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Bring your own device readiness and productivity framework: a structured partial least square approach

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ABSTRACT

Bring your own device (BYOD) is defined as the practice that allow users to bring their private owned devices to organizations or institutions. BYOD bring benefits to both organizations and education sector in terms of cost efficient and productivity enhancement. However, there is a dearth of research on the determinant and impact of BYOD adoption in the context of educational sector. Therefore, the purpose of this study is to develop a BYOD readiness and impact framework based on four dimensions, namely technological readiness, individual readiness, contextual readiness, and organisational readiness. This study employed a quantitative research approach, utilizing an online survey questionnaire as the primary research instrument. Findings were analysed based on descriptive and inferential statistics using statistical package for social sciences (SPSS) version 26 and SmartPLS version 4.0. The findings shows that individual readiness, contextual readiness, and organisational readiness have a positive and significant relationship with BYOD adoption, while technological readiness proof to be an insignificant predictor. Subsequently, BYOD adoption also proven as a positive and significant predictor capable to improve user's productivity.

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1. INTRODUCTION

Bring your own device (BYOD) became one of predominant and widely discussed topic during pandemic COVID-19 which it allows people to bring and use their own devices in an organisation or institution. BYOD is defined slightly different when it is used in different setting such as in the setting of working environment or in education field. However, the main purpose is similar which is to maximize the productivity in both context [1]. In the context of working environment, BYOD is defined as the practice that allow users to use their personal owned devices in completing their task [2]. While in the context of education, BYOD is mainly for facilitating personalised teaching [3] and it is defined as the method that improves learning by utilising mobile devices owned by students [4], [5].

The development of BYOD had benefits students and educators in institutions as well as employees in an organisation. In developing countries, BYOD being adopted and implemented in most higher education institutions to help in students' engagement as well as to enhance students' learning experiences [6]. BYOD helps students to increase their engagement where they actively involve in their learning activities that contribute

to enhance their productivity [7]. However, users' readiness is important to be considered and evaluated in order to ensure the implementation and adoption of BYOD is successful. Therefore, the purpose of this study is to investigate the four attributes namely technological readiness (TRE), individual readiness (IRE), contextual readiness (CRE), and organisational readiness (ORE) to the user behavioural intention in adopting BYOD and to examine the user intention behaviour in adopting BYOD may influence users' productivity.

2. LITERATURE REVIEW

2.1. Bring your own device concept

Education is a significant market that encourages the use of BYOD. The BYOD model was first originated and introduced in colleges and universities due to the influence of tech-savvy students who requested it and educational officials who saw it as a competitive advantage to provide access to the network via personal devices. Currently, this topic garners significant interest [8]. Higher education institutions can leverage the prevalence of mobile device ownership among students to enhance teaching and learning methods. Utilising students' personal electronics introduces the concept of BYOD [9]. Individuals rely on their own gadgets and need the flexibility to utilise them wherever to streamline and enhance their daily tasks. As BYOD implementation rises, teachers are devising innovative strategies to incorporate mobile devices into classrooms. Universities find the idea of students using their personal mobile devices for learning appealing since it can cut costs and enhance the educational process [8].

2.2. Bring your own device in education

BYOD in education has gained traction as a way to integrate personal technology into the learning environment. According to Newhouse *et al.* [10], an investigation into the feasibility of a BYOD policy for students in teacher education found that all laptop devices tested were adequate, but among mobile devices, only the iPad met the demands of teacher education courses. A study emphasizes BYOD model is convenient for students [11], increases engagement, and cost-effectiveness, shifting responsibility for device acquisition and maintenance to students. However, careful planning is needed to effectively support both students and educators. Moreover, cost savings for educational institutions, allowing students to use familiar devices, enhancing comfort and engagement, and offering flexibility [11]. BYOD also promotes collaboration and resource sharing, making it a valuable model for enhancing learning efficiency and alleviating financial burdens on educational institutions, as they do not need to supply identical devices for all [11]. Parental support is essential for the success of initiatives at K-12 institutions. Research indicates that the majority of parents are open to letting their children bring personal gadgets to school for educational reasons, which is influenced by aspects including the school's technology quality and educational programmes [12].

2.3. Bring your own device adoption

Nowadays the education community recognised BYOD as a way to respond to technological advances in which mobile devices boost classroom activities. Educators can employ mobile devices to reposition assignments, enhance learning opportunities, and improve engagement in person or online. Students may study, create, share, and collaborate at any time and place. Additionally, BYOD was thought to encourage the development of 21st-century skills such as digital literacy, innovation and creativity, as well as enhanced nature of peer communication and collaboration [13], [14]. The discussion of BYOD adoption in educational settings can be seen in many research studies. Adoption of BYOD in educational institutions has also been considered a good way to cut institutional spending costs on technological hardware and software since the burden of purchasing the learning and teaching devices has shifted to the students and instructors as well [15]–[18].

2.4. Impact of bring your own device adoption on productivity

Productivity can be measured in terms of money, time, cost, quality, or quantity [19]. In recent years, there have been a shift both personally and professionally towards mobility and the usage of portable devices like laptops, smartphones, and tablets [20]. Mobile devices can be utilised anytime, anywhere, instead of only in designated computer rooms, which removes one of the primary barriers to the adoption of blended learning, which combines in-person instruction with technology. BYOD has the ability to increase students' possibilities to learn anytime, anywhere [21]. It can also increase student engagement and offer value, flexibility, and more individualised learning [22]. Its makes learning more dynamic and encouraging student participation where students can engage in class activities using their own devices due to the turning point system [23].

2.5. Research model

In developed countries, the adoption and implementation of BYOD is intended to boost student motivation and education in universities and colleges [1], [24]–[26]. The intention to adopt bring your own

device (ADO) policies can have significant implications for productivity in organizations, for instance, allowing employees to use their preferred devices can enhance their satisfaction and motivation, leading to higher levels of job performance and task completion rates. Figure 1 shows the research model illustrates the relationship between BYOD readiness and productivity. There are four dimensions are found in this model which are TRE, IRE, CRE, and ORE.

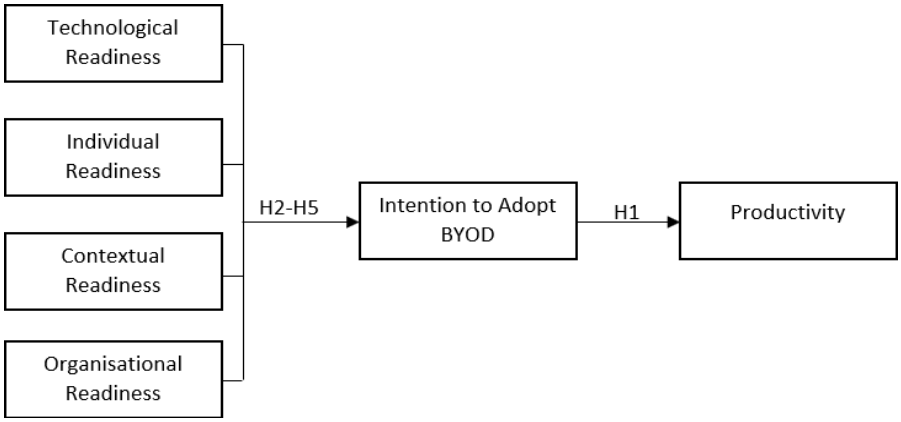

Figure 1. Research model

2.6. Relationship between technological readiness and intention to adopt bring your own device

TRE is the ability of a particular piece of technology to facilitate BYOD activities. BYOD was also thought to foster improved peer collaboration and communication as well as the development of 21st-century skills including digital literacy, creativity, and innovation [13]. When the features of the technology better match the tasks that need to be completed, people are more productive. Doargajudhur and Hosanoo [27] in their study stated that the participant agreed that using personal devices' apps and features instead of the ones provided by the organisation leads to higher performance levels due to the advancement of technology in their own devices. This aligns with the findings [28], who similarly confirmed in their qualitative investigation that workers believe their workload increases when they use personal technology to complete work-related tasks. For instance, research findings have connected workers' use of technology to higher levels of productivity, flexibility, and social interaction. Therefore, it can be hypothesized that: TRE has a positive and significant relationship with the ADO.

2.7. Relationship between individual readiness and intention to adopt bring your own device

IRE is the degree to which individual employees are ready and willing to accept the idea of utilising their personal devices for work-related tasks within an organisation. The BYOD trend emerged as a result of people becoming more and more accustomed to the convenience and advantages of using their own mobile devices for business purposes. To this end, people are willing to bring their own devices into their professional settings to complete tasks [29]. In context of student, according to Hayes [30] discovered blended learning utilising mobile devices has shown to be more successful than traditional methods, and students' experiences with mobile use have been overwhelmingly positive. Therefore, it can be hypothesized that: IRE has a positive and significant relationship with the ADO.

2.8. Relationship between contextual readiness and intention to adopt bring your own device

CRE refers to describe an individual's environmental circumstances that influence how they interact and behave when BYOD is implemented. Mokoena [31] stated that contextual factors such as organisational and environmental factors will affect the adoption of BYOD. The dynamic nature of current technological tools suitable to be used in BYOD-based teaching and learning in schools or college universities can, to some degree, leverage the adoption of BYOD by both students and academicians. The usability and user friendliness of ever-progressing smart phones, laptops, tablets, smart watches, learning management systems, and many other digital tools really encourage the BYOD adoption of the community in the educational setting [17], [23], [32]. Therefore, it can be hypothesized that: CRE has a positive and significant relationship with the ADO.

2.9. Relationship between organizational readiness and intention to adopt bring your own device

The intention to implement BYOD policies is highly influenced by organizational readiness. Studies indicate that companies that are more prepared are more likely to have a favourable attitude toward BYOD

adoption [33]. For example, a culture of experimentation and openness is fostered by strong leadership support for technology innovation, which makes the firm more accessible to BYOD efforts. Furthermore, adequate resource allocation and investment in technological infrastructure are essential for enabling the seamless integration of personal devices into the corporate network. Organizations with robust IT infrastructure and security measures in place are better equipped to address potential challenges associated with BYOD implementation, such as data security risks and compatibility issue [34]. A proactive stance towards change, strong leadership support, adequate resource allocation, and employee readiness are key drivers of successful BYOD adoption. By fostering a culture of readiness and investing in the necessary infrastructure, communication, and training, organizations can maximize the potential benefits of BYOD while mitigating associated risks. Therefore, it can be hypothesized that: ORE has a positive and significant relationship with the ADO.

2.10. Relationship between intention to adopt bring your own device and productivity

The effectiveness with which resources are employed to meet organizational goals and objectives is referred to as productivity. It includes things like productivity per unit of input, task completion rates, personnel performance, and time management. Productivity is a key factor in an organization's sustainability, profitability, and competitiveness [35]. Since technology makes it possible for seamless communication, collaboration, and information access, it has a significant impact on productivity outcomes. The ADO policies can have significant implications for productivity in organizations. Studies suggests that BYOD adoption is associated with various productivity-related benefits, including increased employee engagement, flexibility, and efficiency [36]. BYOD adoption offers various potential benefits, including increased flexibility, employee satisfaction, and cost savings, which can enhance productivity outcomes. However, the successful integration of BYOD into the workplace requires careful consideration of organizational readiness, technological infrastructure, security measures, and employee training. By fostering a culture of innovation, investing in robust IT infrastructure, and addressing potential challenges proactively, organizations can leverage the productivity benefits of BYOD effectively. Therefore, it can be hypothesized that: ADO has a positive and significant relationship with productivity.

3. METHOD

This study employed a quantitative research approach, utilizing an online survey questionnaire as the primary research instrument. Convenience sampling was utilized to select respondents who were most readily accessible to the researcher, a method particularly suitable when randomization is not feasible. The study focused on students from the School of Information Studies within the College of Computing, Informatics, and Mathematics at Universiti Teknologi MARA, encompassing the entire student population from this school across all UiTM campuses in Malaysia. Online questionnaires were distributed via WhatsApp to student groups, in collaboration with programme coordinators from various campuses including Machang, Puncak Perdana, Samarahan, Segamat, Rembau, and Merbok. Data collection took place over a three-week period in September 2023, with 476 respondents participating in the online survey. The collected data underwent descriptive analysis using SPSS version 29, and inferential statistical analysis was conducted using SmartPLS 4. Data normality was assessed using Mardia's test for data cleaning purposes.

4. RESULTS AND DISCUSSION

4.1. Assessment of normality and bias

The initial requirement to analyse data using structured equation modelling using partial least square (PLS-SEM) is to determine the normality and common method bias (CMB). To determine the normality of the research data, Mardia's multivariate analysis was conducted using WebPower as suggested in [37]–[40]. The result shows that the research data is slightly not normal; indicated by Mardia's multivariate skewness (β=303.754, p=<0.01) and Mardia's multivariate kurtosis (β=1593.084, p=<0.01) – thus justifying the usage of PLS-SEM. Next, CMB was analyse using SmartPLS 4.0. Kock [41] recommended an acceptable value of 3.3. while Hair *et al.* [37] recommended a higher value of 5.5. Based on SmartPLS analysis, the research data produced VIF values between 1.430 to 5.312; indicating the fulfilment of CMB and confirming that there is no issue of CMB for the studies.

4.2. Measurement model analysis

There are two steps in SmartPLS analysis – first, to establish the measurement model, and second, to confirm the structural model. Ramayah *et al.* [42] suggest the following criteria must be met to establish the

measurement model – first, established internal consistency reliability. Second, established convergent validity and third, confirming the discriminant validity. For the purpose of the study, a first-order constructs were selected – namely TRE, IRE, CRE, ORE, ADO, and productivity (PRO). A total of 30 items were formulated for the purpose of study.

4.2.1. Convergence validity

The first step is to establish internal consistency reliability and convergent validity. The Table 1 shows the results of consistency reliability and convergent validity assessment. A total of single run was conducte using statistical software SmartPLS 4.0. Items was then analyse based on factor loading, average variance extracted (AVE) and composite reliability (CR). Remarkably, all items meet the threshold indicators - (Factor loading ≥ 0.7; AVE ≥ 0.5; CR ≥0.7) as suggested in [37], [42]. Even though item TRE2 was below the threshold of 0.7; however, it was kept due to higher value of AVE as suggested in [42]. In relation to Cronbach's Alpha coefficient, the study produced a result between 0.863 to 0.954; surpassing the minimum value of 0.7 as suggested in [43] indicating that there is no issue with the reliability of the instrument.

Table 1. Convergence validity assessment

Construct	Factor	Loading	Cronbach's Alpha	AVE	CR
Technological readiness	TRE1	0.777	0.863	0.903	0.652
	TRE2	0.656			
	TRE3	0.854			
	TRE4	0.874			
	TRE5	0.856			
Individual readiness	IRE1	0.851	0.924	0.942	0.766
	IRE2	0.840			
	IRE3	0.859			
	IRE4	0.927			
	IRE5	0.897			
Contextual readiness	CRE1	0.836	0.906	0.930	0.727
	CRE2	0.872			
	CRE3	0.871			
	CRE4	0.856			
	CRE5	0.828			
Organisational readiness	ORE1	0.898	0.950	0.962	0.834
	ORE2	0.929			
	ORE3	0.923			
	ORE4	0.919			
	ORE5	0.897			
Intention to adopt BYOD	ADO1	0.914	0.954	0.844	0.964
	ADO2	0.894			
	ADO3	0.935			
	ADO4	0.924			
	ADO5	0.927			
Productivity	PRO1	0.800	0.919	0.939	0.754
	PRO2	0.831			
	PRO3	0.915			
	PRO4	0.905			
	PRO5	0.886			

4.2.2. Discriminant validity

Upon successful validation of convergence validity, the subsequent step is to confirm the result of discriminant validity for the study. The Table 2 shows the Fornell-Larcker criterion of the study. Based on Table 2, the study has successfully established and confirmed the discriminant validity; as all square root of the constructs are greater than its previous value, thus meet the requirements for confirming discriminant validity.

Table 2. Fornell-Larcker criterion

	ADO	CRE	IRE	ORE	PRO	TRE
ADO	0.919					
CRE	0.554	0.853				
IRE	0.734	0.429	0.875			
ORE	0.767	0.539	0.650	0.913		
PRO	0.780	0.561	0.628	0.662	0.868	
TRE	0.438	0.521	0.481	0.361	0.480	0.807

However, recent study indicating that there is a need to further confirming discriminant validity using heterotrait-monotrait ratio, as suggested in [44]. The Table 3 shows the result of heterotrait-monotrait ratio of the study. According to previous studies, the acceptable values of heterotrait-monotrait ratio is as follows: below 0.85 [45] and below 0.9 [44], [46]. Hence, a detailed analysis of heterotrait-monotrait ratio on Table 3 shows a value between 0.456 to 0.826; indicates that there are no values of greater than 0.85 thus confirming that there is no issue of discriminant validity for the study. Subsequently, its also confirmed that the measurement model of the study has been established.

Table 3. Heterotrait-monotrait ratio

	ADO	CRE	IRE	ORE	PRO	TRE
ADO						
CRE	0.594					
IRE	0.771	0.456				
ORE	0.804	0.579	0.687			
PRO	0.826	0.616	0.666	0.705		
TRE	0.479	0.579	0.533	0.394	0.547	

4.3. Structural model analysis

4.3.1. Hypothesis testing

Once measurement model has been established, the next step is to conduct the structural model assessment. The Table 4 shows the result of the study. In the beginning of the research, a total of 5 hypothesis has been developed and tested. With the completion of structural model analysis, it can be that confirmed that 4 hypotheses have been accepted. First, ADO were found to have significant and positive relationship with Productivity (H1: Supported, t= 22.562, p<0.000). Second, all determinants of ADO were found to have a significant and positive relationship, except for TRE (H2: Not supported, t= 0.663, p>0.000; H3: Supported, t= 7.950, p<0.000; H4: Supported, t= 3.607, p<0.000; H5: Supported, t= 8.100, p<0.000).

Table 4. Structural Model Assessment

Hypothesis	Relationship	t	p	Result
H1	ADO -> PRO	22.562	0.000	Supported
H2	TRE -> ADO	0.663	0.508	Not supported
H3	IRE -> ADO	7.950	0.000	Supported
H4	CRE -> ADO	3.607	0.000	Supported
H5	ORE -> ADO	8.100	0.000	Supported

4.3.2. Coefficient determination score

Table 5 shows the result of coefficient determination score. The test is used to determine the impact of exogenous variables (TRE, IRE, CRE, ORE, ADO) on the endogenous variables (ADO, Productivity). This study used R square adjusted to determine the impact as suggested in [47]–[49]. Thus, findings indicate that the first exogenous variables (TRE, IRE, CRE, ORE) can explained a total of 70.2% (substantial) of the variation, while second exogenous variable (ADO) can explain a total of 60.8% of the variances.

Table 5. Coefficient determination score

Construct	R square	R square adjusted	Decision	Source
Productivity	0.609	0.608	Moderate	Hair *et al.* [37]
Intention to adopt BYOD	0.702	0.700	Substantial	

4.3.3. Effect size

The next step is to explain the effect size of each relationship. The Table 6 shows the f^2 result of the study. Results shows an effect size ranging from small to large (0.001 to 1.557). The largest effect size was produced by the relationship between ADO -> PRO (f^2=1.557) while the smallest effect size as produce by the relationship between TRE -> ADO (f^2=1.557). Subsequently, Figure 2 shows the final structural model of the study.

Table 6. Effect size

Hypothesis		f^2	Result
H1	ADO -> PRO	1.557	Large
H2	TRE -> ADO	0.001	Small
H3	IRE -> ADO	0.244	Moderate
H4	CRE -> ADO	0.041	Small
H5	ORE -> ADO	0.311	Moderate

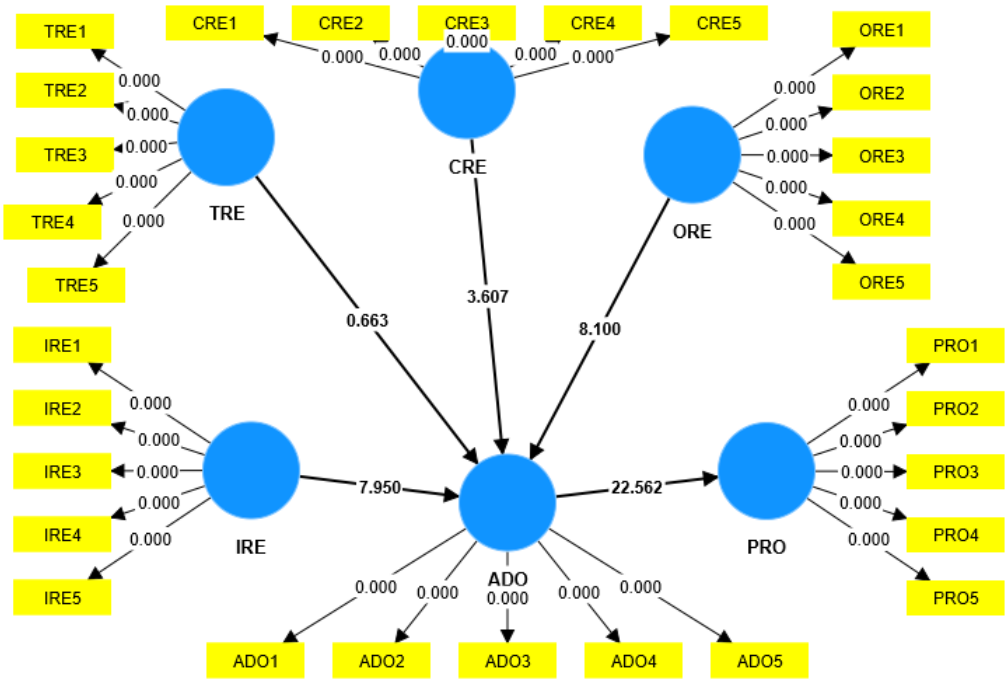

Figure 2. Final structural model

4.4. Discussion

The completion of the findings indicates several interesting discoveries that warrant further exploration and discussion. Intriguingly, one of hypothesis was rejected; TRE was found as an insignificant predictor of ADO (H2: Not supported, t= 0.663, p>0.000). This finding is contrary to the previous studies that found a positive and significant relationship between technological factors and intention to adopt an information system or technological concept. However, this exciting finding can be attributed to several factors. First, students nowadays have a good knowledge on technology; portrayed by their self-efficacy and their capability to learn new skills related to technology with less effort. This contrasts with previous generation that rely heavily on assistance to learn and adapt to a new technology. This is also supported by the rising emergence of artificial intelligence (AI) platforms such as ChatGPT, OpenAI, Bing, Mid Journey, Copy.ai, and Gemini. This technology enables seamless interaction between users and technology – no digital or technological knowledge is needed to create an awesome, real-life illustration of an individual or things, as well as to answer various questions and tasks. Secondly, the increase literacy rate of Malaysian has enabled less dependency on assistance to learn new technology. Most Malaysian especially the new generation has become a technological savvy; thus, it is not surprising that the readiness of technology is no longer affecting them, as they are more than capable to cope with the challenges.

In addition to the negative result, this study also found a positive and significant relationship between other predictors of attitude to adopt BYOD - IRE, CRE, and ORE were found to have a positive relationship that capable to influence adoption of BYOD concept (H3: Supported, t=7.950, p<0.000; H4: Supported, t=3.607, p<0.000; H5: Supported, t=8.100, p<0.000). The result of this study added new literature into the field of information system readiness framework, information system adoption, performance impact, and benefits achievement in relation to productivity improvement and enhancement. This study extends previous studies of [50]–[59].

In spite of positive and negative results, this study also added into the literature a positive and significant relationship between ADO and Productivity (H1: Supported, t=22.562, p<0.000). More importantly, this relationship produces the largest effect size among all relationship in this study (f^2=1.557). The study

provides significant findings on the influence of BYOD adoption on student's productivity improvement. This finding added into the current literature on the positive effect of BYOD adoption on productivity, performance, and benefits achievement. In general, BYOD concept allow individual to use the devices that they are already familiar with on daily basis. This prevents unnecessary problem such as to get familiar with new devices or operating system, different response rate or speed, different input devices, and different software. Moreover, using own devices help an individual to focus on their task, rather than focusing on the effort to be familiar with a new device. Other than that, new device usually has some limitation impose by the organization – such as automatically deleting files upon signing off the account, probability of computer infestation, and limited access time.

5. CONCLUSION

BYOD is a concept that are now becoming a necessity especially with the challenging economic downturn and increasing tax rate, especially among educational institutions. Thus, this study added into the literature of BYOD, information system, information system adoption, as well as productivity enhancement. Moreover, the study also recognizes the importance of BYOD in educational institution and identify the level of dependence among the respondents on their digital devices. The contribution of this paper are as follows. First, the paper develops a conceptual framework linking readiness model, information system adoption, as well as benefit achievement. Second, the paper provides empirical findings from the context of Malaysian research universities. Third, the paper also develops a validated instrument linking readiness model, information system usage, and performance impacts. Fourth, this study added into the body of knowledge on the scarce relationship between readiness model, information system usage, and productivity. However, we believe that this study is not without a limitation. First, we conduct the study using a single quantitative research method. We suggest that future studies to explore other alternatives such as qualitative research, mixed research, and experiments. Second, the respondents are gathered from a single faculty across Malaysia. We suggest that future studies to explore respondents from multiple faculties, as well as a case study comparing two or more faculties. Third, we only focus on generalization of theory; future study may consider on population generalization of study. Nevertheless, albeit all these limitations, we can confirm that our study has met its objective and contributed towards further understanding of the underlying relationship between readiness framework, information system adoption, and performance impacts, and benefits achievement.

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