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Information Communication and Technology (ICT) Adoption in Asian Countries: An Empirical Evidence of Economic and Socio-Cultural Factors

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ABSTRACT

The research dealt with factors affected the different Information Communication and Technology (ICT) adoption rate among Asian countries. The primary purpose was to examine the impact of national wealth and culture on the behavioral adoption of ICT empirically among selected countries in Asia. Data were collected from the World Bank, World Economic Forum, and Hofstede's cultural dimension index. Statistical correlation and multiple regression were utilized to analyze the dataset, such as Gross Domestic Product (GDP) as a proxy for national wealth and Hofstede's cultural dimension as a proxy for culture. The result shows a significant relationship between GDP per capita and uncertainty avoidance on the national ICT adoption index. This finding contributes to improving the acknowledgment of the GDP and national culture as the antecedent of ICT adoption in the global field. Practically, the research updates the previous similar ones and proposes further empirical research to extend the scope of analysis..

Keywords: Information Communication and Technology (ICT) adoption, Asian countries, economic factor, socio-cultural factor

INTRODUCTION

Information Communication and Technology (ICT) has become critical for most countries to leverage their competitiveness in the global field. The advent of ICT in global trade has eradicated the geographical barriers among the countries. On the other side, the government should prepare for the innovation to pace a rapid technological change in the digital era. For instance, by utilizing the ICT in government (e-government) in which a government can provide value, such as improved administration, improved public services, and enhanced social value to the public through the accessibility of government information and service to citizens, employees, business partners, and other entities (Twizeyimana & Andersson, 2019). However, learning culture shall favor innovation in government organizations (e.g., e-government) throughout the public service (De Vries, Bekkers, & Tummers, 2016). World Economic Forum measures global countries' competitiveness using 12 pillars as indicators. Those 12 pillars are institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and innovation capability (Kowal & Paliwoda-Pękosz, 2017). Even though ICT adoption has ubiquitous advantages, it is disposed to be the weakest growth pillars among the 12 components in 57 countries (Schwab, 2018). The wide discrepancy of ICT adoption among global countries also becomes another issue like in Asian countries (Cruz-Jesus, Oliveira, Bacao, & Irani, 2017). For instance, in the Global Competitiveness Report, South Korea comes up to be the best rank of ICT adoption index with a score of 91,3. By contrast, India has the weakest rank (117th) with a score of 28.

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That gap reflects the uneven distribution of technology resources across the world (Schwab, 2018). Several scholars argued that the condition leads to a digital divide among the countries (Pick & Sarkar, 2016; Sung, 2016). Therefore, the problem of disparity in ICT adoption rate among Asian countries is one of the relevant issues in the recent global competitiveness. The diversity of traits among countries in Asia is also an important matter to explain the ICT adoption gap. The research addresses that problem by investigating the variables which influence the adoption rate of ICT in Asia.

ICT adoption is one of the most critical early stages to create ICT diffusion (Dasgupta & Gupta, 2019). To understand the term of adoption, the researchers also expose diffusion to emphasize the two different concepts used in the research. Although in many literature works, those two terms are commonly used together (Kee, 2017). Rogers (2003) defined the diffusion of technology as the process in which innovation was communicated through specific channels over time among the social system members. Therefore, the primary purpose of the diffusion stages was the adoption of an individual to the innovation, whether he/she chose to accept or reject.

Several theories have been proposed to measure the degree of adoption from the individual-level. There are Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), to a country level such as the ICT adoption index from the World Economic Forum. Generally, the adoption and the usage of innovations are contingent upon the individual to another (Mandler, Seifert, Wellbrock, Knuth, & Kunz, 2018).

Several kinds of literature investigate the relationship between national cultures and ICT adoption (Aparicio, Bacao, & Oliveira, 2016; Dasgupta & Gupta, 2019; Mohammed & Tejay, 2017; Takieddine & Sun, 2015; Tam & Oliveira, 2017). The research uses five Hofstede's cultural dimensions as a proxy of national culture and the share of ICT expenditure in each country as a proxy of ICT adoption. Other studies also find that Hofstede's cultural dimension has a significant impact on the relationship of acceptance of e-commerce by customers in Russia (Kim, Urunov, & Kim, 2016), mobile phone service (Abrahão, Moriguchi, & Andrade, 2016), or e-government development (Kovacic, 2009; Kurfalı, Arifoğlu, Tokdemir, & Paçin, 2017; Merhi, 2018; Zhao, 2011). For avoiding bias on the measurement, the national wealth (GDP) is included to predict the relationship since it significantly affects the ICT adoption in government (Alderete, 2018). Few studies analyze the relationship between national culture and ICT adoption at a macro level. For filling the gaps, the research emphasizes the cultural studies at macro levels, such as regions that will improve the accuracy of the relationship. A certain region usually has a unique culture than other areas. The prior studies of culture and ICT adoption are described in Table 1 (see appendices).

Culture is a representation of the collective programming of the mind. Consequently, it generates dissimilarity in each individual's need or behavior in an organization (Erumban & De Jong, 2006; Hofstede, 2001). To the extent of understanding the ICT adoption factors among countries, national culture is widely acknowledged to explain the cross-countries variation in ICT adoption (Erumban & De Jong, 2006; Zhao, 2011). One of the most prominent measurements of national culture is Hofstede's cultural dimension. Hofstede's national culture dimension initially comprises four dimensions (individualism, power distance, uncertainty avoidance, and masculinity) (Beugelsdijk & Welzel, 2018; Gladwin, 1981). The concept concerns dealing with lagging productivity and competition in the global market. The other dimensions, such as long-term versus short-term orientation (Hofstede, 2001) and indulgence versus restraint (Hofstede, Hofstede, & Minkov, 2010), are subsequently added in the study. (Beugelsdijk & Welzel, 2018). Bankole and Bankole (2017) studied that national culture was a fundamental motivation in dealing with risk, behavior, and opportunity in ICT adoption. Thus, to understand the national level of ICT adoption, national culture should be able to illuminate the degree of it.

Several critiques have been addressed to the model. Touburg (2016) argued that Hofstede's cultural dimension assumed people as cultural dopes and ignored the influence of non-cultural factors. It did not account for change, and it had an in-built Western bias. Venkateswaran and Ojha (2019) also revealed that there was criticism of Hofstede's national culture. They stated that national culture dimensions did not exist at the individual level of analysis. Apart from these criticisms, many prior studies recently elaborate on the relationship between Hofstede's cultural dimension and technology adoption. However, few studies examine the relationship at the country level. The previous studies which examine the technology adoption are influenced by Hofstede's cultural dimension, as presented in Table 2 (see appendices).

The first dimension is individualism versus collectivism. Individualism versus collectivism refers to the degree to which an individual's preferences integrate with the organization and group or remain to look after themselves. That condition is affected by social patterns such as language and geographical environment, which are heritable traits. There are several studies relating to individualism in studying technology adoption. For instance, individualism or collectivism significantly affects the acceptance of mobile commerce (Faqih & Jaradat, 2015). Also, individualism culture affects internet addiction significantly (Arpaci, Kesici, & Baloğlu, 2018; Jiang, Li, & Shypenka, 2018).

Meanwhile, collectivism also drives the adoption of technology by influencing people in a group or similar interest activities. A study finds a significant impact of collectivism on intention towards online group buying in South Korea (Han & Kim, 2019).

According to Hofstede's cultural dimension index, most Asian countries have a low score of individualism (Smith & Robinson, 2019). However, several Asian countries have the highest IDV score (India with IDV = 48 and Japan with IDV = 46). Dissanayake *et al.* (2015) argued that these countries had both collectivistic and individualistic traits. Nevertheless, the character of Asian countries mostly is collectivism. Desmarchelier and Fang (2016) found that the United States, the United Kingdom, and Australia were faster to diffuse with the innovation than others. The model also showed that countries with higher diffusion were prone to be individualists (European countries) than collectivists (Asian countries). Hence, the first hypothesis is:

H1: Asian countries with low individualism are prone to have a high level of ICT adoption

The second dimension is power distance. It perceives how to manage unequal people (Hofstede *et al.,* 2010) in different institutions and organizations (Zhao, 2011). This dimension reflects how the employees in an organization sense their daily work environment and what they expect for the environment. Schwartz (1992) argued that a country became a hierarchy when the power distance was high, and egalitarianism when the power distance was low. Power distance is also related to political and economic development (Hofstede, 2011). Hence, a society with a low power distance (or more egalitarianism) tends to have higher ICT adoption since the level of equality and wealth also has higher scores. Erumban and De Jong (2006) found that power distance was the most significant cultural factor explaining ICT adoption. Based on the explanation, the second hypothesis is as follows.

H2: Asian countries with low power distance are prone to have a high level of ICT adoption

The third dimension is uncertainty avoidance. Zhao (2011) defined uncertainty avoidance as how an individual in an organization perceived and avoided ambiguous and uncertain circumstances. The research has shown that countries with uncertainty avoidance are more emotional. Meanwhile, the society with uncertainty acceptance tends to be tolerant of different opinions (Hofstede, 2011). In Asian countries, the uncertainty can be any condition, such as natural disasters or radical ideas or behavior. Thus, in countries with higher uncertainty avoidance like Japan, the effort and time spent to resolve the threat are also higher than in other countries with lower UAI (Dissanayake *et al.,* 2015). In the context of ICT adoption, the complexity of UAI is a trade-off with the effort to deal with the risk. Thus, the third hypothesis is:

H3: Asian countries with high uncertainty avoidance are prone to have a high level of ICT adoption

The fourth dimension is masculinity versus feminity. The country has a high score of masculinity when society prefers achievement and assertiveness. Reversely, when people tend to have a quality of life, care, and love, the country has a high index in feminity. Among Asian countries, South Korea has the lowest score of masculinity (Workman, Lee, & Jung, 2017). Hallikainen and Laukkanen (2018) found that masculinity cultures really affected the ability and benevolence in the case of e-commerce in China and Finland. They argued that one of the reasons to use IT, especially e-commerce in China and Finland, was the belief culture about the online store's trustworthiness. Meanwhile, China is one of the most top countries for masculinity in Asia (Phadoongsitthi et al., 2017) . Masculinity and feminity have been used to describe the individual values to get the achievement. For example, masculine society tends to have higher challenges in work and the need for recognition. Hence, to accomplish a successful job, an individual should utilize all the resources such as technology or innovation. The fourth hypothesis is:

H4: Asian countries with high masculinity are prone to have a high level of ICT adoption

The fifth dimension is the long-term orientation. This dimension represents the orientation of the society regarding the values of its traditional culture. A high score of long-term orientation means that the inherited cultures create spirit in the community. Meanwhile, a low score of long-term orientation indicates the openness of society in new ideas, new cultures, and modernization. Several studies argue that the country with a low index of long term orientation (or short term orientation society) is expected to have a higher rate of new technologies adoption. It is because people are more easily to accept modernization (Erumban & De Jong, 2006; Zhao, 2011).

Meanwhile, in Asian countries, society tends to attach future orientation. Although Asian countries have a higher score in long term orientation, it does not mean that Asian countries lag in technology. The technology can be developed by combining the values and religious cultures (Özbilen, 2017). Hence, the higher long-term orientation in Asian countries means that society will have a stronger desire to adopt ICT to maintain their future values. This study proposes a high long-term orientation in Asian countries correlates with a high level of ICT adoption. Thus, the fifth hypothesis is as follows.

H5: Asian countries with high long term orientation are prone to have a high level of ICT adoption

The sixth dimension is indulgence versus restraint. This dimension is the latest national culture dimension developed in 2010. Hofstede *et al.* (2010) explained that indulgence tended to allow relatively free gratification of basic and natural human desires related to enjoying life and having fun. A high score of indulgence is interpreted as the society that more

enjoys life in spite of the poor condition. For example, in Asian countries, Philippines citizens are expected to have a more joyful community because of the high indulgence score rather than Hongkong citizens. Therefore, to correlate with the research, indulgence, such as spending money, fun-related feeling, other enjoyment of leisurely activities, is estimated to correspond with the attitude of adopting the technology since it can support the need for indulgence. For example, to fulfill the hesitation of spending money, the community can utilize technology, such as e-commerce and other fun-related technologies. The sixth hypothesis is:

H6: Asian countries with high indulgence are prone to have a high level of ICT adoption

Gross Domestic Product (GDP) is known as a measurement of economic prosperity which has an essential role in explaining the governments' ICT adoption disparities (Andrés, Amavilah, & Asongu, 2017; Kumar, Baishya, Sadarangani, & Samalia, 2020). It is formulated as the sum of the gross value added, engaged in production and services. In many works of literature, GDP has been widely known as a predictor of ICT adoption in many countries. Toader, Firtescu, Roman, and Anton (2018) argued that GDP played a significant role in ICT adoption. Similarly, Mimbi and Bankole (2016) found that the greater the GDP of a country was, the higher the adoption and usage of ICT were. As a proxy for economic growth, GDP correlates with basic phenomena such as physical capital and industry productivity. It reflects the standard economic development in a country to other countries (Klafke, Picinin, Raiher, & Pilatti, 2018). In the context of technology, countries with high GDP reflect the ability to provide better service and production in ICT infrastructure. Therefore, they can pass the technology barriers and suffice the ICT adoption need in society. Then, the last hypothesis is:

H7: Asian countries with high GDP are prone to have a high level of ICT adoption

The research aims to investigate the relationship of national wealth and cultures to the ICT adoption in selected Asian countries based on the availability of the data. By understanding the relationship, governments or policymakers practically can design the appropriate strategies or policies related to each embedded culture before inducing the level of national ICT adoption. The research also contributes to the theoretical implication by updating results and findings compared to other similar studies and enhancing the scope of ICT adoption theories.

METHODS

The research employs two sources of the dataset. First, the data of Hofstede's national culture index. The indexes include the power distance, masculinity, individualism, long-term orientation, uncertainty avoidance (Hofstede, 2001), and indulgence (Hofstede *et al.,* 2010). Second, the dataset is taken from the World Economic Forum to obtain the ICT adoption index. The dataset is officially downloadable on the website of the World Economic Forum. ICT adoption index represents the development of the Internet, telecommunication, and infrastructure in a country. In the advanced and emerging economies, this index has become precedence for governments to be a source of value creation, productivity growth, improved living standards, and a key to enhance global competitiveness. This index comprises five components: mobile-cellular subscriptions, mobile-broadband subscriptions, fixed-broadband Internet subscriptions, fiber Internet subscriptions, and Internet users. A higher ICT adoption index in a country means that the subscriptions per 100 population of mobile-cellular, mobile-broadband, fixed broadband internet, fiber internet, and internet users are higher than other countries with a lower index.

Then, data are sorted and filtered to generate a group of Asian countries. Afterward, the available and used national culture indexes for the research are 16 countries. The selection of those countries is done by considering the availability of data.

For obtaining the data of Asian countries, four steps of analysis are conducted. First, the Asian countries cultural indexes provided by Hofstede's cultural dimension are Arab countries (i.e., Egypt, Iraq, Kuwait, Lebanon, Libya, Saudi Arabia, and the United Arab Emirates), Bangladesh, China, Hongkong, India, Indonesia, Iran, Japan, South Korea, Malaysia, Pakistan, Philippines, Singapore, Taiwan, Thailand, Vietnam (Hofstede, 2001). Second, the Arab countries are filtered and grouped in the Asian continent, i.e., Iraq, Kuwait, Lebanon, Saudi Arabia, and the United Arab Emirates. In the third stage, the data are updated with the indulgence dimension index, referring to Hofstede *et al.* (2010). In this stage, Kuwait, Lebanon, and Pakistan are eliminated since the data are unavailable. In the fourth stage, the study refers to ICT adoption data of 2018 provided by the World Economic Forum. The result shows that all the Asian countries have the data of ICT adoption index except Iraq. Finally, according to those stages, 16 Asian countries are selected. The Asian countries to be examined are Saudi Arabia, The United Arab Emirates, Bangladesh, China, Hong Kong, India, Indonesia, Iran, Japan, South Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, and Vietnam.

RESULTS AND DISCUSSIONS

The research proposes the relationship on the Asian countries' culture dimension and GDP as the independent variables with ICT adoption index as dependent variable. To understand the independent and dependent variables in the observed dataset, the research explores a statistical description presented in Table 3 (see appendices).

Table 3 shows the statistic of the Asian countries' culture dimension data and GDP per capita in 2018. Power distance (PDI) in 16 countries has the highest mean score for culture dimension with 73,69, followed by long term orientation (LTO) (54,84), masculinity (MAS) (52,75), and uncertainty avoidance (UAI) (51,87). Individualism (IDV) mean score in Asian countries is the lowest score among culture dimensions with 27,69. It can be seen that ICT adoption index in Asian countries varying from the lowest score of 27,98 to the highest score of 91,25. Similarly, GDP per capita among Asian countries also has extreme values from USD1.698,26 to USD64.581,94. The mean score for GDP per capita in selected countries in Asia is USD20.140,45. The statistic of GDP among sample countries is shown in Figure 1.

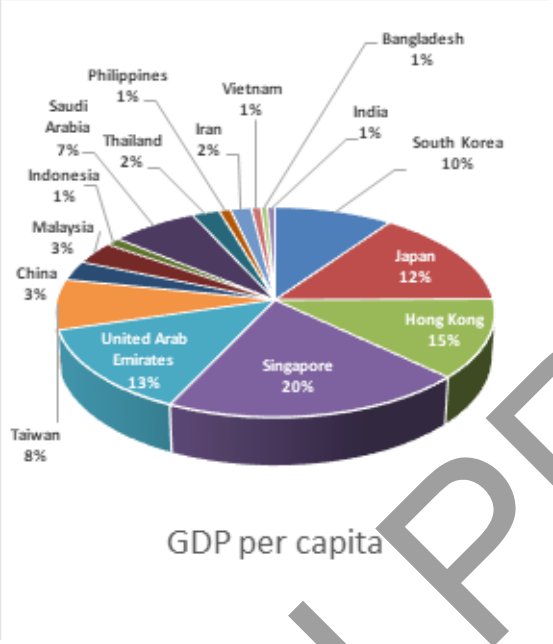

Figure 1 Proportion of GDP per Capita in Asian countries

Multiple regression analysis is conducted. For addressing the problem of assumption violation, the researchers set several parameters to assure that the models are free from bias. The first test is the normality test using Kolmogorov-Smirnov (KS). The result is presented in Table 4. The model has a significance (2-tailed) of 0,200. Therefore, it can be concluded that the model has a normal distribution (p-value > 0,05). Moreover, the research examines the Variance Inflation Factor (VIF) in model 1. It is an indicator that represents the multicollinearity value. It does not exceed the value of 10,00. Hence, the model is free from multicollinearity since the VIF value is below 10,00. The results are shown in Table 5.

The next step is regression analysis. The research performs F-test to measure dispersed or scattered data from the mean. If the p-value is less than the significant level (0,05), the data provides sufficient evidence to conclude that the regression model fits. Table 6 shows that the F-test has a significant level since the p-value is < 0,05. Therefore, cultural factors and GDP simultaneously impact the ICT adoption in Asian countries. Then, to empirically test the predetermined hypotheses, each variable is partially tested for ICT adoption. The results are shown in Table 7. The regression analysis summarizes all the relationships between independent variables (PDI, MAS, IDV, UAI, LTO, IVR, and GDP) and dependent variables (ICT adoption) in the model.

Table 4 KS Normality Test

Model	KS Normality Test
1	0,200

Table 5 Multicollinearity Test

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	PDI	0,485	2,061
	IDV	0,349	2,864
	MAS	0,405	2,468
	UAI	0,652	1,534
	LTO	0,366	2,729
	GDP	0,795	1,258
	IVR	0,924	1,082

a. Dependent Variable: ICT

Table 6 F-Test

Model	F	Sig.
1	7,262	0,006

Table 7 Regression Analysis

		Standardized Coefficients		
		Beta [a]		Sig.
Model 1	(Constant)			0,703
	PDI	0,156		0,427
	IDV	-0,332		0,171
	MAS	0,152		0,481
	UAI	0,324	*	0,080
	GDP	0,808	***	0,001
	LTO	0,131		0,559
	IVR	0,112		0,433

[a]. Dependent Variable: ICT
Notes: * p < 0,1; *** p < 0,01; and R^2 = 0,846

According to Table 7, IDV has a negative coefficient with ICT adoption (β= -0,332). It means there is an inverse relationship of the IDV culture to ICT adoption in Asia. The inverse relationship IDV can be interpreted that Asian societies tend to have fewer individualistic traits. According to Hofstede (2011), Indonesia, Taiwan, and South Korea are the countries that have the lowest IDV scores among Asian countries with IDV of 14, 17, and 18, respectively. Meanwhile, India, Japan, and Iran are the top rank for IDV scores in Asia with 48, 46, and 41, respectively. The higher scores of IDV indicating that a country is individualistic. Conversely, the lower scores of IDV mean that a country is collectivistic (Mansson & Sigurðardóttir, 2017). The research shows that the higher ICT adoption index in Asia is affected by reducing the individualistic trait (called collectivism), as shown in the negative coefficient value. However, to verify the predetermined hypothesis (Asian countries with low individualism are prone to have a high level of ICT adoption), the researchers should check its significance. Table 7 presents the p-value of IDV is 0,171. With that value, IDV fails to meet significance at 10%. As a result, H1 is rejected.

The next dimension is PDI (β= 0,156). PDI surprisingly does not meet the significance of ICT adoption (p-value > 0,1). Therefore, this finding differs from previous research (Erumban & De Jong, 2006). Asian countries that have lower power distance are not weighty enough to reflect the higher ICT adoption. For instance, Malaysia has the highest power distance (104) in Asia and globally. However, its ICT adoption score of 69 is higher than in lower PDI countries such as Iran (PDI = 58 and ICT adoption = 47) or Thailand (PDI = 64 and ICT adoption = 56). The extreme index of PDI in Malaysia is one example of the diversity condition among Asian countries. Malaysia is a joint legacy of the Malay feudal system and the influence of the British. Hence, it is the combination of respectful and a complex, nuanced system of titled classes and tends to grant much power to those at the top of an organization (Sweetman, 2012). Although most Asian countries have low score PDI, it is not a significant factor that affects ICT adoption since several countries have been transforming their culture to egalitarianism (Yengoyan, 2006). In the research, H2 is also rejected.

The interesting finding is UAI which is significant to ICT adoption (β= 0,324, N=16 (see Table 3), p = 0,08). This result supports H3 that Asian countries with high uncertainty avoidance are prone to have a high ICT adoption level. The hypothesis is contrary to several previous studies (Erumban and De Jong, 2006; Merhi, 2018). They stated that UAI had a negative correlation with innovation technology. In Asia, Japan, and South Korea have the highest UAI score. However, the ICT adoption of these two countries is also at the top among Asian countries. According to Hofstede (2001), there should be a differentiation between "hope for success" in low-UAI countries and "fear of failure" in high-UAI countries. Hence, low-UAI countries have a willingness for new ideas and behavior to win the competition. As opposed, the high-UAI countries avoid losing in the competition. Japan and South Korea have high uncertainties conditions, such as natural disasters (Dissanayake *et al.,* 2015). So, they adopt more technology to avoid uncertainties.

Furthermore, MAS is not significant to ICT adoption. The result shows that MAS has β of 0,152 and p-value of 0,481. According to Hofstede (2011), Thailand has the lowest masculinity (MAS = 34), while Japan, China, and the Philippines have the highest MAS with score 95, 66, and 64, respectively. Based on Merhi (2018), MAS is significant collaboratively with IDV. Nevertheless, when the model excludes IDV, MAS will not be significant anymore to e-government adoption. Moreover, Zhao (2011) and Kovacic (2009) also found a similar result to this study that MAS was not significant to government adoption. The reason why MAS is not significant to the ICT adoption index is probably on its description. The masculine countries (higher MAS score) are more competitive and sensitive to material reward (Pelau & Pop, 2018). However, Asian countries are more feminine, oriented to social values (Hofstede, 2011). Another study also indicates that some of MAS predictive properties are valid only across wealthy countries (developed countries) rather than in developing countries such as Asia (Minkov, 2018). Thus, H4 is rejected. This finding confirms previous studies by Kovacic (2009) and Zhao (2011). Nevertheless, several studies find that MAS is significant to technology innovation instead (Bankole & Bankole, 2017; Merhi, 2018).

The next dimension is LTO with β of 0,131 and p-value of 0,559. It is not significant to ICT adoption in Asia. South Korea has the highest LTO score (LTO = 100). The next countries are Taiwan, Japan, and China with LTO score of 92,95; 87,91; and 87,41, respectively. The lowest score for LTO is Iran with LTO of 13,6. Several studies, such as Zhao (2011) and Zhao, Shen, and Collier (2014), find that countries with long-term orientation cultures are more willing to adopt e-government than the countries with short-term orientation culture in European countries. The result shows that H5 is not supported. This result reflects that using ICT in Asian societies, such as websites and e-services, is partially dependent on their willingness to adopt IT, not on their long term orientation. Similar to previous dimensions, IVR is also insignificant to ICT adoption in Asia (β = 0,112, p-value = 0,433). Few studies have examined IVR role since it is the latest culture dimension proposed by Hofstede *et al.* (2010). IVR should be tested with sufficient empirical evidence. This study suggests that IVR is not significant at 10%. The presence of some nation-specific factors may explain this. Kumar *et al.* (2020) explained factors that caused IVR to be insignificant to ICT adoption were autocratic government or frequent political turmoil. Those reduced the citizens' reception and adoption of ICT. Therefore, H5 (LTO) and H6 (IVR) are both rejected, respectively. Both LTO and IVR findings are different from several previous studies (Zhao, 2011; Zhao *et al.,* 2014).

As summarized, UAI is the only culture dimension variable which is significant with ICT adoption. Simultaneously, the others (H1, H2, H4, H5, and H6) are rejected based on the statistical analysis. The cultural dimensions have little impact on ICT adoption. UAI is the significant (p-value < 0,1) aspect of ICT adoption in Asia with its highest coefficient, among other cultural dimensions.

Next, GDP per capita is the only variable that has a significant value at 1%. From Table 7, GDP has β of 0,808 and p-value of 0,001. GDP as a proxy for wealth and economic development holds a major influence on adopting ICT. In the data, Singapore has the highest GDP per capita, and Bangladesh is the lowest. With that high GDP, Singapore is also one of the leading countries in achieving high ICT adoption in Asia, besides Korea and Japan. The result shows that a higher GDP per capita in Asian countries will influence society to adopt ICT. A higher GDP per capita reflects a higher ability and wealth of the society to use technology. Other studies also conclude similar results in developing countries in Africa (Bankole & Bankole, 2017; Mimbi & Bankole, 2016).

In the same way, Kayisire and Wei (2016) argued that GDP was one of the crucial indicators utilized to approximate the economic wellness of a nation. GDP per capita is particularly useful when one country is compared with another because it represents the countries' relative performance. Therefore, the research emphasizes a strong economic foundation factor (such as GDP) that is indispensable in ICT adoption in Asian countries. By this result, H7 which states that Asian countries with high GDP are prone to have a high ICT adoption level is supported.

The research reveals that the national cultures and GDP impact ICT adoption in Asia, given a p-value of 0,006 < 0,01. Countries with higher UAI and higher GDP have a better perception of adopting technology in Asia. The result shows that PDI, IDV, MAS, LTO, and IVR are insignificant to ICT adoption (p-value > 0,1). The research indicates that the UAI as a proxy of cultural dimension and GDP as a proxy of economic welfare have an essential impact on the development of ICT adoption in Asia. For increasing the value of the research, several research contributions and practical implications for governments and policymakers regarding ICT adoption in Asian countries are proposed. For the research contribution, the research enriches Hofstede's cultural theory by combining it with another factor, such as GDP, to predict the recent ICT adoption in Asia. The research also extends the current literature of ICT adoption which is always expanding rapidly yearly by identifying the influencing factors.

For the practical implications, the research proposes two contributions based on the result. First, governments give attention to national economic development and GDP development. The research finds that the most significant factors of ICT adoption are the level of GDP per capita. Second, the government should eradicate uncertain situations or uncomfortable environments which make the public or citizens refuse to adopt ICT. The research reveals that UAI as a factor in avoiding uncertainties, insecurities, and inconveniences is significant to leverage the ICT adoption in Asia.

CONCLUSIONS

The research provides insights into what factors determine technology adoption using a cultural approach. The result shows that uncertainty avoidance is the significant cultural factors that influence ICT adoption in Asia. GDP appears to be the strongest determinant besides cultural factors to explain the ICT adoption variation. Other variables, such as power distance, individualism, masculinity, long term orientation, and indulgence, are insignificance to the relationship.

A limitation of the research is that the number of observations is too low to use the multivariate regression model. The sample of the countries covers Asian countries which rely on the availability of data. Since the Hofstede's cultural dimensions for Asian countries are limited to several countries, in the future, expanding the sample of the countries are suggested, especially for the countries that have a diverse culture with common Asian countries, such as ex-soviet countries (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan). The variables are also taken from outdated data, such as Hofstede's cultural dimension which indicates another limitation of the research. The cultural data based on the survey are conducted in the 1960s and 1970s. Although cultural factors are not changing rapidly, the result and implication of the research should be revisited using a recent phenomenon. For further research, the usage of a recent cultural index theory is suggested to have another perspective of analysis.

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APPENDICES

Table 1 The Recent Studies of Cultural Dimension on ICT Adoption

Author	Aim of the study	Sample	Findings
Valaei, Rezaei, Ismail, and Oh (2016)	Examine Hofstede's cultural factors on Attitude towards Online Advertisements (ATOA) and Attitude towards Online Brands (ATOB)	285 respondents in Malaysia	Individualism and long-term orientation support the ATOA and ATOB. Meanwhile, power distance supports ATOA. Masculinity supports ATOB. Uncertainty avoidance is the only variable that does not support both ATOA and ATOB.
Ghanem, Mansour, and Adel (2017)	Measure the impact of the national culture of Hofstede, TAM, and normative beliefs of marketing managers on the adoption of e-tourism	109 marketing managers at the tourism companies in Egypt	The culture of uncertainty avoidance has a significant positive impact on perceived ease of use and perceived usefulness. It also affects marketing managers' attitudes in tourism companies towards e-tourism and their intention to use it. Moreover, the results affirm that long-term orientation culture has no significant impact on the perceived usefulness, ease of use, or actual use of e-tourism for Egyptian tourism companies. However, it seems to affect the quality and effective adoption of the e-tourism business.
Mohammed and Tejay (2017)	Investigate the impact of national culture on the relationship between information privacy and e-commerce adoption in developing countries	218 respondents in Trinidad & Tobago	The multiple factors, influenced by culture, inform individuals' decisions to adopt e-commerce and transact online. However, privacy concern is not reflective of society's cultural values
Sanakulov and Karjaluoto (2017)	Explain smartphone adoption in three different countries by analyzing its cultural effects.	299 respondents in Uzbekistan, South Korea, and Turkey	The cultural differences significantly affect intention formation. The significance varies in each country, and collectivism/ individualism moderates these relationships.
Chou, Li, and Ho (2018)	Investigate the factors that predict users' behavioral intention to adopt mobile commerce (m-commerce) in Taiwan based on the revised UTAUT and two of Hofstede's cultural dimensions (power distance and uncertainty avoidance) as moderators.	435 respondents in Taiwan	As for moderating variables, power distance has a negative relationship with social influence on behavioral intention to use m-commerce. It implies people who accept a high level of power distance are less influenced by people who are important to them to adopt m-commerce. Uncertainty avoidance does not have positive relationships with performance expectations, effort expectations, social influence, and trust to adopt m-commerce by smartphone.
Mandler *et al.* (2018)	Analyze the impact of national culture on mobile commerce adoption and usage intensities	Individual consumer survey data from 43 countries	Different cultural dimensions significantly affect consumer adoption and usage of mobile commerce services. Uncertainty avoidance is a consistent predictor of mobile shopping, banking, and payment. Meanwhile, masculinity and indulgence significantly impact usage intensity for mobile shopping and banking.
Wlömert and Papies (2019)	Conduct a conceptual study in which the differences in economic and cultural factors are associated with different market outcomes in the wake of broadband Internet proliferation.	-	There is a negative association between broadband internet penetration and music revenue. It is weaker in high-income countries. In terms of cultural factors, the study finds that the market's response to the introduction of broadband Internet is less negative in countries with a high score on Hofstede's individualism and uncertainty avoidance dimensions.

Table 2 Brief Summary of the Technology Adoption and Cultures in Prior Studies

Author	Country	Operational Variables
Mahfuz, Khanam, and Hu (2016)	Bangladesh	PD*, UA, IDV, M*, IVR
Zaidi, Henderson, and Gupta (2017)	India	PD*, UA, M, C, UA
Khan and Cox (2017)	77 countries	PD, IDV*, M*, UA, IVR*
Mahomed, Mcgrath, and Yuh (2018)	Malaysia	C*, IVR*, LTO*, M, PD*, UA**
Zhang, Weng, and Zhu (2018)	27 countries	IDV*, UA*, PD*, LTO, M
Salehan, Kim, and Lee (2018)	56 countries	UA, LTO
Huang, Teo, Sánchez-Prieto, García-Peñalvo, and Olmos-Migueláñez (2019)	China and Spain	C**, PD, UA*, IVR*
Kitonsa, Agbozo, and Turygina (2019)	UAE, Italy, Costa Rica, Argentina, and Saudi Arabia	PD, IDV, UA, M
Tam and Oliveira (2019)	Southern Europe	IDV*, UA*
Higueras-Castillo, Liébana-Cabanillas, Muñoz-Leiva, and Molinillo (2019)	Spain, German, Mexico	C**

Note= C: Collectivism, IDV: Individualism, IVR: Indulgence, LTO: Long Term Orientation, M: Masculinity, PDI: Power Distance, UAI: Uncertainty Avoidance, * fully support, and ** partially support

Table 3 Statistic Descriptive of the Variables

	N	Min	Max	Mean	Median	Std. Dev
PDI	16	54,00	104,00	73,69	75,50	13,48
IDV	16	14,00	48,00	27,69	22,50	11,13
MAS	16	34,00	95,00	52,75	51,50	14,27
UAI	16	8,00	92,00	51,87	53,50	22,60
LTO	16	13,60	100,00	54,84	54,03	27,45
IVR	16	16,96	57,14	36,13	36,61	10,99
ICT	16	27,98	91,25	65,31	65,09	19,48
GDP	16	1.698,26	64.581,94	20.140,45	10.504,90	19.898,19

Note= PDI: Power Distance, IDV: Individualism, MAS: Masculinity, UAI: Uncertainty Avoidance, LTO: Long Term Orientation, IVR: Indulgence, ICT: Information Communication and Technology, GDP: Gross Domestic Product