research on how HEIs have maintained their performance during the COVID-19 pandemic when almost all activities have been conducted online. Various related studies on the determinants of HEI performance have examined the role of management commitment, reward system, performance-based budgeting, the internal quality management process, intellectual capital, performance measurement systems, service quality and management process alignment (Fernandes & Rinaldo, 2018; Pratolo, Sofyani, & Anwar, 2020; Tjahjadi, Soewarno, Astri, & Hariyati, 2019). However, related research investigating the impact of IT on HEI performance during the COVID-19 pandemic is still lacking. Moreover, there has been widespread research conducted on the role of IT for organisational performance but in the context of developed countries such as Australia, Germany and the United States by Queiroz et al. (2018), in China by Chen et al. (2014) and in Portugal and the Netherlands by Bianchi, Sousa, Pereira and Luciano (2017). Meanwhile, research on this issue in developing country contexts, Indonesia in particular, remains scarce (Sofyani et al., 2020, Nfuka and Rusu, 2011). Prior studies have also focused more on business organisations than not-for-profit organisations (NFPO) such as HEIs. Therefore, this research was carried out to address these gaps.

Specifically, the current study examines IT governance and the effect of IT-AOC on HEI performance during the COVID-19 pandemic. Previous studies have proposed that turbulence in the market and uncertainty conditions can affect the relationship between the roles of IT capabilities on organisation performance (Chakravarty et al., 2013; Chen et al., 2014). Hence, Queiroz et al. (2018) suggested future studies examining whether and how environmental factors influence the role of IT-AOC. Extending those studies, this research re-examines the role of process agility as a mediating variable. As such, it offers two contributions to the body of knowledge and practices. Firstly, it extends the discussion of critical factors of IT aspects that affect organisational performance, especially in HEIs and when faced with the COVID-19 pandemic. The findings might also be helpful in a non-pandemic context due to the issue of the fourth industrial revolution, which is closely related to IT development in many areas, including HEIs. Next, this study presents empirical evidence of process agility as the mediating variable in the educational institution sector and a developing country context, i.e., Indonesia. In practical terms, this study recommends that HEI management and policymakers (ministry of education) pay attention to IT development, mainly IT governance and IT-AOC, and agility aspects since they can enhance HEI performance.

LITERATURE REVIEW

The IT Governance

ITGI (2003) defined IT governance as part of corporate governance and consists of various mechanisms for ensuring that IT is sustainable and can help achieve an organisation's strategic goals. IT governance involves stakeholders from executive management supervising the implementation of IT strategies that aim to increase the capability and agility between IT and business relationships and manage all IT risks effectively (Spremic & Popovic, 2008). Different from IT management which focuses on the adequate internal supply of IT services and products and the management of current IT operations, IT governance concentrates on the performance and transformation of IT to meet the current and future demands of the business and the business' customers (Wim Van Grembergen, De Haes, & Guldentops, 2004).



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Although some of the literature on IT governance have looked at different fields, most previous publications have focused on the business sector context, i.e., companies. Therefore, research on IT governance in the NFPO context, such as in HEIs, is necessary to extend the existing literature (Sofyani et al., 2020; Nfuka and Rusu, 2011). IT governance plays an essential role, and its effective implementation is necessary to achieve the organisation's targeted goals. IT governance contains five primary domains: (1) ensuring the link between business plans and IT (strategic alignment); (2) optimising IT spending and IT value; (3) securing optimal investment (management resources); (4) handling of IT asset security (risk management); (5) tracking project delivery (performance measurement) (Meyer et al., 2003; Webb, Pollard, & Ridley, 2006). In developing IT governance, the five domains are closely associated with organisational performance.

In general, research related to IT governance is primarily conducted in three main issues: implementation, impacts and determinants. Ribbers, Peterson and Parker (2002) highlighted that effective IT governance processes are indicated by the completeness of methodological and social interventions, which involve strategic integration between business and IT decisions and building collaborative relationships and shared understanding among key stakeholders within the organisation. Ali and Green (2005) pointed out that effective IT governance is influenced by the senior management involvement in IT, the presence of an IT strategy committee, ethics/culture of compliance in IT and corporate communication systems. Meanwhile, Bowen, Cheung and Rohde (2007) revealed that more effective IT governance performance outcomes are determined by the active involvement of IT steering committees, a shared understanding of business and IT objectives, comprehensive and well-communicated IT strategies and policies and a balance of business and IT representatives in IT decisions. Moreover, Nfuka and Rusu (2011) examined the determinants of IT governance in the public sector and found a strong association between effective IT governance and the support and involvement of senior management.

Discussing IT governance impact, De Haes and Van Grembergen (2008) uncovered that IT governance could improve the maturity of business-IT alignment. Meanwhile, Heart, Maoz and Pliskin (2010) found that IT governance could increase IT-enabled enterprise adaptability, subsequently enabling organisations to improve their performance. Moreover, Lunardi et al. (2014) discovered that companies that adopted IT governance practices achieved better performance than those that did not adopt them. Lunardi et al.'s study is consistent with the findings from other research that IT governance is a vital factor in enhancing corporate performance (Lazic, Groth, Schillinger, & Heinzl, 2011; Lazic, Heinzl, & Neff, 2011; Liang, Chiu, Wu, & Straub, 2011; Weill & Ross, 2004; Wu, Straub, & Liang, 2015). In a public sector setting, Sofyani et al. (2020) discovered that effective IT governance could enhance the accountability, transparency and service quality of local government institutions.

On the other hand, to date, most prior studies on IT governance have been carried out in the for-profit organisation (FPO) sector. Various IT governance researchers have also noted this trend (Ali, Green, & Parent, 2009; Rodriguez-Repiso, Setchi, & Salmeron, 2007; Warland & Ridley, 2005). As a result, very little is known of IT governance issues in the public or NFPO sector, including the context of HEIs (Ali et al., 2015; Nfuka & Rusu, 2011). The COVID-19 pandemic, requiring HEIs to conduct online-based operations across almost all their activities, has forced better IT development and governance. The situation then has opened an opportunity within the HEI realm to investigate how IT governance and IT-AOC roles affect HEI performance, primarily during the COVID-19 pandemic.

The IT Application Orchestration Capability (IT-AOC)

The IT-AOC is an emerging topic that was introduced by Queiroz et al. (2018). They conceptualised IT-AOC as an ability to update IT application portfolios in the organisation. An IT application portfolio comprises the number of applications used by the organisation to support an entity's business processes (Nazir & Pinsonneault, 2012). IT-AOC indicates that the organisation can renew the portfolio of IT applications to support various business processes. Tallon et al. (2016) contended that the organisational capabilities required to gain a competitive advantage depend on how well the organisation manages IT resources to support the business processes closely linked to its goals.



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Theoretically, IT-AOC is conceptualised based on research into resource orchestration by Sirmon et al. (2007; 2011) and extant literature on IT capabilities by Van Oosterhout, Waarts and van Hillegersberg (2006), Lee and Xia (2010) and Vessey and Ward (2013). Then, Sirmon, Hitt and Ireland (2007) emphasised the need for companies to continuously and quickly update their resource portfolios to obtain a competitive advantage. They demonstrated three key distinguishing competencies that an organisation can use to update its IT resource base: gaining resources from factor markets, developing resources internally and releasing outmoded resources. These three key competencies thus become formative indicators of IT-AOC. Based on Queiroz et al. (2018), high IT-AOC can enhance process agility and firm performance. It has proven to be highly relevant during the era of the COVID-19 pandemic, considering that almost all HEI activities have shifted online. Accordingly, to enhance their performance during the ongoing pandemic, HEIs need to establish their IT-AOC.

The Process Agility

Process agility is an entity's ability to respond to changes that occur due to consumer demands. Organisations must have technical skills, plus workforce and management expertise to manage their IT (Van Oosterhout et al., 2006). Process agility also implies the capabilities of flexibility, speed and innovation that a company needs to respond fast to market dynamics, newest customer needs and technology development (Mathiassen & Pries-Heje, 2006). From a theoretical point of view, agility rests on dynamic capability theory. This theory is concerned more with competitive sustainability in response to fast-changing current business conditions (Teece, Pisano, & Shuen, 1997). This concept is arguably relevant to the current study context, where the pandemic of COVID-19 has triggered rapid changes in the academic and non-academic processes of HEIs throughout the world.

Conceptual Framework and Hypotheses Development

IT governance can be implemented in all organisations, including HEIs, to improve organisational performance. IT governance is vital for reducing the weaknesses and risks that hinder performance and process innovation in organisational business activities (Syafei, 2017). As highlighted previously, some research has also confirmed that IT governance is critical for organisations to attain a competitive advantage, primarily by enhancing their performance and goal achievement (Mithas, Tafti, Bardhan, & Goh, 2012; Wu et al., 2015). In the local government setting, Sofyani *et al.* (2020) found that effective IT governance could promote better service quality and improve transparency and accountability practices. A related study on IT governance by Bianchi et al. (2017) revealed that IT governance had a significant effect on HEIs in teaching, learning and research activities. Thus, the hypothesis was derived as follows:

H₁: IT governance positively influences HEI performance.

IT-AOC is very much necessary concerning building a competitive advantage (Queiroz et al., 2018). IT variations and updates such as software, cloud applications, e-learning and other service platforms to bolster both academic and non-academic activities are the primary needs for HEIs amid the current COVID-19 pandemic. Kwateng, Agyei and Amanor (2019) and various other studies (Chen et al., 2014; Sanders & Premus, 2005) found that IT capability would affect an organisation's business performance process. Meanwhile, Queiroz et al. (2018) empirically determined that IT-AOC plays a critical role in improving companies' performance. As such, developing the above arguments, the hypothesis was formulated as below:

H₂: IT-AOC positively influences HEI performance.

Ravichandran (2018) identified that process agility could positively impact performance in terms of the ability to respond to market changes and increase competitive advantage. In comparison, Chen et al. (2014) found that the environment complexity strengthens process agility, with the effect that various business environments require organisations to respond to changes that occur to achieve the desired performance. In this regard, the COVID-19 pandemic has massively and rapidly altered the HEI business process in transitioning from predominantly face-to-face to a process that takes place primarily online and has been dramatically impacted by mandatory lockdowns. It



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also clearly demands agility on the part of HEIs to adapt their operations to maintain performance. Based on the above statement, the following hypothesis was derived:

H₃: Process agility positively influences HEI performance.

IT governance is a section of corporate governance that focuses on improving organisational performance by maximising the value derived from IT (Wilkin, Couchman, Sohal, & Zutshi, 2016). Meanwhile, IT-AOC indicates companies' ability to continuously update applications and build new IT resources to improve performance. Although most studies have concluded that the IT aspect is a critical factor in obtaining a competitive advantage through performance improvement, several studies found that IT investment did not always yield value-added with increased performance (Davenport, 1994; Orlikowski, 1992). It reflects the fact that while business processes continually evolve (Van Oosterhout et al., 2006), IT investment that is a legacy from prior management may not necessarily be compatible with future needs (Queiroz et al., 2018). Over time, existing IT investment and governance become irrelevant or lag that of the competition. In this context, an entity's process agility is crucial in terms of its ability to meet changing demands. It is in line with the study from Chae, Koh and Park (2018) that companies in the IT transformation phase display superior performance compared to IT leader companies. As such, the adoption of an IT leader strategy does not necessarily promote better performance. In another paper, Chae, Koh and Prybutok (2014) suggested that IT resources can improve business performance, but only when they are accompanied by other elements such as (1) an effective organisational structure, (2) a productive culture and (3) sufficient skills to leverage IT assets for business needs. Thus, they recommend that future studies focus on these additional resources to comprehend the IT capability-business performance relationship better. We include process agility as a mediating variable to cover their third point, as suggested above.

Process agility is an excellent organisational resource that helps the organisation navigate and manage rapidly occurring changes in its environment (Swafford, Ghosh, & Murthy, 2008). Besides, effective organising and governance mechanisms are critical to building process agility within the organisation (Gallagher & Worrell, 2008). However, it can sometimes be challenging to balance the mechanisms of IT governance alongside agility. Hence, to reach an organisation's competitive advantage, its IT governance practices should be aligned with process agility (Couto, Lopes, & Sousa, 2015). It means that IT governance can enhance organisational performance if it is designed to balance with or even promote process agility. Thus, the argument was hypothesised:

H₄: IT governance influences HEI performance indirectly through process agility.

From another angle, Queiroz et al. (2017) uncovered that the influence of IT-AOC on companies' performance is manifested in process agility. It signifies that IT-AOC can promote better performance if it successfully creates process agility for the organisation to adapt to new demands – for instance, online business processes in most HEIs in the world during the COVID-19 pandemic. In other words, as identified by Queiroz et al. (2018), process agility mediated the IT-AOC-performance relationship. A similar finding was also discovered by Chen et al. (2014). Developing such arguments, we hypothesised as follows:

H₅: IT-AOC influences HEI performance indirectly through process agility.

According to synthesised literature review above, a conceptual framework of this research was formulated, as shown in Figure 1.



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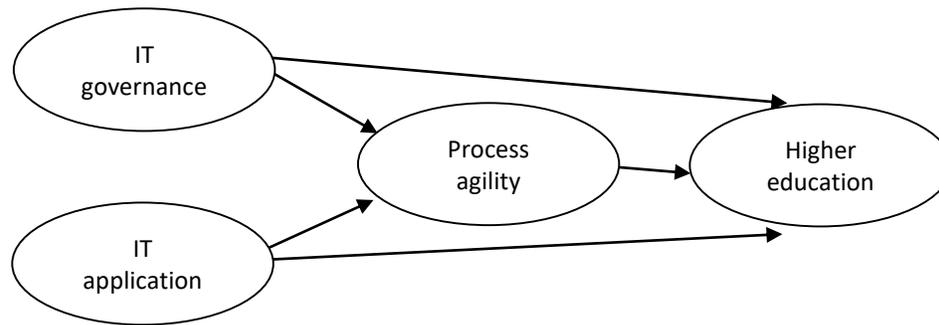


Figure 1. Conceptual Framework

METHODS

Research Design

This research used the survey method and adopted an explanatory research model to analyse how one variable influenced the other through hypothesis testing. The research involved HEIs in Java Island (research population), where most Indonesian HEIs are located, especially those with advanced IT development. The research sample was then determined using the purposive sampling technique, with the criteria that an HEI had developed IT to support its operations. The research also applied cluster sampling, with the collection of the research sample divided based on the six provinces in Java: Banten, DKI Jakarta, West Java, Central Java, Yogyakarta Special Region and East Java. Besides, the study's respondents were considered experts who understood IT development and HEI performance in their place of work (Sekaran & Bougie, 2016; Zikmund, Babin, Carr, & Griffin, 2013). They included the following job roles: rector/director/head/vice-rector/vice-director/deputy, dean and head of study programme.

Variable Measurements

A Likert scale of 1 (strongly disagree) to 5 (strongly agree) was employed to measure all variables. IT governance refers to policies that give roles and value-added to the environment at every level of the organisation. This variable was measured by referring to Ali and Green (2007). Next, IT-AOC is defined as the ability to update IT applications within an organisation or company to generate profits and obtain strategic benefits. Meanwhile, process agility implies the organisation's ability to develop and exploit competition and knowledge structures for success in an unpredictable environment. These two variables were assessed by developing Queiroz et al.'s (2018) measurement. Lastly, HEI performance is the HEI achievement in terms of operational activities that have been planned and realised during a specific period. This variable was gauged based on regulation issued by the National Accreditation Board for HEI (Indonesia). We used this regulation since the measurement deals with the research context, namely Indonesia.

Questionnaire Preparation and Administration

The questionnaire development process was subjected to expert validation (Lewis, Templeton, & Byrd, 2005), which involved four experts from the fields of public sector accounting, accounting information systems and management accounting. After receiving input from the experts, various improvements were made to the questionnaire in terms of the instructions, phrases, sentence length, punctuation accuracy and respondent information. Data collection was then carried out by distributing the questionnaires directly to respondents at their offices and via personal email. This approach was adopted because it tends to get a higher response rate than distributing questionnaires by post (Hartono, 2013).



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The questionnaires were distributed in person or online using Google Forms from 15 September to 15 December 2020 (three months). The sample and respondent characteristics data are presented in Table 1. After removing the non-conforming respondents, 248 responses (data) from 129 HEIs were collected and included for analysis. Because of the self-reporting approach of the survey research, there is the potential for common method bias or also called common method variance (CMV) (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), a situation in which the respondent answers the items in the questionnaire normatively (Chang, van Witteloostuijn, & Eden, 2020). Thus, the Harman Single Factor test was utilised to detect this problem (Tehseen, Ramayah, & Sajilan, 2017). The bias is considered significant in influencing the study results if one common factor accounts for a large proportion of the covariance between measures, i.e., more than 50% (Podsakoff et al., 2003). Our analysis showed that the first factor explained only 33.67% or less than 50%. These results, therefore, concluded that CMV did not significantly impair the validity of this study's results.

Table 1
Sample and Respondents' Demographics

Information	Description	Number	Percentage
Accreditation Status of HEI	Number of Samples:	129	100
	A	13	10
	B	80	62
	C	31	24
	Not Accredited	5	4
HEI Types	Number of Samples:	129	100
	Private HEI	117	91
	Public HEI	12	9
HEI Categories	Number of Samples:	129	100
	Academy	16	12
	Polytechnic	9	7
	Specialised School	43	33
	Institute	13	10
	University	48	37
Education Level of Respondents	Number of Respondents:	248	100
	Bachelor	32	13
	Master	163	66
	Doctoral	53	21
Position of Respondents	Number of Respondents:	248	100
	Higher Education Leaders	106	43
	Faculty Leaders	42	17
	Head of the study programme	100	40

Data Analysis Technique

This study used the variant-based Partial Least Squares Structural Equation Modelling (PLS-SEM) approach to analyse the inner model (validity and reliability of data) and outer or structural model (hypotheses testing). This method permits the simultaneous testing of measurement models and structural models (Chin, Marcolin, & Newsted, 2003; Joe F. Hair Jr, Sarstedt, Hopkins, & Kuppelwieser, 2014). It aims to answer a series of interrelated research questions



in one systematic and comprehensive analysis by modelling the relationship between several concurrently dependent and independent constructs (Gefen, Straub, & Boudreau, 2000). PLS-SEM performs the task of measuring the relationship path between constructs simultaneously so that there is no statistical problem. PLS-SEM also tends to tackle the problem of multicollinearity and data distribution (Gustafsson & Johnson, 2004). As a technique, PLS-SEM was suitable for use in this research because it works using minimal data assumptions and data requirements and a relatively small sample size; it is also based on a theoretical foundation that is not too strong (Akbar, Pilcher, & Perrin, 2012; Pratolo et al., 2020).

Hair, Black, Babin, Anderson and Tatham (2010) argued that the minimum sample size using PLS-SEM analysis is the '10 times rule'. Thus, the sample size must be ten times larger than the latent variable with the model's most indicators. Since the process agility and HEI performance were the latent variables with a maximum number of indicators (nine), the minimum sample size, as suggested by Hair et al. (2010), should therefore be 90 (10 x 9). Given that the sample size collected for the study was 129, this assumption had been met.

ANALYSIS AND RESULTS

Descriptive Statistics

Table 2 contains the scores of descriptive statistics for each variable. Out of 129 in total, several HEIs had a maximum score of 5 on all variables. According to Alach (2017), for implementing specific policies in an organisation, the mean score of the Likert scale is interpreted as 1 = very poor and 5 = very good. However, for the majority of HEIs, IT-AOC was still rated under 4 on the scale. It means that while implementing IT governance, IT-AOC and process agility were optimal for several HEIs. In contrast, some HEIs scored 1 for IT-AOC, indicating a deficiency in their ability to update applications for their needs during the COVID-19 pandemic. Furthermore, looking at the mean scores, most HEIs already had a good level of IT governance and process agility, as shown by a mean score above 4. The deficiency could therefore be due to many HEIs encountering barriers to increasing their ability to update IT applications, such as budget constraints and the competence of the IT team. Moreover, during the COVID-19 pandemic, HEI performance appeared to be less than optimal, as indicated by a mean score below 4.

Table 2
Descriptive Statistics

Variable	Min.	Max.	SD	Mean
IT Governance	2.70	5.00	0.58	4.46
IT Application Orchestration Capability	1.00	5.00	0.68	3.72
Process Agility	2.60	5.00	0.57	4.16
HEI Performance	2.30	5.00	0.57	3.81

N samples: 129 HEIs

Measurement Testing Results

In the research model, the IT-AOC construct is formative while the others are reflective. In the first step, we assessed the reliability of the formative construct, which can be measured using two methods, t-statistic value (> 1.96) and p-value (< 0.05) and a collinearity indicator with a VIF score (< 5) (Joseph F Hair Jr, Hult, Ringle, & Sarstedt, 2014). Table 3 shows that the reliability indicator measurement technique was seen in the outer weight value. The scores for all indicators disclosed a significant result; a t-value was greater than 1.96 and a p-value was less than 0.05. Additionally, based on the collinearity indicator measurement technique (VIF), all IT-AOC indicators had a value less than 5, meaning that all indicators were in good shape. Thus, there were no issues with multicollinearity, and all formative indicators of IT-AOC were reliable in explaining the IT-AOC construct (Hair et al., 2014a).



Table 3
Formative Construct Test

Indicator	Outer Weight		VIF
	t-statistics	p-values	
ITAOC1	5.016	0.000*	1.099
ITAOC2	3.029	0.001*	1.084
ITAOC3	1.944	0.026**	1.121

Significant at the alpha of 0.01 and 0.05***

In the next step, we evaluated the reflective constructs: IT governance, process agility and HEI performance. First, convergent validity was assessed, namely the extent to which some of these items could measure the concept. Referring to Hair et al. (2014a), the outer loading and average variance extracted (AVE) values were employed to evaluate the convergent validity. Table 4 displays that the loading values for all items were higher than the required score of 0.5 (Hair et al., 2014a). Table 4 also indicates that the AVE value agreed with the rule of thumb value, i.e., greater than 0.5 (Fornell and Larcker, 1981).

Table 4
Convergent Validity and Reliability Test Results

Variable / item	Indicator	Loading
<i>IT Governance (AVE = 0.751; CR = 0.900; CA = 0.836)</i>		
ITG1	IT positive impact on the environment at every HEI organisation level	0.891
ITG2	A value-added promoted by IT to the HEI	0.903
ITG3	A significant supporting factor of IT governance in the HEI	0.802
<i>IT Application Orchestration Capability (AVE = NA; CR = NA; CA = NA)**</i>		
ITAOC1	Updating IT applications independently (internally)	0.810
ITAOC2	Purchasing advanced IT applications from a provider company	0.664
ITAOC3	Stopping or disabling IT applications that are not useful	0.582
<i>Process Agility (AVE = 0.624; CR = 0.920; CA = 0.897)</i>		
PA1	Meeting environmental changes	0.817
PA2	Providing new services according to student needs	0.824
PA3	Adapting the academic process to the new curriculum policy	0.797
PA4	Adjusting tuition fees in response to environmental changes, i.e., COVID-19 pandemic (studying from home)	0.552
PA5	Expanding regional, national and international markets for new students	0.832
PA6	Adopting new technology to improve academic quality	0.847
PA7	Adopting new technology to improve administrative service quality	0.819
<i>Higher Education Institution Performance (AVE = 0.560; CR = 0.917; CA = 0.898)</i>		
HEP1	Organising education according to the new regulated curriculum	0.713
HEP2	Organising online lectures during the COVID-19 pandemic effectively	0.777
HEP3	Supervising students' final assignments (thesis) to completion according to schedule	0.821
HEP4	Publishing a large number of articles in national accredited journals	0.546
HEP5	Publishing a large number of articles in reputable international journals (Scopus or Web of Science)	0.455*
HEP6	Producing community service work programmes that can solve problems that exist in partner communities	0.783
HEP7	Providing effective services to all campus academics	0.854



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Variable / item	Indicator	Loading
HEP8	Providing fast service to all campus academics	0.867
HEP9	In general, the HEI performance meets the determined performance indicators.	0.810

* The item was excluded due to being less than 0.5; ** The score was not calculated due to it being a formative construct; AVE = Average Variance Extracted; CR = Composite Reliability; CA = Cronbach's Alpha

Moreover, we tested discriminant validity. It shows the extent to which items can be distinguished between constructs (Compeau, Higgins, & Huff, 1999). In Table 5, the correlation value between the intended construct was higher than its correlation with other constructs. It can thus be said that discriminant validity had been established (Gefen & Straub, 2005). A score could not be obtained for ITAOC because this construct is formative.

Table 5
Discriminant Validity (Fornell-Larcker)

Construct	HEP	ITAOC	PA	ITG
HEP	0.748			
ITAOC	0.308	NA*		
PA	0.338	0.219	0.866	
ITG	0.400	0.345	0.390	0.790

*A formative construct was not calculated; ITG = IT Governance; ITAOC = IT Application Orchestration Capability; PA = Process Agility; HEP = Higher Education Institution Performance

A reliability test was then performed to assess the consistency between indicators. From Table 4, the Cronbach's alpha (CA) scores were higher than 0.6; thus, the constructs can be said to be reliable (Chin et al., 2003). Similarly, the composite reliability (CR) scores were more than 0.7, agreeing with the rule of thumb (Fornell & Larcker, 1981). As such, all constructs in this study had high reliability. No value existed for the IT-AOC construct as this construct is formative in nature. Since all the assumptions of the validity and reliability tests had been met, we could proceed with hypotheses testing.

Hypothesis Testing Results

Table 6 contains the hypothesis testing results. Panel A gives the testing results for the direct effect, while Panel B shows the results for the indirect effect (mediation). In this research, all hypotheses were supported. Additionally, it was found that the adjusted R-squared score for HEI performance was 0.216, meaning that factors inside the model explained the dependent variable (HEI performance) by 21.6%. At the same time, other factors outside the model explained the rest (78.4%). Referring to Chin (1998), the current study had the R-squared score at a moderate level.

Table 6
Hypothesis Test Results

Hypothesis	Coefficient	t-statistic	p-values	Conclusion
Panel A. Direct effect				
H ₁ : ITG → HEP	0.206	2.563	0.005*	Supported
H ₂ : ITAOC → HEP	0.165	1.975	0.024**	Supported
H ₃ : PA → HEP	0.263	3.309	0.001*	Supported
Panel B. Indirect effect (mediation)				
H ₄ : ITG → PA → HEP	0.034	2.516	0.006*	Partial mediation
H ₅ : ITAOC → PA → HEP	0.030	2.397	0.008*	Partial mediation

Significant at the alpha of 0.01* and 0.05**



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DISCUSSION

The current study suggests that effective IT governance enhances HEI performance in terms of learning, service quality, research, publication, community service and HEIs' internal process management during the COVID-19 pandemic. This result confirms various studies, including Bianchi et al. (2017) and some research findings (Liang et al., 2011, Lunardi et al., 2014, Mithas et al., 2012, Wu et al., 2015). Lunardi et al. (2014) argued that effective IT governance mechanisms could help the organisation monitor and control IT and IT services, improving IT infrastructure efficiency and the quality of internal, external and outsourced IT services. It, in turn, leads to performance improvement. As occurred at many Indonesian HEIs, IT development coordination has been enhanced during the pandemic. Online-based operations have demanded a stronger IT focus. There has been monitoring of the roles of IT in achieving performance indicators both academically and non-academically, even though this was forced by the pandemic. From the data in Table 5, the high mean score of IT governance indicates that the COVID-19 pandemic has provided lessons for the development of IT governance in Indonesia's HEI sector.

Furthermore, this study also found that even though IT-AOC was still not optimal, with a mean score of 3.71 (see Table 5), it could promote HEI performance; thus, it confirms Queiroz et al. (2018). However, this study also extends the IT-AOC literature since the prior study by Queiroz et al. (2018) was undertaken in companies (FPO), whereas this research was conducted in the HEI sector (NFPO) context. Additionally, this study addressed the suggestion by Chakravarty et al. (2013) and Chen et al. (2014) to test the role of IT capability on organisational performance in certain conditions such as market turbulence and uncertainty. Using the COVID-19 pandemic as its context, this study, therefore, extends discussion regarding the critical role of IT-AOC as online-based business processes have become compulsory during the pandemic. IT procurement is necessary for organisations to pursue specific goals (Ali & Green, 2007). With the rapid changes taking place in their environment during the pandemic, organisations also need to maintain their IT portfolios to provide value-added (Nazir & Pinsonneault, 2012). Organisations such as HEIs have a significant need for IT variations and updates, including cloud applications, e-learning, teleconferencing, accounting information systems and other platforms to support their teaching, learning, research, administrative and financial management activities and improve their overall performance. Therefore, this study confirms that, during the COVID-19 pandemic, only HEIs with strong IT-AOC could ultimately maintain their performance.

According to the resource-based view (RBV) theory, the organisation is a collection of resources focused on optimising them to achieve its goals (Barney, 1991). In this study, IT governance and IT-AOC are organisational resources that played a significant role in achieving HEI performance during the COVID-19 pandemic, where almost all HEI operations were carried out online. In fact, competition between HEIs has been maintained despite the worldwide spread of COVID-19. These study findings have shown that only those HEIs capable of governing IT effectively and with good IT-AOC and process agility could perform well. The RBV premises that internal resources can provide a sustained advantage if the organisation can articulate them as valuable, rare, inimitable and non-substitutable (VRIN) (Barney, 1991). It corresponds to Bharadwaj's (2000) view that companies use their IT investments to create unique IT resources and skills. It determines their overall effectiveness since IT investment is neither sustainable nor likely to boost profits suddenly.

Moreover, this study discovered that process agility positively affected HEI performance both independently and as a mediating variable. It shows that HEI management needs to pay serious attention to process agility to adapt to the rapidly evolving education process, especially amid the massive COVID-19 pandemic. Lu and Ramamurthy (2011) and Ravichandran (2018) argued that organisational agility is a competency that allows organisations to adapt to the changes posed by the environment. The current study's findings verify that process agility is crucial to organisations maintaining their performance during uncertain situations. This study is, therefore, in line with Ravichandran (2018), Chen et al. (2014) and Chakravarty et al. (2013), who stated that process agility had a positive impact on organisational performance.



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In addition, this study addressed the reasons why some IT investments did not necessarily improve performance. Chae et al. (2014) advised considering whether the organisation has sufficient skills to leverage IT assets for its business needs as a factor influencing the relationship between IT and performance. As such, we tested process agility as a mediating variable following Queiroz et al. (2018) and Chen et al. (2014). Indeed, the current research has confirmed that process agility acted as a partial mediating variable, as also found by Queiroz et al. (2018). Since the mediating hypotheses (H₄ and H₅) were supported, this study reinforces that process agility could mediate the role of IT governance and IT-AOC in promoting HEI performance. In addition, this study responds to Chen et al. (2014) and Chen et al. (2018), who found that IT capability did not influence organisational performance. It denotes that process agility is an essential factor to consider as part of IT development within the organisation.

From a theoretical perspective, process agility as an element of partial mediation confirms the dynamic capabilities theory. It is evident from the vital role of process agility in relieving the pressure of rapid change on HEIs, namely the rapid transition from face-to-face to online-based activities for academic and non-academic purposes. In different study contexts, Tseng and Lee (2014) uncovered that an organisation's dynamic capability, such as its process agility, is a significant intermediate organisational mechanism through which the benefits of knowledge management capability are converted into performance effects at the corporate level. Thus, knowledge management capability enhances organisations' dynamic capability, and in turn, dynamic capability boosts organisational performance and provides a competitive advantage. This finding is also consistent with Wang and Hsu (2010), who noted that dynamic capability, R&D and production are significant determinants of performance in the high technology industry.

CONCLUSION

This study aimed to examine the influence of IT governance, IT-AOC and process agility on the performance of HEIs during the COVID-19 pandemic. Process agility was also tested as a mediating variable. A total of 129 HEIs comprising different types – university, institute (college), specialised school and academy – were involved. The respondents were represented by HEI management at different levels, including the chancellor, vice-chancellor, faculty dean and the heads of study programmes. The study found that IT governance, IT-AOC and process agility positively influenced HEI performance. It was also exposed that process agility partially mediated the relationship between IT governance and IT-AOC and HEI performance.

This study has important practical and theoretical implications for the field of knowledge. Practically, the study results suggested that IT and agility are critical factors that can improve HEI performance, especially during the COVID-19 pandemic, when almost all HEI academic and non-academic activities have been conducted online. Therefore, HEI management and policymakers must emphasise the importance of effective IT governance practices and the maximum IT-AOC improvement. Although this study was conducted in the context of the COVID-19 pandemic, it may also be essential to consider the results in a non-pandemic context. From a theoretical point of view, the study results broaden the discussion of dynamic capabilities and RBV theories in the NFPO sector, in this case for HEIs, which is still lacking. Also, it provides empirical evidence about the critical determinants of HEI performance from the IT perspective and the role of process agility as a mediating variable.

Despite its positive contribution, this study also has several limitations. First, the research only included HEIs in Java Island, Indonesia. Indonesia is a large country with many other territories and islands. Therefore, readers should exercise caution when drawing conclusions, especially for generalising purposes. Thus, further research is recommended to examine similar topics in other locations (islands) in Indonesia or even in other countries to strengthen or even reject the results of this study. This study also used a single approach, namely a survey. Therefore, a detailed explanation was not provided, specifically how IT governance, IT-AOC and process agility were established technically or operationally and then affected HEI performance during the COVID-19 pandemic. Consequently, future studies need to use a qualitative with an exploratory approach to complement the results of this study. In addition, it is suggested that future research examines the determinants of IT governance, IT-AOC and process agility in the



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HEI sector. Moreover, education is an essential element in the development of a country. Therefore, it is crucial to investigate the determinants of the performance and quality of HEI.

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