Does Digital Governance do Exist in Thai Organizations? Maturity and Its Determinants

Benjawan Kunviroteluck[1]

Patipan Sae-Lim[2*]

Abstract

Digital technology is one of the elements that plays a significant role to business and society. Firms adopt it to stimulate business growth and reduce long-term operational cost. However, it does not mean that firms can employ it by ignorance of its governance. Digital governance is then vital to control transparency and, accountability by following the principle of good governance. To this concern, the researchers hypothesized that 1) "are there any concerns in digital governance in Thai organizations 2) in which any factors lead to the high maturity of digital governance? The quantitative model given discriminant analysis was conducted under three explanatory factors: leadership, technology acceptance, and organizational culture. The maturity of digital governance was measured using Capability Maturity Model Integration (CMMI). According to the result, all explanatory factors are significantly associated with the digital governance. When classifying the maturity of digital governance, it was found that leadership and organizational culture affected the digital governance at a high level.

Key words: Digital governance, leader, determinant, maturity, technology acceptance

Introduction

Evolution of digital technology has changed rapidly and become a part of daily living in the current society and various fields. The government sector has also prioritized digital adoption for development and steering the country toward the digital age (Thailand 4.0), as digitalization is the link between the business operation of each organization that would lead to the connection of various processes, and finally result in the integration to minimize the work steps and processes. Consequently, organizations' operations would be smooth and sustainable (Thitathan, 2020). Furthermore, this would enhance the country's competitiveness (Ministry of Digital Economy and Society, 2011).

As a result of the situation of the VUCA (Volatility, Uncertainty, Complexity and Ambiguity) World, which is a significant accelerator for the application of digitalization, the customary operations in the organization might not respond to the current situation. For this reason, organizations should be active and adapt themselves to the changing context by applying digital platforms to add value to themselves and maintain the organization's existence (Hai Guo, Zhuen Yang, Ran Huang, and Anqi Guo, 2020). In addition, the organization should be flexible, as this would allow rapid restoration and a sustainable existence (Sae-Lim and Pinvanichkul, 2021). For instance, during the COVID-19 pandemic in the United Kingdom, medical service practices were changed by adjusting the treatment process, counseling, and having an appointment via digital devices that proved to be convenient and constructed teamwork (Reddy and Brumpton, 2021).

However, if digital technology is utilized inappropriately, the negative effects would be on the individual, organization, and society; such as, the theft of financial transactions data, data trading of competitors, and stealth of personal data use and theft, thus causing social inequality due to the lack of consideration and governance.

Consequently, to adopt digital technology safely and securely, as well as to ensure reliability to the individual within the organization and external parties, digital governance is necessary for transparency and accountability to enable the organization to administrate and execute by following good governance.This would concur with the survey results of Deloitte Insights regarding the technology trend in 2020, which emphasized the ethics and reliability of technology, as this was an indicator of the digital norms, values, and new regulations that enhanced the transparency and confidence, minimized digital inequality, increased the value, and constructed a firm foundation toward the organization (Briggs & Buchholz & Team, 2020).

Without digital governance, the effects that might be possible would include the policy setting to subserve a specific group of people, which would distort the decision-making process (Zenklusen, 2021). Therefore, to avoid this problem and set the social and national standards, the organization should determine the appropriate level of digital governance for its reliability and the confidence of internal and external stakeholders. As such, Thailand collected the statistical data of the indicators of good governance of the country in 2015-2019, from the Worldwide Governance Indicators (WGI) (The World Bank, 2019) (Figure 1.1).
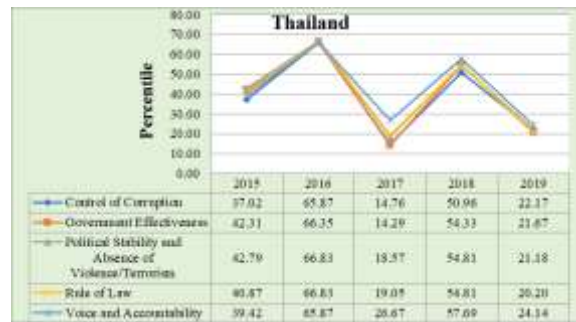
Fig. 1.1 Indicators of good governance of Thailand in 2015-2019.

Figure 1.1 shows that the indicators of good governance of Thailand changed and were unstable in terms of the problem of corruption control, government's potential, political and legal security, and obligations affecting the stakeholders. Hence, these issues reflected the uncertainty of the organizations' governance in Thailand. As a result, the researcher studied the maturity of digital governance and its influential factors in Thai organizations in order to adopt it as the guidelines for policy proposal.

Theoretical Constructions

Digital Governance

In order to avoid the risks and minimize the current conflict of digital utilization, organizations should implement digital governance, as this would be a tool to arrange, determine, and develop the principles, policies, strategies, and standards to link and exchange the digital data between the government and private sector to be consistent with international standards. Thus, the role and responsibility would be assigned to be ready for Thailand 4.0 and drive the digital economy (Suvannasan, 2017).

Moreover, the efficient design of digital governance would mitigate the management conflict within the digital organization (Welchman, 2015) . Consequently, the researchers applied the Capability Maturity Model (CMMI) to determine the value of digital governance. CMMI was the model used for evaluating and improving the process in the organization (Carnegie Mellon, 2010) to validate the performance accuracy (Patón-Romero, Baldassarre, Rodríguez, and Piattini, 2019), which included five parts comprising safety and privacy, utilization, content, service, and citizens' participation (Figure 2.1).
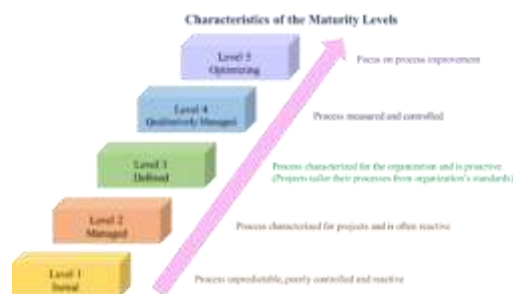

Fig. 2.1 Maturity level of CMMI. (Godfrey, 2008)

The researchers foresaw the significance of the factors measuring the maturity level of Thai organizations that they should consist of safety, privacy, utilization, content, and transparency.

The Explorations of Determinants

The researchers explore several articles relating to the determinants of digital governance. Nevertheless, we found the three factors most citations as the following.

1) Leadership

Thailand is entering a rapid changing period and VUCA World (Suksawang, 2017), which would be a challenge to the leaders of an organization to resolve the impacts of such changes. The leader is an important driver, who would move forward and

encourage the employees to participate in making a change and creating uniqueness over the competitors, as well as adding value to the products and services (Pongsiri, 2017). Thus, the leader in this age should have digital leadership, as this would be changeable and adaptable at all times to correspond with the changing innovations and technologies (Goethals, Sorenson, Burn, 2004). The key skills of digital leadership include vision, understanding, clarification, and agility (figure 2.2).

Fig 2.2 The VUCA Prime Model (Bawany, 2018)

Apart from VUCA (Volatility, Uncertainty, Complexity and Ambiguity) , Bawany (2018) also defined VUCA as " Vision, Understanding, Clarifying and Agility". The authors used this framework to measure the effectiveness of leadership. To illustrate, to be the effective leader, he/she should set the clear vision. However, in order to deal with the volatility, such vision could be altered to cope with the turbulent environment. To deal with uncertainty, leader should posit and understand the current situation from organizational strengths and weaknesses. In the complexity world, leader significantly clarifies and prioritizes tasks. The most required leader competency is the agility.

In addition, leadership is highly concerned with governance. This is consistent with the research on the COVID-19 pandemic, which has illustrated that the government's management of the leader highlighted governance to resolve the problem arising from uncertainty (Ansell, Sorensen, and Torfing, 2020). As a consequence, the governance design should be efficient, available for change, and practical. It should also be consistent with the study on the leadership competencies in a turbulent environment (Sae-Lim, 2019) , in which it has been reported that the leadership competencies in the twenty-first century were very significant because they determined the vision, personnel strategies, access of interest, and paradigm rearrangement. Additionally, the leadership skill is crucial because it merges communication skills to other skills; such as, prediction, the thinking process, digital literacy, networking, and participation. All these factors are solutions to uncertain circumstances; such as, VUCA.

2) Technology Acceptance Model (TAM)

Innovation acceptance is the self-study on a process, which is proved by an experiment that such thing is useful. The acceptance of such matter is developed and becomes a habit leading to the practice and implementation (Foster, 1973). At present, digital technology has rapidly inundated all fields, so everyone has to quickly adapt to learn and understand technology to decrease the working period for the purpose of convenient and speedy coordination between the agencies for decision-making. This corresponds with the Technology Acceptance Model (TAM) (Davis, Bagozzi, and Warshaw, 1 9 8 9), which is an accepted and widely used model (Figure 2.3).
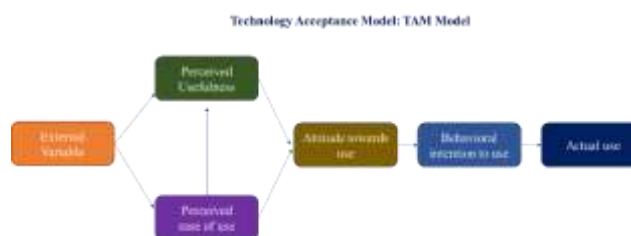

Fig. 2.3 Technology Acceptance Model (TAM). (Davis, 1989)

Figure 2.3 shows that the external variables would have the following effects:

1) Perceived Ease of Use - A level where the user's proficiency or attempt is not required for the use.

2) Perceived Usefulness - A level where the user recognizes that technology promotes work efficiency.

Hence, this was consistent with the research on extending TAM to understand E-governance adoption by teachers in Greece (Karavasilis, Zafiropoulos, and Vrana, 2010) , which TAM was the model used to distribute the innovations and construct

confidence, risk and personal innovation, and to create a model for an electronic control system of the teachers' survey in Greece. The results indicated that personal innovation was related to TAM.

3. Organizational Culture

Culture is one of the key foundations forming the behavior and attitude of people in society in the form of work and way of life, which is transferred from generation to generation until it becomes partial behavior. Each organization has its own unique culture (Kluckhohn and Kelly, 1945; Moore, 2019,). While entering the digital era, numerous organizations have been impacted due to the rapid change of customers' demands, which organizations must adjust their strategies and create a new organizational culture (Moore, 2019) (Figure 2.4)
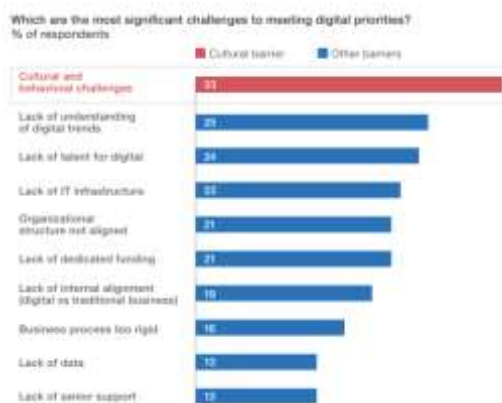

Fig 2.4 McKinsey Digital survey of 2,135 respondents (Goran, LaBerge, and Srinivasan : 2017)

the combination between the traditional organizational value and digital organization might be implemented (Brightside, 2020; Henley, 2019) via the following methods
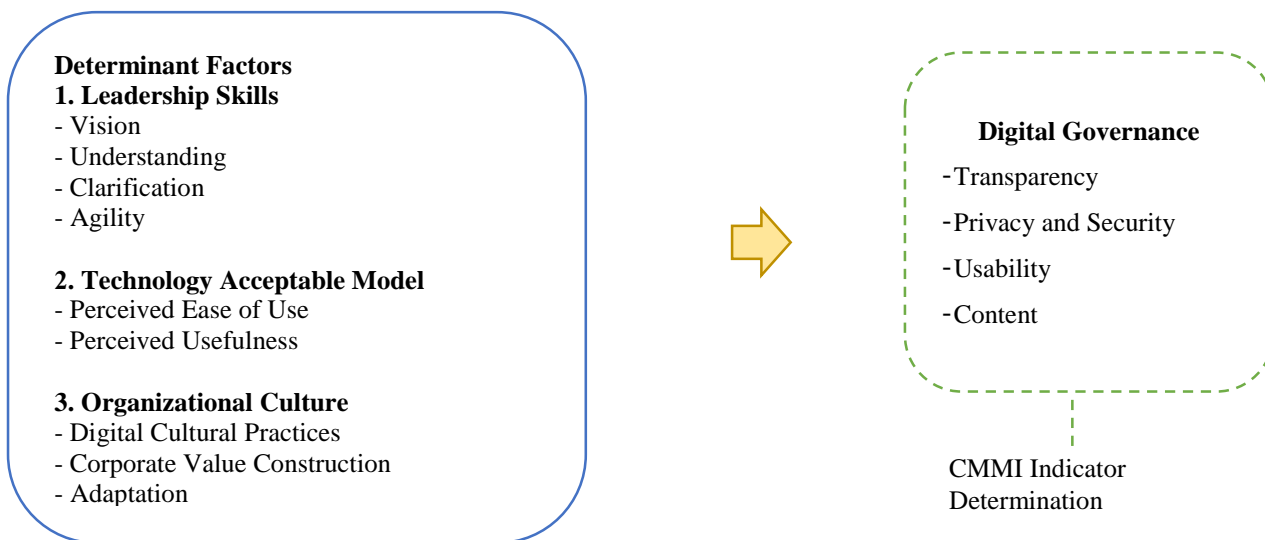
4. Previous Articles

For the " maturity level of data safety" , the safety regulations should relate to the business goal consisting organizational governance, organizational culture, system architecture, and service management in order to identify the strengths and weaknesses of the specific security of the organization. Thus, various models would be developed, which would correspond with the maturity model. The assessment would focus on the management structure, practice, and overall performance of the organization, including safety, to use as a guideline for practice and evaluation in the organization (Saleh, 2011).

"Digital maturity: framework and assessment model": The growth of digital technology would drive the industrial changes. Therefore, organizations would be forced to adopt digitalization to manage the change of the processes, and concepts and an assessment model would be developed. The research results indicated that digital maturity comprised eight factors involving strategy, leadership, the business model, operation model, personnel, culture, governance, and technology. Organizations could develop and implement digital maturity to assess the organization in the current circumstance and set strategic goals to prepare for the digital changes (Rossmann, 2018).

Therefore, the " Digital Maturity Model 4.0" would assist in the organizational planning and upgrading of the degree of digitalization. The leader of the organization should also set the digital clarification to prevent any digital threats. As a result, the determination of digital maturity would be a tool to assess the digital preparedness that would consist of four aspects: culture, technology, organization, and in-depth information. This would be conducted in order to fulfill the different customers' demands based on the process development and improvement, which would add constant value to the organization (Gill and VanBoskirk, 2016).

Research Framework

Determinant Factors
1. Leadership Skills
- Vision
- Understanding
- Clarification
- Agility

2. Technology Acceptable Model
- Perceived Ease of Use
- Perceived Usefulness

3. Organizational Culture
- Digital Cultural Practices
- Corporate Value Construction
- Adaptation

Digital Governance
- Transparency
- Privacy and Security
- Usability
- Content

CMMI Indicator
Determination

Methodology and Modelling

The quantitative research method was applied. A total of 400 sets of interval Likert scale questionnaires were distributed to the sample group, who consisted of people working in government and private organizations where digital use was emphasized. Discriminant analysis was utilized to determine the digital governance score because the dependent factors of this research were determined into categories. Capability Maturity Model Integration (CMMI) was applied for determining the score (Table 3.1).

Table 3.1 Determination of the digital governance score using the discriminant approach based on CMMI.

Range	Explanation	New Score Value
1-14	The organization has not yet controlled its digital use and access.	1 (Low)
15-28	The organization is likely to give significance to digital access and application, and digital governance.	2
29-42	The organization has set the vision, policies, guidelines, and steps of digital governance appropriately. However, the implementation has not yet started.	3
43-56	The organization has implemented the vision and policies of digital governance as planned under the transparency and accountability.	4
57-70	The organization has focused on digital governance to promote the performance and integration with safety, accuracy, clarity, and accountability.	5 (High)

Both descriptive and inferential statistics were employed. In this research, the variables were classified as category -nonmetric. Thus, the "Discriminant Function" was applied. Multiple Discriminant Analysis (MDA) (Thairuekham, 2008) was the technique used to identify the dependent variables, which comprised digital governance. The score was classified into numeric group and range, and the range of the score was 1-5 (Table 3.1). This approach was similar to multiple regression analysis. The method to produce the MDA was similar to that of liner regression (LR), but MDA was more efficient (Alayande and Adekunle, 2015; Härdle and Simar, 2015). MDA used the stepwise method and the statistics were Wilks' Lambda, which tested the difference between the groups in order to classify more than two variable groups. This research included more than two variables, so the dependent variables should be reclassified. The conditions of the MDA test involved 1) various independent variables had normal distribution, 2) had common variance in the group, 3) had a linearity condition, and 4) the independent variables had no multicollinearity. Therefore, MDA was the more appropriate method (Hair et al., 2010; Sae-Lim and Tulyanitikul, 2021; Wanitchbancha, 2008).

The function equation of the classification of the discriminant analysis was (Wanitchbancha, 2003):

$$D = d_0 + d_1X_1 + d_2X_2 + \ldots + d_kX_k$$

where

D = the score of digital governance.

$X_1, X_2 \ldots X_k$ = Leadership, technology acceptance, and organizational culture.

d_0 = Constant or the value of the dependent variable of Y where X is in the equation.

$d_1, d_2 \ldots d_k$ = coefficient or Slope of X_1.

Empirical Results

The research results illustrated that leadership, technology acceptance, and organizational culture had normal distribution, and each factor was independent. When testing the correlation affecting digital governance, it was found that all three factors affected digital governance with a statistical significance level of 0.05 (Table 4.1).

Table 4.1 Difference between the groups of factors affecting digital governance.

Tests of Equality of the Group Means				
Factors	**Wilks' Lambda**	**F**	**Sig.**	**Interpretation**
Leadership	0.728	49.289	0.000	Significance
Technology Acceptance	0.878	18.310	0.000	Significance
Organizational Culture	0.808	31.365	0.000	Significance

* Statistical significance at 0.05.

To table 4.1, it presented that leadership, technology acceptance, and organizational culture are all significantly correlated to digital governance and the three factors had multivariate normal distribution (Wilk's Lambda less than 1).

Table 4.2 Independence test of the three factors affecting digital governance.

Variables in the Analysis				
Step		Tolerance	F to Remove	Wilks' Lambda
1	Leadership	1.000	49.289	
2	Leadership	.721	20.651	.808
	Organizational Culture	.721	5.591	.728

Table 4.2 showed that the tolerance of leadership and organizational culture was 0.721. This implied that both factors were independent and had no correlation.

Table 4.3 Variance and correlation between the three factors affecting digital governance.

Eigenvalues				
Function	**Eigenvalue**	**% of Variance**	**Cumulative %**	**Canonical Correlation (R_c)**
1	.406[a]	95.7	95.7	.537
2	.018[a]	4.3	100.0	.134

a. The first two canonical discriminant functions were used in the analysis.

Table 4.3 showed that the equation was formulated with two factors. From the Eigenvalue, leadership and organizational culture, which had variance within digital governance, was 95.7% and 4.3%, respectively. Simultaneously, R_c comprising leadership and organizational culture explained the correlation of digital governance. Component 1 was 0.537, which showed a high correlation, while Component 2 was 0.134 showing a low correlation. However, the researcher determined the coefficient of the three factors for the digital governance discriminant to create the equation of the score classification as shown in Table 4.4.

Table 4.4 Coefficient of the three factors of the classification of digital governance.

Canonical Discriminant Function Coefficients

Factors	Function	
	1	**2**
Leadership	1.146	-1.308
Organizational Culture	0.607	2.003
(Constant)	-6.634	-3.112

Unstandardized coefficients.

Table 4.4 showed that there were two factors, which the data were the most accurate and efficient. The equation of the score classification was as follows:

$$Y_1 = -6.634 + 1.146\ X_1 + 0\ X_2 + 0.607\ X_3$$

$$Y_2 = -3.112 - 1.308 X_1 + 0\ X_2 + 2.003\ X_3$$

where

Y	was	Digital Governance
X_1	was	Leadership
X_2	was	Technology Acceptance
X_3	was	Organizational Culture

After the classification, the new score of digital governance was shown in Table 4.5.

Table 4.5 Results of the membership prediction

Classification Results[a,c]							
Digital Governance			Predicted Group Membership				Total
			2	**3**	**4**	**5**	
Original	Count	2	4	4	0	0	8
		3	17	36	8	4	65
		4	13	28	56	58	155
		5	27	4	26	115	172 ⭐
	%	2	50.0	50.0	0.0	0.0	100.0
		3	26.2	55.4	12.3	6.2	100.0
		4	8.4	18.1	36.1	37.4	100.0
		5	15.7	2.3	15.1	66.9	100.0
Cross-validated[b]	Count	2	4	4	0	0	8
		3	21	32	8	4	65
		4	13	28	56	58	155
		5	27	4	26	115	172 ⭐
	%	2	50.0	50.0	0.0	0.0	100.0
		3	32.3	49.2	12.3	6.2	100.0
		4	8.4	18.1	36.1	37.4	100.0
		5	15.7	2.3	15.1	66.9	100.0

a. 52.8% of original grouped cases correctly classified.
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.
c. 51.8% of cross-validated grouped cases correctly classified.

From Table 4.5, the scores in Range 2 and 3 changed (red ellipses), while other scores remained the same. However, most respondents gave the score in Range 5 (57-70 scores) to the significance of the factors affecting digital governance.

Table 4.6 Average score of the three factors of digital governance.

Prior Probabilities for the Groups			
		Cases Used in the Analysis	
Digital Governance	Prior	Unweighted	Weighted
15-28	.250	8	8.000
29-42	.250	65	65.000
43-56	.250	155	155.000
57-70	.250	172	172.000
Total	**1.000**	**400**	**400.000**

Table 4.6 illustrated that most respondents, 172 persons or 66.9% (red stars), gave importance to all three factors at Range 5 (57-70 scores), which was in line with Table 4.5. That being said, the organization emphasized digital governance in order to enhance the integrated operational performance with safety, accuracy, transparency, and accountability.

Moreover, the researchers tested the correlation between the three factors of digital governance using the regression analysis approach in order to compare with the Discriminant Analysis (Table 4.7).

Table 4.7 Digital governance correlation classified by the three factors (applying regression analysis).

*

Factors	Digital Governance					Interpretation
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
(Constant)	1.927	0.230		8.394	0.000	-
Leadership	0.415	0.055	0.416	7.520	0.000	Significance
Technology Acceptance	-0.045	0.086	-0.035	-0.528	0.598	Insignificance
Organizational Culture	0.239	0.091	0.189	2.640	0.009	Significance

Statistical significance = 0.05.

From Table 4.7, it was found that leadership and organizational culture were related to digital governance with a statistical significance level of 0.05 (Sig. = 0.000). The value of both factors was predicted with the regression equation as follows:

$$Y = 1.927 + 0.415X_1 + 0X_2 + 0.239X_3$$

In short, digital governance could determine by leadership and organizational culture with a statistical significance.

Conclusions

The research discovered that leadership, technology acceptance and organizational culture affecting digital governance were different among the groups with a statistical significance level of 0.05 (Sig.=0.000). After classification, leadership and organizational culture had the scores in the highest range.

When determining the correlation of each factor with digital governance, the following results were determined:

▪ *Leadership:* It was found that leadership affected digital governance. The obvious leadership skills included vision, understanding, and agility. This was consistent with digital leadership (Wilson et al., 2003) that the leader should have vision, foresee the future precisely, and adapt themselves to keep up with the changing situation (VUCA) (Suksawang, 2017). In terms of government administration, the leader should implement governance to monitor the employees performance to work efficiently, smoothly, and flexibly. Hence, this corresponded with the research on the leadership competencies in a turbulent environment

(Sae-Lim, 2019), which indicated that not only communication skills were important for leadership in the twenty-first century, but also prediction skills, thinking process, digital literacy, networking, and participation that would help to minimize the impacts from VUCA. As such, it would be clearly seen that the leadership skill was very crucial, as it helped to mitigate the impacts of VUCA. Therefore, the leader should acquire such skills to plan the strategies, set the policies and operation plans, as well as the initiate the provision of digital governance efficiently. Importantly, the leader would be the key component who would drive the organization and encourage the employees to achieve the goals sustainably to construct transparency, accountability, and consistency with good governance under the rules and regulations implemented in Thailand.

▪ *Technology Acceptance:* It was found that technology acceptance affected digital governance. This comprised perceived ease of use and perceived usefulness. This was consistent with the research discovering that the Technology Acceptance Model or TAM was the tool for controlling electronics among teachers in Greece (Karavasilis, Zafiropoulos, and Vrana, 2010). An electronic governance system was invented to generate innovation distribution and construct confidence, minimize the risks, and encourage individual innovation. It was noticed that if the employees in the organization had digital literacy, they would be able to adapt and adjust themselves to cope with any uncertain circumstance. As a result, they would learn and accept digital governance easily. As a consequence, eventually, the organization would strengthen its competitiveness sustainably.

▪ *Organizational Culture:* Culture is a significant factor to digital governance. This consisted of digital culture practice, corporate value construction, and adaptation. This was consistent with the survey results of McKinsey and Company (2 0 1 7), which reflected that the main problem of entering the digital age was culture and behavior (Goran, Laberge, and Srinivasan, 2017; Moore, 2019), as each organization had a different organizational culture in terms of operation, values, and attitude (Kluckhohn and Kelly, 1945; Moore, 2019). The organization with efficient digital provision would have substantial digital governance planning. Consequently, the employees would be educated and give the value of the digital governance policy, operation approach, and attitude to learn and follow the digital governance policy. As a result, this would be transferred from generation to generation and become the organizational culture. As a result, the success of organizational culture would depend on the cooperation and participation of all personnel in the organization, including the management.

Recommendations and Limitations

According to the research implications, the researchers propose three theme of the policy recommendations.

Digital governance policy

The executive should have a solid and clear vision and mindset, and constantly develop and learn new technologies. This would be because it would be obvious that the lifestyle of the people would have changed to the New Normal. For this reason, the executive should review and revise the plans and policies to correspond with the environment; such as, set the policy to access the data of the organization and the stakeholders, to control the use of electronic signatures, and other policies. However, the digital governance policy should be at an appropriate level in order to facilitate the move to follow the policy for the organization sustainability.

The government sector should set a clear and up-to-date digital governance policy, as digital technology has continuously changed and developed. An outdated or delayed policy might generate a gap for theft.

Skills development

Efficient digital governance would begin with the understanding and digital application among the employees. However, each employee would have a different level of digital learning skills. Thus, the organization should measure the understanding about the technology application in order to classify the employees to develop and educate them about digital technology. This method would help to minimize the inequality of digital application in the organization.

The government sector should provide digital literacy development to the public inclusively to resolve the inequality of digital learning and access. The government sector should also encourage and publicize the benefits of digital application to the people and provide the available learning channel to the public, as well as include the rules and regulations of digital governance for the people to acknowledge and use digitalization accurately. Then, the people would feel it is safe to use a digital system, as it would be accountable and transparent. Therefore, this would be a crucial component to promote and improve the infrastructure of the country to stand at the same level with other countries.

Organizational culture construction

New organizational culture construction must have a clear digital governance policy, reduce work, and coordinate redundancy. The organization might adjust the organizational culture to be a multiflex structure to be flexible in coordination and the working time. Moreover, the employees would be able to learn diverse functions.

The government sector should convey the policy, rules, and regulations of digital governance clearly to construct the confidence and reliability to the people because digital tools would be the key component of the operation in the New Normal period to minimize the risks around the COVID-19 pandemic situation and continue the coordination with the public.

To make over the future publications, we propose that each organization should be taken into consideration to set the digital governance policy. An organization with the digital provision would also have digital governance planning. Consequently, the employees could learn and be more ready to use digital systems than other organizations.

Moreover, this research only aimed at medium and large organizations using a digital system. Thus, further research should focus on small-sized organizations or SMEs, as they could form the foundation and plan for the provision of digital governance from the very beginning.

Only leadership, technology acceptance and organizational culture were used as the factors affecting digital governance in this research. However, there are more interesting factors; such as, business forms, operational approach, government policy, etc.

Subfactors of digital governance should be examined; such as, data disclosure, service, and public participation. Prior to the issue of the digital governance policy, the government sector should query about these factors to the entrepreneurs and public to inform the organizations and people to acknowledge and set the plan to be consistent with the government's policy.

Ultimately, qualitative research should be conducted; such as, an in-depth interview with executives of the organization to obtain information about the concepts and provision of digital utilization, as well as the digital governance policy setup.

Reference

Alayande, S. A. and Adekunle, B. A. (2015). An overview and application of discriminant analysis in data analysis. *IOSR Journal of Mathematics.* 11(1): 12-15.

Ansell, C. & Sørensen, E. & Torfing, J. (2020). The COVID-19 pandemic as a game changer for public administration and leadership? The need for robust governance responses to turbulent problems. *Public Management Review Journal.* 23(7), 949-960

Bawany, S. (2018). The VUCA Prime Model. *Leading in a Disruptive VUCA World.* [Online URL : https://www.slideshare.net/cee-global/leading-in-a-disruptive-vuca-world-2018]. accessed on January 29, 2021. Australia : Business Express Press.

Briggs, B & Buchholz, S. & Team (2020). Tech Trends 2020, *Deloitte Development LLC.*

Brightside People Team (2020). *How to Create Digital Culture Like Us?* [Online URL: https://www.brightsidepeople.com/สร้าง-digital-culture-อย่างไรให้เป็นแฟ/] accessed on February 18, 2021

Carnegie Mellon University. (2010). *CMMI for Development, Version 1.3, 2010.* United States : Software Engineering Institute.

Davis, F. D. & Bagozzi, R.P. & Warshaw, P.R. (1 9 8 9). User acceptance of computer technology: A comparison of two theoretical models. *Management Science Journal.* 35(8) , 982-1003

Foster, G.M. (1973). *Tradition societies and technology change.* New York: Harper and Row.

Gill, M. & VanBoskirk, S. (2016). *The Digital Maturity Model 4.0.* Benchmarks: Digital Business Transformation Playbook. USA : Forrester Research, Inc.

Goethals, R.G. & Sorenson, J. G. & Burns, J.M. (2004). *Encyclopedia of Leadership.* SAGE Publications, Inc.

Godfrey, S. (2008) *What is CMMI ?.* NASA presentation. [Online URL: https://ses.gsfc.nasa.gov/ses_data_2004/040601_Godfrey.ppt] accessed on December 8, 2008

Goran, J. & LaBerge, L. & Srinivasan, R. (2017). *Culture for a digital age.* McKinsey Digital survey 2016. [Online URL: https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/culture-for-a-digital-age] accessed on January 29, 2021.

Hai Guo & Zhuen Yang & Ran Huang & Anqi Guo (2020). The digitalization and public crisis responses of small and medium enterprises: Implications from a COVID-19 survey. *Frontiers of Business Research in China*, 14(1), 1-25.

Hair, J. F., Black, W. C., Babin, B. J. and Anderson, R. E. (2010). *Multivariate Data Analysis: a Global Perspective*. New York: Pearson.

Härdle, W. K. and Simar, L. (2015). *Applied Multivariate Statistical Analysis (4th ed.).* New York: Springer Heidelberg.

Henley, M. (2019). *3 Steps to Building a Digital Culture.* [Online URL: https://www.cmswire.com/digital-workplace/3-steps-to-building-a-digital-culture/] accessed on February 18, 2021.

Karavasilis, I. & Zafiropoulos, K. & Vrana, V. (2010). Extending TAM to Understand E-Governance Adoption by Teachers in Greece, *Springer-Verlag Berlin Heidelberg 2010*, 2(112), 57–68.

Kluckhohn, C., & Kelly, W. H. (1945). The concept of culture. In R. Linton (Ed.). *The Science of Man in the World Culture*. New York: Columbia University Press, 78-105.

Ministry of Information and Communication Technology. (2011). *Information and*

Communication Technology Policy Framework 2011-2020 (1st ed.). Bangkok:

Ministry of Information and Communication Technology.

Moore, D. (2019). *Corporate Culture is More Critical Than Ever in the Digital Age.* [Online URL: https://www.northridgegroup.com/blog/corporate-culture-is-more-critical-than-ever-in-the-digital-age/] accessed on January 29, 2021].

Patón-Romero, J. D. & Baldassarre, M. T. & Rodríguez, M. & Piattini, M. (2019). Maturity model based on CMMI for governance and management of Green IT. *The Institution of Engineering and Technology.*13(6), 555-563

Pongsiri, N. (2017). Leader in Digital Economy Age. *HR Society Magazine Journal*, 15(172), 20-23

Reddy, V. & Brumpton, L. (2021) Digital-driven service improvement during the COVID-19 pandemic, *Paediatrics and Child Health*, 31(5), 220-222.

Rossmann, A. (2018). *Digital Maturity: Conceptualization and Measurement Model*. San Francisco 2018 : 39th International Conference on Information Systems (ICIS 2018), 2, 1-9

Sae-Lim, P. (2019). Leadership Competencies in Turbulent Environment, *Journal of MCU Peace Studies*, 7(6), 1525-1540

Sae-Lim, P. & Pinvanichkul, T. (2021). Materializing sustainability and business resiliency: The numerical experiments with value at risk (VaR), *Journal of Business & Economic Management*, 9(2), 58-65

Sae-Lim, P. & Tulyanitikul, B (2021). Longevity Risk Mitigation and Its Determinants: An Empirical Study of Thai Society. *Humanities, Arts and Social Sciences Studies*. 21(2), 224-234

Saleh, M.F. (2011). Information Security Maturity Model. *International Journal of Computer Science and Security*. 5(3), 316-337.

Suksawang, S. (2017). *VUCA Challenge of Leaders in New Era*. Thailand: HCD Innovation Co., Ltd [Online URL: www.sasimasuk.com/16768188/vuca-world-ความท้าทายสำหรับผู้นำยุคใหม่] accessed on January 02, 2021.

Suvanasarn, M. (2017). Governance and Digital Governance and Innovative Technology/ Business Model. [Online URL: https://www.itgthailand.com/page/3/] accessed on January 10, 2021].

Thairuekham, S. (2009). *Teaching Material for Advanced Statistics for Educational Research.* Kalasin,: Prasan Printing.

Thitathan, T. (2020). *Opportunity in Crisis: e-Business SME Survival in Digital Age.* Thailand: Bank of Thailand

The World Bank. (2019). *The Worldwide Governance Indicators (WGI).* Washington, D.C.: International Bank of Reconstruction and Development. The Word Bank.

Wanitchbancha, K. (2003). *Advanced Statistical Analysis with SPSS for Windows (3rd ed).* Bangkok: Thammasan.

Wanitchbancha, K. (2008). *Multivariate Analysis (3rd ed).* Bangkok: Thammasan.

Welchman, L. (2015). *The Basics of Digital Governance in Managing Chaos: Digital Governance by Design.* New York: Rosenfield Media.

Wilson, E. J. & Goethals, G. & MacGregor, J. (2003). *Leadership in the Digital Age.* The Encyclopedia of Leadership. [Online URL: https://www.semanticscholar.org/paper/"-LEADERSHIP-IN-THE-DIGITAL-AGE-"-Wilson-Goethals/166fc20321a8432cae85f02f8c87f849adcf3628?p2df] accessed on December 18, 2020.

Zenklusen, H. (2021). *Agile framework development for digital governance*. Switzerland: Netcentric, A Cognizant Digital Business Ltd.