COVID-Driven Innovation in Higher Education: Analysing the Collaboration of Leadership and Digital Technology during the Pandemic in UiTM Malaysia and UNNES Indonesia

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Abstract: This study aims to analyse the way leadership and digital technology usage affect the faculty members' research performance in surviving higher education sustainability during the COVID-19 pandemic. A breakthrough innovation is needed to design a fast-track online work management system. Hence, it requires a loyal contribution from all the faculty members to support this system. This quantitative study conducted in Malaysia and Indonesia, included 260 faculty members from various fields of studies. Using the online questionnaire, it shows that leadership and technology usage plays an important role to maintain faculty members' research performance during the pandemic. However, it has a slight difference in result between Malaysia and Indonesia in terms of the portion of leadership and digital technology that affected the research performance. The higher education leaders play a stronger role in affecting Malaysian faculty members' research performance, while Indonesian faculty members are influenced more by digital technology usage than by their leaders. Each of them has a significant implication in designing the effective institution policies in optimizing faculty members' research performance.

Keywords: COVID-19, research performance, leadership, digital technology

1. Introduction

The pandemic of COVID-19 has changed almost every aspect in human life. Recorded at 5:02pm CET, 23 November 2020, the confirmed cases of COVID-19 reported to WHO has reached 58 425 681, including 1 385 218 deaths. Since 1 April 2020, more than 80 countries have decided to implement either lockdown or social distancing policies which impacted social and business activities of more than 3.4 billion people or 43% of human population in the world (Marinoni et al., 2020). Based on the same source, it is written that since May 2020, as many as 177 countries have shut down schools and universities. An interesting finding revealed from Crawford et al., (2020) stated that based on UNESCO data, at the beginning of this pandemic, most of the developed countries chose to close higher education and transform the teaching and learning activities into an online learning system. Meanwhile, some developing countries insisted on carrying out local closures depending on the severity of the area.

Table 1. Higher Education Response to COVID-19 by Country

WESP (2020) category	Country	COVID-19 Cases/1M pop#	Extension of semester break	Reported campus closures^	Reported move to online teaching
Developed economies	Australia	166	No	All	All
	Germany	745	No	All	All
	Italy	1,616	No	All	All
	Republic of Ireland	530	No	All	All
	United Kingdom	288	No	All	All
	United States of America	431	No	Some	Some
Developing economies	Brazil	20	No	Some	Some
	China	57	Yes	All	All
	Chile	112	No	All	Some
	Egypt	6	No	All	All
	Hong Kong	86	Yes	All	All
	India	0.8	Yes	All	Some
	Indonesia	5	No	All	Some
	Jordan	25	No	All	Some
	Malaysia	81	No	All	No
	Nigeria	0.5	No	All	Some
	Republic of Korea (South Korea)	188	Yes	All	Some
	Singapore	144	No	Some	Some
	South Africa	22	Yes	All	Some
	United Arab Emirates	58	No	All	Some

1M pop = 1 million population; # = Worldometer, 2020 (20 March 2020); ^UNESCO, 2020 (20 March 2020)

The most reasonable issue of this phenomenon is about facilities and infrastructures in developed countries for conducting online learning. Those countries have better facilities and are more ready and qualified compared to the developing countries. Some barriers for implementing online learning in developing countries are reported as listed here: technological, education/literacy background and socio-economic in Nepal (Subedi, et al., 2020); unfamiliar e-learning usage in Indonesia (Mailizar, Almanthari, Maulina & Bruce, 2020); law, regulations and platforms in Georgia (Basilaia & Kvavadze. 2020); mental and technical online learning readiness in Malaysia (Kamal, et al., 2020; Chung, Subramaniam & Dass, 2020; Sim, Sim & Quah, 2021); the counterproductive use of smartphone (Shuhidan, Majid, Shuhidan, Anwar & Hakim, 2020; Fook, Narasuman, Aziz, Mustafa & Han, 2021). However, due to the rapid increase of cases around the world, almost all of the developing countries finally had to take a tough decision to conduct the distance learning education with all the consequences, including Indonesia and Malaysia.

Indonesia had released regulations for some big cities to do large-scale social restriction or *Pembatasan Sosial Berskala Besar (*PSBB) regulations. One of the implementations includes schools and higher educations that have to conduct online learning since March 2020. The regulations organize the implementation of online learning both conceptually and technically. Similar to Indonesia, Malaysian government also has to shut down schools and universities. This is part of implementing the Movement Control Order (MCO) program. The MCO was initiated from 18 March 2020, with the closure of educational institutions, government and private institutions (except for essential services). However, on the 4th May, 2020, the Conditional Movement Control Order (CMCO) was implemented to allow the re-operation of several sectors of the economy. During this period, schools and colleges were still closed, and large-scale social gatherings were still prohibited (World Bank, 2020). Teaching and learning activities then shifted to distance learning via online using various platforms such as Cisco Webex, Google Classroom, Zoom, Google Meet or Microsoft Teams. The governments also set some television programs and free internet facilities to support the students to study from home. For those who are inaccessible to the Internet area, the teachers have made arrangements to do home visits or give assignments to the students.

Besides those challenges in the teaching and learning process, during the pandemic, higher education institutions have another issue in maintaining research productivity. They have to reorganize their research activities to ensure that they work effectively. There are a lot of limitations faced by the students in the universities and colleges. For instance, students in the science faculties some challenges, for instance limited research members within the laboratory due to social distancing. Other than that, the absence of technicians at core facilities and supplies stores as there is a strict limitation of not working in air-conditioned room. On the other hand, loss of many skilled laboratory staff who might be

categorized as one of risk groups, such as pregnant women, the ones who have small children and old parents at home as well as people with immune disorders (Mendoza, Garcia & Korban, 2020).

For the faculty members of art, humanities and social studies, they have quite a different limitation in doing research. Carrying out fieldwork during the pandemic leads researchers to have an intensive contact with infected residents or health care facilities, hence this harms themselves to a contagion (Padros, et al., 2020). A remote observation could help the observation stage, yet it does not seem valid enough for a participative research approach. Therefore, even though there has been plenty of research talking about research performance in higher education institutions (Jauhar, Pant & Nagar, 2017; Koya, 2017; Aithal & Aithal, 2020; Padlee et al., 2020; Martinez, Nafarrate & Balderamma, 2020), research performance of faculty members during the pandemic emerges as an interesting discussion with regard to the new challenges faced by the researchers and institutions.

Both Indonesia and Malaysia are from the same region of Asia continent, which is in Southeast Asia. They have similar culture, language, race and majority religion. The regulations issue, particularly for the education sector during the pandemic has also high similarities. During the pandemic, the research performance of faculty members is declining. Universitas Negeri Semarang is one of the public higher education institutions in Indonesia. The faculty members have publications in reputable and indexed journals yearly. However, there has been a decrease from 462 research articles in 2019 to only 291 research articles in 2020. The citations number also dropped from 33 530 to 27 721 from 2019 and 2020 respectively.

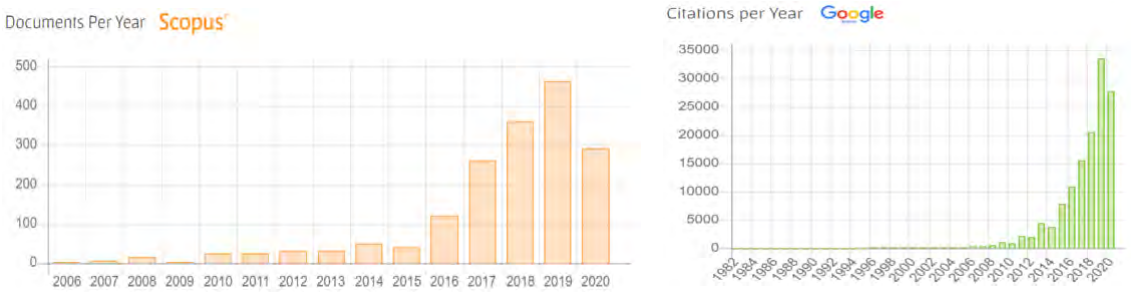

Fig. 1 Data of Publication from UNNES, Indonesia
(Source: https://sinta.ristekbrin.go.id/affiliations/detail?id=9&view=overview)

Meanwhile, the same phenomenon happens in Universiti Teknologi MARA (UiTM), Malaysia. During the pandemic period in 2020, the published articles have declined tremendously from 2 839 to 1 520 articles. On the other hand, the citation has decreased from 17 446 in 2019 to 13 874 citations in 2020.

Fig. 2 Data of Publication from UiTM, Malaysia
(Source: UiTM Database, 2020)

Emotional and interpersonal support is needed not only by students, but also by all university faculty members in adapting to new work realities. Task and relationship-oriented leadership behaviour is needed to control employee attainment in a virtual environment during a pandemic (Bartsch et al., 2020). Psychological empowerment, strengthening, job appreciation, and communication from leaders are important. Dirani et al., (2020) stated that during a pandemic, the organization will develop under a leader who (i) provides a strong role; (ii) accommodates shared leadership; (iii) has good communication skills; (iv) ensures employees access to technology; (v) prioritizes employees emotional stability; (vi) maintains the financial health of the organization; and (vii) increases organizational resilience. Noor Azizah et al., (2020) stated that transformational and transactional leadership have a significant effect on faculty members' performance through job satisfaction as the mediator variable for faculty members at Jakarta Islamic universities during the pandemic.

Many numbers of research have even confirmed that leadership has a positive and significant effect on faculty members' performance, as some research argue this finding. Purwanto et al., (2019) stated that transformational and authentic leadership have no significant effect on faculty members performance at 14 private universities in Tangerang, Indonesia. In line with this study, Pongpearchan (2016) found that power distance has no significant and positive moderation effect on the relationship of transformational leadership and high-performance work system on the work motivation of faculty members in the business schools of Thailand public universities. Furthermore, Asmawi, Zakaria and Wei (2012) suggested that transformational leadership has a negative effect on research and development culture in Malaysian universities. However, this finding has to be discarded due to reliability issues. Kalsoom et al., (2018) found that the findings of previous studies were inconclusive regarding the importance of any leadership that improves performance. Based on the inconsistent findings and the temporary organizational chaos due to the pandemic, the first hypothesis of this study is postulated as "*leadership has a significant impact on research performance of faculty members for higher education institutions in both Indonesia and Malaysia*".

Constantiou et al., (2017) found that entities shaped by digital platforms have higher resilience in accommodating restrictions during the pandemic. Digital technology is emerging as a strategic means as it is flexible and adjustable (Constantiou & Kallinikos, 2015). It enables rapid updating of business strategy and offers a protective shield for organizations experiencing sudden interruptions due to external shocks. Digital technology is the core aid in teaching and learning process, research, and community service during pandemic in higher education institutions. Seabrook, Kern, and Rickard (2016) stated that positive and high-quality social interactions, social support and connections built in online devices have a negative correlation with depression and anxiety symptoms. However, on the other hand, the sudden change of extremely high technology exposures can cause technostress for many people, including faculty members of higher education institutions. Technostress refers to stress in the use of technology, which includes techno-complexity, techno-insecurity and techno-overload. Technostress has an impact on health and also potentially reduces faculty members' work performance (Christian et al., 2020; Li & Wang, 2020). This article will discuss further the impact of digital technologies to the research performance among faculty members of higher education institutions. In its progress, this research also aims to investigate deeper whether the merits of digital technology outnumber the drawbacks. Therefore, the second hypothesis of this study is "*digital technology has a significant impact on research performance of faculty members for higher education institutions in both Indonesia and Malaysia*".

This study examined the role of leaders and digital technology usage as potential variables to overcome the problem of decreasing research performance in those countries. In addition, it tried to compare each research variable to develop a better understanding of characteristics from the countries in designing a contributed recommendation based on the findings.

2. Research Methodology

This study is a quantitative case study conducted in UNNES, Indonesia and UiTM Malaysia. An online questionnaire was handed out to a convenience stratified sample of faculty members from different disciplines. Some faculty members were selected and heads of department in specific subject areas in UNNES and UiTM were approached for an official approval to circulate the questionnaire to

their staff. Departments chosen in this study included the broad group of Arts and Humanities, Science and Technology, and Social Sciences. Using Slovin's formula with 10% error estimation, it was determined the sample size of UNNES was 154 faculty members, while UiTM's was 106 faculty members, with a total respondent of 260 faculty members.

The questionnaire comprises five (5) statements examining the research performance of faculty members, six (6) statements measuring leadership and six (6) statements about digital technology usage adopted from Fullwood, Rowley and Delbridge (2012) published questionnaire with some adjustments in the variable of research performance. The indicators of research performance are (1) problem solving; (2) new opportunities; (3) work process improvement; (4) productivity and (5) achievement. The leadership is described by: (1) clear instructions; (2) subordinate's opinion consideration; (3) respect for department managers; (4) logic objective set for the department; (5) trust towards department managers and (6) favouritism towards specific people. Meanwhile, the digital technology is explained by (1) human-centred technology; (2) linkage and relevance; (3) technology complexity; (4) training availability; (5) user-friendly and (6) collaborative orientation.

Each statement has 1-7 options according to the Likert scale. The options range from a group of categories—least to most—asking respondents to indicate how much they agree or disagree with the given statements (Allen & Seaman, 2007). The collected data were analysed using Warp-Partial Least Square (PLS) considering that most relationships between variables describing natural and behavioural phenomena are nonlinear (Kock, 2010).

3. Results

3.1 Quantitative Case Study 1: UNNES, Indonesia

3.1.1 Demographic of Respondents

The respondents from UNNES comprise 83 male and 71 female faculty members, who have been worked at this university for 0-5 years (45), 6-10 years (31), 11-15 years (32), 16-20 years (11), 21-25 years (8), and more than 25 years (27). The faculty members involved in this study have different positions, including lecturer (45), assistant professor (68), associate professor (34), and professor (7). In terms of study background, this study comprises respondents from Faculty of Economics (55), Faculty of Social Sciences (47), Faculty of Education (33), Faculty of Law (12), and Faculty of Physical Science (7).

3.1.2 Descriptive Statistics

The descriptive statistics of faculty members from UNNES shows that all research variables (research performance, leadership and digital technology) have high criteria with the average score of 30.54, 34.66, and 34.94 respectively. The order of the variables starting from the highest is digital technology, leadership and research performance. It describes leadership variables as strong as the digital technology variable in influencing the research performance of UNNES faculty members.

Table 2. Descriptive Statistics for Faculty Members of UNNES

Variables	Max	Min	Std. Deviation	Mean	Category
Leadership	42	18	5.54	34.66	high
Digital Technology	42	16	5.15	34.94	high
Research Performance	35	19	4.00	30.54	high

3.1.3 Common Method Bias

Common method bias or the general method bias test is used to account for errors in measurement. The use of the survey method may lead to general method bias because the measurements

of different constructs come from the same source. The common method test can be evaluated from the value of full collinearity VIFs as the result of full collinearity testing including vertical and lateral multicollinearity. The criteria for full collinearity VIFs must be <3.3. Table 3 shows that all variables have each a value <3.3. Therefore, all these variables are not biased against one another and can be continued to analyse the model in this study.

Table 3. The Value of Full Collinearity VIFs for Faculty Members of UNNES

Variables	*Full Collinearity VIFs*
Leadership	1,881
Digital Technology	2,143
Research Performance	1,502

3.1.4 Outer Model

The outer model evaluation is carried out to construct each indicator from the existing variables to find out if there are errors that occur. This evaluation includes assessing convergent validity and composite reliability. Construction indicator value can be seen from the combined loadings and cross loadings.

Table 4. Loading Factor P Value, AVE dan Composite Reliability for Faculty Members of UNNES

Variables	Loading Factors	P-Values	AVE	Composite Reliability
Leadership				
X1.1	0.763	< 0.001	0.534	0.872
X1.2	0.764	< 0.001		
X1.3	0.629	< 0.001		
X1.4	0.745	< 0.001		
X1.5	0.688	< 0.001		
X1.6	0.782	< 0.001		
Digital Technology				
X2.1	0.629	< 0.001	0.524	0.864
X2.2	0.793	< 0.001		
X2.3	0.423	< 0.001		
X2.4	0.758	< 0.001		
X2.5	0.815	< 0.001		
X2.6	0.838	< 0.001		
Research Performance				
Y1.1	0.697	< 0.001	0.592	0.879
Y1.2	0.772	< 0.001		
Y1.3	0.816	< 0.001		
Y1.4	0.755	< 0.001		
Y1.5	0.803	< 0.001		

The outer model in this study shows that several indicators do not meet the loading factor value > 0.70. Some still show a value of <0.70 and if this happens, the indicator is required to be removed so that there is no indicator bias. However, the loading factor value <0.70 is still tolerable and should not be eliminated if the AVE value is > 0.50 and the loading factor value is > 0.40. All variables in this study have each an AVE value > 0.50, so the possibility of an indicator error in this study can be avoided. There is no loading factor value <0.40, hence it is stated that this research model meets convergent validity. Therefore, it can be stated that this research model is valid and can be continued.

The research model can be accepted if it can meet the convergent validity and composite reliability. Convergent validity model is seen from each indicator's loading factor value and AVE for

each variable which is > 0.70; then the questionnaire is confirmed as reliable. All variables in this study meet the composite reliability with the condition that the composite reliability coefficient value is > 0.70 which has been met by all variables. Hence, the outer model of this research fulfils the reliability of the model and can be continued to the next stage.

Table 5. Correlations among Latent Variables and Errors for Faculty Members of UNNES

	X1	X2	Y1
X1	0.730	0.675	0.473
X2	0.675	0.724	0.565
Y1	0.473	0.565	0.769

There is a correlation between all variables in their diagonal values. All variables have a good correlation value with other variables. It can be described that all variables accomplish the criteria for discriminant validity. It could be concluded that the results of convergent validity, composite reliability and discriminant validity of this research model can be accepted that the inner model can be analysed further.

In the WarpPLS analysis, there are several measures of fit and quality indices that must be met. The following are the results of the fit and quality indices model:

Table 6. Model Fit and Quality Indices for Faculty Members of UNNES

No	Model Fit and Quality Indices	Criteria Fit	Analysis Result	Justification
1	APC	$p < 0.05$	0.328 $p < 0.001$	Accepted
2	ARS	$p < 0.05$	0.358 $p < 0.001$	Accepted
3	AARS	$p < 0.05$	0.350 $p < 0.001$	Accepted
4	AVIF	Acceptable if <= 5, ideally<= 3.3	1.723	Ideal
5	AFVIF	Acceptable if <= 5, ideally<= 3.3	1.842	Ideal
6	GoF	Small>= 0.1, medium>= 0.25, large>= 0.36	0.444	Large
7	SPR	Acceptable if >= 0.7, ideally =1	1.000	Ideal
8	RSCR	Acceptable if >= 0,9, ideally = 1	1.000	Ideal
9	SSR	Acceptable if >= 0,7	1.000	Accepted
10	NLBCDR	Acceptable if >= 0.7	1.000	Accepted

The table above shows the fit and quality indices model of this study which analyses the inner model in the research model. The overall value of this model shows good results. The inner model can be accepted if the APC, ARS and AARS values are completely accepted. Therefore, the inner model can be accepted and can proceed to the next stage, which is hypothesis testing.

3.1.5 Hypothesis Test

The criteria for testing this model are the same as the fit and quality indices model discussed above. The objective of examining this model is to see the direction, relationship and the magnitude of the coefficient between variables. In the table of fit and quality indices, it is confirmed that the model in the study is eligible and the research model is accepted. Once accepted, we will see here how are the direction, relationship and the number of coefficients between variables. The hypothesis test results are presented in Table 7.

Table 7. Hypothesis Test Result for Faculty Members of UNNES

No	Path	Coefficient	P *Value*	Justification
1.	Leadership → Research Performance	0.252	< 0.001	H_a accepted
2.	Digital technology → Research Performance	0.404	< 0.001	H_a accepted

3.2 Quantitative Case Study 2: UiTM, Malaysia

3.2.1 Demographic of Respondents

The respondents from UiTM consist of 35 male and 71 female faculty members from different study backgrounds, which are social sciences (88), science and technology (14) and art and humanities (4). As many as 10 respondents have been working for 0-5 years, 21 respondents for 6-10 years, 35 respondents for 11-15 years, 14 respondents for 16-20 years, 8 respondents for 21-25 years and 18 respondents for more than 25 years. Their positions include lecturer (62), senior lecturer (12) associate professor (26) and professor (6).

3.2.2 Descriptive Statistics

The descriptive statistics of faculty members from UiTM finds that research performance, leadership and digital technology have medium criteria with the average score of 22.62; 27.25; and 28.79 respectively. The variable with the highest mean is the digital technology, followed by leadership and research performance.

Table 8. Descriptive Statistics for Faculty Members of UiTM

Variables	Max	Min	Std. Deviation	Mean	Category
Leadership	36	20	3.78	27.25	Medium
Digital Technology	39	19	4.45	28.79	Medium
Research Performance	30	14	3.39	22.62	Medium

3.2.3 Common Method Bias

Common method bias concept has been explained in the previous case study. The criteria for full collinearity, VIFs have to be < 3.3. Table 3 describes that all variables have each a value of <3.3. Therefore, all variables are not biased against one another and can be continued to analyse the model in this study.

Table 9. The Value of Full Collinearity VIFs for Faculty Members of UiTM

Variables	Full Collinearity VIFs
Leadership	1.169
Digital Technology	1.283
Research Performance	1.127

3.2.4 Outer Model

Construction indicator value for UiTM faculty members can be seen from the combined loadings and cross loadings. There are several indicators in the variables that do not meet the loading factor requirements for the case of UiTM. This might lead to research bias; therefore, it is necessary to remove the indicator to improve the validity of the result. The deleted indicators are X1.2, X1.4, X2.1, X2.3, Y1.1, Y1.4 and Y1.5. Table 10 shows the rest of the indicators with no loading factor value < 0.40. Hence, it is stated that this research model meets convergent validity and this research model is valid and can be continued.

Table 10. Loading Factor P Value, AVE dan Composite Reliability for Faculty Members of UiTM

Variables	Loading Factors	P-Values	AVE	Composite Reliability
Leadership				
X1.1	0.815	< 0.001		
X1.3	0.901	< 0.001	0.738	0.894
X1.5	0.859	< 0.001		
Digital Technology				
X2.2	0.654	< 0.001		
X2.4	0.839	< 0.001	0.651	0.880
X2.5	0.861	< 0.001		
X2.6	0.854	< 0.001		
Research Performance				
Y1.2	0.922	< 0.001	0.851	0.919
Y1.3	0.922	< 0.001		

Convergent validity model is seen from each indicator's loading factor value and AVE. Meanwhile, the composite reliability is seen in the composite reliability coefficients which the requirement is that the value of composite reliability coefficients is > 0.70, hence the questionnaire is confirmed as reliable. All variables in this study meet the composite reliability with the condition that the composite reliability coefficients value is > 0.70 which has been met by all variables. Therefore, the outer model of this research fulfils the reliability of the model and can be continued to the next stage.

Table 11. Correlations among Latent Variables and Errors for Faculty Members of UiTM

Variables	Leadership	Digital Technology	Research Performance
Leadership	0.859	0.379	0.157
Digital Technology	0.379	0.807	0.334
Research Performance	0.157	0.334	0.922

There is a correlation between all variables in their diagonal values. All variables have a good correlation value with other variables. It could be concluded that, based on the results of convergent validity, composite reliability and discriminant validity, this research model can be accepted so that the inner model can be analysed further.

Table 12. Model Fit and Quality Indices for Faculty Members of UiTM

No	Model Fit and Quality Indices	Criteria Fit	Analysis Result	Justification
1	APC	p < 0.05	0.320 p < 0.001	Accepted
2	ARS	p < 0.05	0.243 p = 0.002	Accepted
3	AARS	p < 0.05	0.229 p = 0.003	Accepted
4	AVIF	Acceptable if <= 5, ideally<= 3.3	1.038	Ideal
5	AFVIF	Acceptable if <= 5, ideally<= 3.3	1.193	Ideal

6	GoF	Small>= 0.1, medium>= 0.25, large>= 0.36	0.426	Large
7	SPR	Acceptable if >= 0.7, ideally =1	1.000	Ideal
8	RSCR	Acceptable if >= 0.9, ideally = 1	1.000	Ideal
9	SSR	Acceptable if >= 0.7	1.000	Accepted
10	NLBCDR	Acceptable if >= 0.7	1.000	Accepted

The table above shows the fit and quality indices model of this study which analyses the inner model in the research model. Based on the result, the inner model can be accepted if the APC, ARS and AARS values are completely accepted. Therefore, the inner model can be accepted and can proceed to hypothesis testing.

3.2.5 Hypothesis Test

The criteria for testing this model are the same as the fit and quality indices model discussed above. In the table of fit and quality indices, it is confirmed that the model in the study has fulfilled the requirements and the research model is accepted. Once accepted, we will see here how are the direction, relationship and the number of coefficients between variables. The hypothesis test results are presented in Table 13.

Table 13. Hypothesis Test Result for Faculty Members of UiTM

No	Path	Coefficient	P *Value*	Justification
1.	Leadership → Research Performance	0.325	< 0.001	H_a accepted
2.	Digital technology → Research Performance	0.314	< 0.001	H_a accepted

3.3 Comparison of Variables between UNNES, Indonesia and UiTM, Malaysia

Table 14. Independent T-Test for Faculty Members of UiTM

	Levene's Test		Independent T-Test		Hypothesis Justification
	F	Sig.	t	Sig.	
Leadership	13.258	.000	12.834	.000	Accepted
Digital Technology	1.888	.171	9.787	.000	Accepted
Research Performance	3.902	.049	16.937	.000	Accepted

The Levene's test for homogeneity is only significant for the digital technology variable, while leadership and research performance data from UNNES and UiTM are not homogenous because UNNES scores are significantly higher than UiTM for these variables. The independent t-test of all variables are significant, then there are confirmed that leadership, digital technology and research performance between UNNES and UiTM faculty members are significantly different.

4. Discussion

Before the pandemic, the main reason virtual team or virtual organization is needed included cost reduction, globalization, flexibility, enabling technology, information capturing and organizational consequences (Andriessen, 2012). Now, when we face the pandemic, human being safety becomes the main reason above all prior reasons. During the pandemic, in terms of research performance among faculty members of UNNES and UiTM, generally the publication rate of universities is declining. However, the indicators of research performance in this study are not limited to the number of publications published by the faculty members. The indicators of research performance are (1) problem

solving; (2) new opportunities; (3) work process improvement; (4) productivity and (5) achievement. From all the indicators, UNNES has "high" category, while UiTM is in "medium" category. All indicators are valid for UNNEs, but only two indicators are detected valid for UiTM respondents, namely they are new opportunities and work process improvement. It implies that if the faculty members are generally aware of the changes that happen due to the pandemic, they have a different defence strategy to maintain their research performance.

The UNNES faculty members have a more comprehensive approach to find the solution for obstacles they meet in doing research and to identify new opportunities that exist during the pandemic (it could be the new idea for the research instead of the barrier). They too are eager to improve their work process to maintain their productivity and achievement of the research performance. On the other hand, UiTM faculty members have more focus in catching the new opportunities in research during pandemic and improving the research process. There is no one better than the other because each higher education institution has its own preferences based on several considerations.

Fischer and Neubert (2015) found that problem solving competency is a set of skills, knowledge and abilities required to deal with complicated and dynamic non-regular situations in various domains. Analytical, creative and pragmatic combination of thought is required for goal identification, solution path creation, and practical implementation of planned actions to overcome obstacles (Funke, Fischer & Holt, 2017). Doing research during a pandemic is one thing never imagined before, yet it could be a means to measure the depth of research knowledge of researchers to be able to make decisions of what to do and do not have to do for their research. This competency is important to preserve the quality of their research although they have to modify some parts or steps of their research. Therefore, it is strongly bound to the working process improvement.

Recently, research on health, science and technology are multiplied focusing on what and how we deal with this outbreak. Furthermore, in the qualitative research tribes, Cornwall (2020) stated that the COVID-19 pandemic is a once-in-a-lifetime chance to document people's experiences and to explore various life aspects of the current crisis if qualitative research can somehow be carried out. Therefore, the pandemic gives a lot of opportunity for researchers to explore something new for each particular field study, especially related to the technology usage (Garfin, 2020). If faculty members of UNNES and UiTM as researchers take this challenge, they could produce way more research and publications compared to during the normal situation. Hence, it potentially becomes a new achievement for the institutions.

The leadership variable is described by: (1) clear instructions; (2) subordinate's opinion consideration; (3) respect for department managers; (4) logic objective set for the department; (5) trust towards department managers and (6) favouritism towards specific person. UNNES faculty members believe their university managers have high leadership competency, while UiTM faculty members take the view that their university managers have a medium leadership capability. Despite their personal opinion about their leaders, the effect of leadership on research performance in UiTM is higher (32.5%) than in UNNES (25.2%). This condition occurs due to different regulations applied in both countries. In Malaysia, faculty members have to decide their career, whether they choose to be on research track or teaching track. Both tracks have different performance targets. Faculty members with the research track have a certain number of publications targeted each year based on their academic qualification, ranging from 1-3 publications in reputable journals each year. Meanwhile, Indonesian regulation does not have any track to be chosen for faculty members of higher education institutions. The regulation sets that all faculty members should conduct teaching and learning, research and community service activities in the same portion with certain targets for each activity. It leads to less target for the annual number of publications. This also becomes an answer as to why the number of publications in UiTM is higher than UNNES (data performed in the introduction of this paper).

The higher education institutions involved in this study might have different levels of leadership effect on research performance. However, both of them confirmed that there is a significantly positive effect of leadership on research performance. This is in line with the research finding of Muhammed and Zaim (2020) who found that leadership plays a vital role in the overall success of knowledge management in organizations. The leader's support has a positive impact on the success of organizational management, which can positively affect organizational innovation performance and, subsequently, their financial performance. Other studies that support the results of this study include

Rehman and Iqbal (2020) that stated it is empirically proven that knowledge-oriented leadership has a strong direct and positive impact on the performance of higher education organizations.

The second hypothesis of this study examined whether or not there is a significant effect of digital technology on research performance of faculty members for higher education institutions in both Indonesia and Malaysia. The digital technology indicators for this study are (1) human-centred technology; (2) linkage and relevance; (3) technology complexity; (4) training availability; (5) user-friendly and (6) collaborative orientation. All indicators are measured in a high category for UNNES faculty members, meaning that respondents acknowledge all components of digital technology play important roles. On the other hand, two indicators are identified as invalid for UiTM faculty members, including human-centred technology and technology complexity. It describes that the UiTM faculty members have no big deal with advancement and complexity of a technology as far as it is user-friendly and works to support their activities. This condition leads to a different rate of impact for digital technology on research performance between UNNES (40.4%) and UiTM (31.4%).

The rapid development of digital technology has made the research process easier than a couple of decades ago. Moreover, during the worldwide lockdowns, physical and social distancing, researchers face methodological barriers in conducting their empirical fieldwork. Under such predicaments, qualitative researchers are trying to find alternative methodological approaches, making use of telecommunications and digital tools for remote data collection (Roy & Uekusa, 2020). Among quantitative researchers, digital technology also means a lot. Jung (2014) as well as Bhagwatwar, Hara, and Ynalvez (2013) found technology usage as a factor influencing research productivity in Japan, Singapore, and Taiwan. Khin and Ho (2019) showed that digital orientation and digital capabilities have a positive effect on digital innovation.

Many researchers develop a wide range of technology-based research innovation in this pandemic. Some of them are the development of digital approaches to remote paediatric healthcare (Badawy & Radovic, 2020); the usage of digital tools for geriatric care (Nicol, Piccirillo, Mulsant & Lenze, 2020); self-reflection method for qualitative research (Roy & Uekusa, 2020); tourism recovery strategy against pandemic (Yeh, 2020); developing online business model (Setiawan & Fatimah, 2020); technology usage in education during pandemic (Tufan, 2020; Dutta, 2020; Rohman, Marji, Sugandi & Nurhadi, 2020; Azlan et al., 2020) and many more. All these publications reflect the support of digital technology in many aspects of life during the pandemic, including in research methodology issues.

The leadership and technology usage are urgent to maintain the university productivity as stated by Maruping and Magni (2015) that the collective motivation (in this case is raised by the leader) reflected in team empowerment triggers to shape individuals' post-adoption behaviour. In this context, the post-adoption behaviour is the new normal virtual team behaviour which is fully supported by digital technology. Thus, leadership and technology are two aspects in universities which inevitably need more collaboration to build stronger virtual teams to achieve the university target, including research and publication target, during the pandemic.

5. Conclusion

Both Indonesia and Malaysia higher education institutions (and also all aspects in countries worldwide) experienced temporary chaos in the beginning of the pandemic. However, humans have the highest adaptability among creatures on this planet. Humans learn from experience and are eager to resolve problems with all possible alternatives, hence there is no exception for the research performance. Capable university managers produce effective policies and gain faculty members' trust in order to adjust the research activities with existing circumstances. Meanwhile, digital technology usage supports every part of research activity, so much more in this less-direct-contact era. Based on this study, it would likely conclude that the bundle of a good leadership and an appropriately-used digital technology is a potential combination of predictors to be properly treated to maintain or even increase the research performance among faculty members. Further research is required to expand the samples and establish other variables to develop more comprehensive understanding about the research performance among Asian faculty members during or after the pandemic.

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