Indicators for Organizational Digital Transformation in the Thai University Context

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ABSTRACT

Organizational digital transformation comprises a number of significant factors for measuring success, each of which involves different evaluating criteria. This research was aimed at developing indicators and criteria behind Thai universities' organizational digital transformation by the use of the quantitative research method and a questionnaire for data collection. The informants included administrators of six Thai universities: 303 high-level administrators, 174 middle-level administrators, and 18 low-level administrators. From the total of 495 administrators, 262 completed and returned the questionnaire. Analyses were then performed based on the statistics showing frequencies and percentages. The findings showed nine key indicators, nine sub-indicators, and 10 evaluating criteria that are appropriate for evaluating the work outcomes in the dimension of digital transformation. The most appropriate indicators were the digital strategies and personnel. The results would benefit administrators, academics, researchers, and the officers involved in deploying the work of organizational digital transformation under the educational context. The benefits would be in planning and developing the policy in digital transformation of Thai universities that is in the right direction and more clarified. Other institutions would also be able to effectively and successfully apply the indicators in their digital transformation process.

KEYWORDS

Digital Technology, Digital Organization, Digital Transformation, Transformation Indicators, University Transformation

INTRODUCTION

The present reliance on different technologies, systems, and platforms is changing the global economy from the industrial era to a new economic era. Traditional businesses are fading away and are being replaced by digital businesses. Organizations need to undergo this situation with the use of their existing resources and tools (Osmundsen et al., 2018) and inevitably attempt to transform the organizational ecology to be in line with the new age. This process involves a new business structure, implementation processes, consumers' experiences, personnel, organizational culture,

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infrastructures, and technologies that assist in streamlining interaction of people in the organization (Richards, 2018). Many organizations have become aware of the importance of such changes so that they can compete and adjust themselves in time with the digital-age development, notwithstanding whether it is the operational process or transforming the thoughts of personnel that requires urgent action (Osmundsen et al., 2018).

Universities are another sector affected by technologies and digital tools. Traditional concepts on the teacher-centered approach have changed to a learner-centered approach; therefore, learning and teaching strategies and approaches have also changed (Taraghi et al., 2010). Former or traditional instructional forms may no longer meet the learners' needs. Instructors who used to be university lecturers may become specialized personnel in small institutions, whereas entrepreneurs in the private sector may become instructors who can provide learners with new experiences. The former mode of instruction in which learners attend the lesson in the classroom will turn to online learning that is available at any place and time (Tapscott, 2014; Logically, 2018; Numnonda, 2020). This evidence of change demonstrates that the present digital technology development has effected impacts on the teaching and learning approaches. If universities do not take any action to transform their organizations, then they risk the condition known as digital disruption.

Recently, Thai universities have been working hard to transform into a complete digital organization until this effort becomes the trend in university development. The urge comes from the Ministry of Higher Education, Science, Research and Innovation (MHESRI). MHESRI has outlined the policy and plans to implement works in the line of digital technology, along the same direction and in accordance with the national developmental strategies. The goal is for the university to be an organization that operates proficiently with digital technology (MHESRI, 2019). In addition, the CIO Digital University Forum of Thai universities has been established as a venue for university administrators to discuss, learn, and share experiences among themselves and propose common guidelines for organizational digital transformation (CIO Digital University Forum, 2018).

Organizational digital transformation is not only an application of technology for individual and organizational changes (Veiga & Andrade, 2021) but also a strategy applied in organizational development for efficient operations. In so doing, technologies will be integrated with digital channels to meet the expectations of consumers, facilitate cross-cooperation between working units, and adjust the duties and roles by means of dynamic competency. A digital organization will be able to rapidly draw the advantages from new digital alternatives when facing the changing customers' expectations (Soule et al., 2016; Osmundsen et al., 2018). However, the process of pulling out and mobilizing all the organizational resources for this new development is a challenge (Veiga & Andrade, 2021). The organizational digital transformation process usually comes in the form of set activities that are consecutively carried out to attain the predetermined objectives. The activities must be assessable so that the work outcomes can be realized. According to SoluteLabs (2023), measuring the progress of digital transformation can be challenging because it encompasses various aspects of an organization's operation, such as strategy, technology infrastructure, processes, and talent. Indicators can help an organization assess the progress of its digital transformation efforts. This assessment can provide a baseline measurement and identify gaps and areas for improvement. Thus, specifying the implementation indicators for realistic translation of organizational strategies is important. The indicators and organizational strategies are interrelated; if any strategy of an organization is not evaluated, that strategy is of no use and meaning (Vukomanović et al., 2010).

At present, different organizations' attempts to become a digital organization have begun, with clarified indicators. However, their digital transformation indicators cannot be applied in the university context where operations are different. This situation indicates that universities still have no indicator for evaluating the work under the dimension of organizational digital transformation (Numnonda, 2020). Without indicators to guide their organization's digital transformation, universities may struggle to measure their progress and identify areas of improvement. Indicators provide a framework for evaluating the effectiveness of digital transformation efforts, and they also can help

universities make informed decisions about resource allocation and strategy (Popova et al., 2020). They allow universities to track their performance in varied areas, such as educational service digitization, university-industry collaboration, and organizational culture transformation (Sánchez, 2020). Indicators also enable universities to assess the impact of their digital transformation on key stakeholders, such as students, faculties, and industry partners. By providing measurable goals and benchmarks, indicators help universities stay focused and accountable for their digital transformation journeys. Overall, indicators play a crucial role in guiding and evaluating the university's digital transformation efforts, ensuring that they are aligned with strategic goals and that they drive positive outcomes (Fernández et al., 2023).

We thus became aware of the importance of indicators and interested in developing them for organizational digital transformation in the Thai university context. These indicators can be used as the criteria in the evaluation of the work outcomes and as the directional guide in the development of the policy related to organizational digital transformation of Thai universities. The outcomes will be useful for the administrators, academics, researchers, and those responsible for digital transformation in the educational context. Other institutions can also apply the indicators for the success and quality of their organizational digital transformation. The focus of our research was on developing the indicators and criteria for organizational digital transformation in Thai universities and on obtaining the scope of knowledge of the indicators for organizational digital transformation. The outcomes would be useful for administrators, academics, researchers, and those involved in the transformation into a digital organization in Thai universities.

LITERATURE REVIEWS

The concept of digital transformation has been of interest among global business and nonbusiness organizations owing to the rapid development of digital technology that has infiltrated all sectors. Many organizations are thus aware of the importance of organizational transformation to remain under the present competitive situations. Digital transformation is a strategy of organization transformation that incorporates digital technologies into all parts both inside and outside the organization. It begins with building inspiration among personnel by altering their thinking process, thereby enabling the organization to automatically transform its business form, products, services, structure, or other processes with the use of technologies that will result in good experiences for its customers. The organization will be able to compile, analyze, and use information to creatively build values for the consumers, resulting in advantages and business opportunities as well as disruptive innovation and its sustainable growth under the digital economy era (Numnonda, 2020; Hess et al., 2016; Reis et al., 2018; Kaplan & Haenlein, 2019).

Digital transformation has continuously been of an area of interest for organizations. MIT Sloan Management Review and Deloitte University conducted research on the strategy of deploying digital technologies by collecting data from more than 4,800 administrators and managers of companies; their findings showed that nearly 99% of the sample group anticipated that their industries and businesses will be disrupted in the future from digital technology (Kane et al., 2015). The important reason that inevitably leads to confrontation of business organizations with challenges arising from competition and introduction of modern technologies is that the former organizational management cannot respond to the rapid changes of products and services. Administrators of many organizations have laid digital plans for their business operations. These plans may include development or building of new forms of businesses that lead to transformation of different infrastructures, products, services, or automatic processes of the organization as well as the transformation of full-cycle business competition (Hess et al., 2016).

Up to the present time, "digital organizations" have received a lot of interest owing to the rapid changes and development of the digital technology that affect organizations' operations. This growing interest is a result of enterprises' attempts to find a clear approach for transformation into digital

organizations. As a result, many academics and organizations define a digital organization as any organization having flexibility and ability to rapidly and constantly transform itself. This does not mean only installation and use of technologies in the organization, but also development of strategies for transforming the former operations into digital form. As such, tools and digital technologies are integrated in the operations both inside and outside the organization in order to increase the competitive advantages" (Richter et al., 2017; Sussan & Acs, 2017; Dinh et al., 2018; National Science and Technology Development Agency [NSTDA], 2020). A digital organization should possess the following characteristics (Kane et al., 2015; Soule et al., 2016; Deloitte, 2018):

- It sees the importance of providing good experiences for customers.
- It develops digital skills for staff and recruits new staff with high digital skills who have the culture of digital perception.
- It operates in a digital environment.
- It deploys the organization with data and analyses.
- It has a digital core.
- It has a digital human resource section.

Organizational digital transformation necessitates indicators as a tool to efficiently measure the progress of implementation, evaluate the status by setting a clear trait or variable, follow up on the changes, and evaluate the outcomes. The indicators will be in the form of quantitative or qualitative information (Srisatidnarakul, 2012; Chaiyaphankul et al., 2016; the Compass, 2020). Each objective must comprise at least one clear, unambiguous, and explainable indicator. From reviewing of the related literature, we found that the development of indicators involves the following steps (National Statistical Office, 2016):

1. Setting the developmental objectives.
2. Compiling the information for developing the indicators.
3. Analyzing and defining the indicators.
4. Developing and stipulating the indicators.
5. Verifying the quality of the indicators.
6. Testing the indicators and evaluating, etc.

We reviewed documents, textbooks, and research studies related to digital transformation in university settings. These works have delved into various aspects of digital transformation, including its impact on organizational routines and processes (Almatrodi & Skoumpopoulou, 2023; Gennad'evich et al., 2023), the adoption of digital technologies in university libraries to sustain dynamic information services (Hoang et al., 2023), and the use of digital content and resources in medical education (Ikenwe & Udem, 2022). The research has underscored the importance of understanding the drives and factors influencing the adoption of digital technologies (Lotova, 2022). Overall, these research studies contribute to our understanding of digital transformation in university contexts. According to the reviews of literature, however, digital enterprise transformation indicators have not been studied in the university context.

However, these publications included, for instance, the ranking of international digital governments performed by the Waseda University Institute of e-Government, which collaboratively surveyed 10 world-class leading universities in the network of International Academy of CIO (IAC). This survey evaluated the level of e-government development in 65 countries worldwide that reflected the trend of e-government development at present. The evaluation was performed from 10 items of key indicators, with their 35 sub-indicators (Digital Government Development Agency [DGA], 2018). Additionally, the United Nations compiled the E-Government Development Index with an aim to assess the readiness

for e-government development of different countries, their direction of e-government development, and their ability in applying information technology to serve the public. In that study, 193 member countries were surveyed in three major aspects (DGA, 2018; Knoema, 2018). The other related work was the survey on the progress of worldwide organizational digital transformation, measured from 10 key factors, by Dell Technologies (Dell Technologies, 2018). After the synthesis of literature and research works related to digital organization indicators, we derived 11 indicators:

1. The readiness of the infrastructure and network is the principal indicator of a strong digital structure. This means readiness of the network systems that avail establishment of the points and connections between the principal organization and suborganizations (DGA, 2018; Knoema, 2018; Dell Technologies, 2018; Obi, 2018).
2. Efficiency in administration and management covers competent administrative and management of the infrastructure, budget, and resources. The organizational management system must be efficient for the entire organization so that all the work will be smoothly, rapidly, and concomitantly performed (DGA, 2018; Knoema, 2018; Dell Technologies, 2018; Obi, 2018).
3. The management should cover the matters of information, with the ability in efficiently storing and retrieving information for common use. Management should also disclose information between the principal and branch organizations, thereby laying rules and regulations for information access (DGA, 2018; Knoema, 2018; Dell Technologies, 2018; Obi, 2018).
4. Online service provision means compilation of processes, policies, steps, tools, technologies, and attempts in providing facilities; providing customer services through systems and platforms; and developing single sign-on for users by identifying oneself and the use of online services of the organizations so that users are able to search and reach the services conveniently (DGA, 2018; Knoema, 2018; Obi, 2018).
5. Strategies, visions, and support from the administrators are the issues an organization must plan for; it must develop strategies in line with this vision of digital transformation, with fully supportive administration, by managing the strategies and investment on different items (DGA, 2018; Knoema, 2018; Dell Technologies, 2018).
6. The use of newly emerged information technology or introduction of digital technology in the organizational operations, with fast application of modern technologies that suit each situation (Dell Technologies, 2018; Obi, 2018).
7. Cyber safety is an indicator to ensure that organizations are equipped with sufficient and efficient information about cyber laws that can handle cyber criminals and a strong unit responsible for the safety of personal information (Dell Technologies, 2018; Obi, 2018).
8. Promotion of participation is an indicator to help the staff members of all sections in the organization to take part in the deployment of the organization, with clarified roles and duties of each activity, including the use of systems and platforms as the tool to listen to customers' opinions so that the customers can take part in decision-making and creating collaboration between organizations (DGA, 2018; Knoema, 2018; Obi, 2018).
9. Promotion of digital organization is an indicator for measuring the activities of the organization that have an impact on the digital organization promotion, with digital operations and services using the systems and platforms as the principal tool as well as having the framework of legal, propelling, supporting, and evaluating mechanisms (Obi, 2018).
10. Ideal digital culture is an indicator to instill that a digital organization must have digital DNA at the core. This leads to an impact on digital culture in mechanism development, cross-organizational operations, and support of work with digital technologies to streamline the organization's operations (Deloitte, 2018).
11. Appropriate skills and expertise ensure that a digital organization has skillful staff with necessary expertise in digital operations to be able to meet with the changing processes (Janzik, 2015; Ivančić et al., 2019).

RESEARCH METHOD

We conducted this study using the quantitative research method to develop the indicators and criteria used for organizational digital transformation of Thai universities. The unit used in the research was the Thai universities according to the Announcement of the Office of Higher Education Commission, Ministry of Higher Education, Science, Research and Innovation (MHESRI). We chose to study six governmental universities that are members of the CIO Digital University Forum and have a clear policy to transform into a digital organization (CIO Digital University Forum, 2018; Office of the Higher Education Commission, 2020). Our research involved a four-step process:

Step 1: Analysis of the literature related to the indicators of digital organizations and the results of a study obtained from interviewing administrators of Thai universities on the strategies, factors, and processes in digital transformation. After this research, we reorganized the indicators comprising 10 key indicators, 12 sub-indicators, and 12 evaluating criteria. The 10 key indicators are as follows: (1.) digital strategies, (2.) digital culture, (3.) organizational leaders, (4.) digital technology, (5.) personnel, (6.) budget, (7.) operations, (8.) processes, (9.) information management, and (10.) innovation.

Step 2: Three experts verified the quality and validity of the tool. Next, we tried out the tool with 30 people who did not belong to the sample group. The reliability of the tool was found using the Alpha Coefficient Formula and the Cronbach's method. The reliability found was 0.92.

Step 3: We used the quantitative research method and collected data from a total of 495 administrators of the six chosen Thai universities. This total comprised 303 high-level administrators, 174 middle-level administrators, and 18 low-level administrators. The tool used for data collection was the questionnaire. The breakdown of the returned and completed questionnaires consisted of 158 (52.15%) high-level administrators, 84 (48.28%) middle-level administrators, and 17 (94.44%) lower-level administrators, totaling 262 (52.93%) of the 495 recipients of questionnaires. We then used the descriptive analysis method by organizing the obtained data, categorizing the content group, and tabulating for description. Next, we interpreted the results of the analyses to check the factor loading, with the scoring criteria as follows: Yes means 1 point, and No means 0 points. We calculated the parameters in percentages and interpreted them according to Bloom's criteria (Bloom, 1956), which were divided into three levels:

Level 1: The score higher than 80% means agree at a high level.
Level 2: The score between 60.0% and 79.9% means moderately agree.
Level 3: The score lower than 59.99% means agree at a low level.

Step 4: Confirmation of the appropriateness of the indicators for their use as the criteria to evaluate the organization in the dimension of digital transformation. According to Halek et al. (2017), content validation is a minimum quality requirement for an instrument development. Content validation is usually done through subject expert judgment about the significance of individual items within an instrument (Creswell, 2012). We analyzed the judgment of the experts to confirm the appropriateness and accountancy of the item. The index of item-objective congruence (IOC) is one method to quantitatively measure content experts' judgments of items (Turner & Carlson, 2003). After the experts rate the items, the results are calculated to create the indices of IOC for each item on each objective. According to Brown (2005), if the IOC is between 0.5 and 1.00, the item is deemed acceptable, but if the IOC falls below 0.5, it means that the item is not fitting and must be removed or reviewed.

We collected the information from nine experts: three digital administrators of universities, three experts in digital technology or information science, and three academics in modern organizational

management or organizational quality assessment. The evaluation form was used to collect data from the experts. The following is the scoring criteria:

- +1: Certain that the item is valid for use as an indicator.
- 0: Not certain that the item is valid for use as an indicator.
- -1: Certain that the item is not valid for use as an indicator.

RESULTS

For the development of the indicators and the criteria for organizational digital transformation in Thai universities, the related concepts and theories were synthesized. Ten key indicators, 10 sub-indicators, and 12 evaluating criteria were found for organizational digital transformation of Thai universities (Table 1).

Table 1 lists the results of the analysis and interpretation of the level of opinions of informants related to the indicators for organizational digital transformation. Of the 10 indicators, 10 criteria were found to be appropriate at the high level, and two criteria were appropriate at the moderate level. Most of the sample group (237 informants; 90.5%) saw that the operation indicator should be the best indicator for digital transformation. The indicator seen by 236 informants (90.1%) as the next in importance was digital strategy, followed by digital technology (229 informants; 87.4%).

Next, we confirmed the appropriateness of the indicators by collecting the information from nine experts. We found that two items had an IOC lower than 0.50: (1.) Criteria for evaluation on "Personnel's level of attitudes and willingness to transform into digital" under the key indicator Digital culture (IOC = 0.33) and (2.) the key indicator on "Information management" with the sub-indicator "The university uses big data solutions by constantly compiling, storing, and analyzing the data in digital format, which is open for personnel all over the organization to use the digital information," and criteria for evaluation on "The number of solutions with systematic management of big data" (IOC = 0.22). Based on research by Brown, (2005), if an IOC falls below 0.5, it means that the item is not acceptable. Therefore, these two items have been removed from the indicators' list (Table 1).

From this data, we conclude that nine key indicators were found appropriate to use for evaluating the quality in digital transformation in the context of Thai universities. We define them in this section and list evalution criteria for each indicator.

Key Indicator One: Digital Strategies

The university has clear strategies to transform into digital to drive forward the organization, and the strategies are continuously used as guidelines for the work.

Evaluation criteria: The announcements or resolutions of the University Council and the University's administrative committee on policy and strategies for transformation into a digital organization.

Key Indicator Two: Digital Culture

The university has digital DNA at the core by clearly intervening the profound parts of the organization with digital technologies.

Evaluation criteria: The target number assigned to faculties and departments in the university to use digital technologies as the core business.

Key Indicator Three: Organization Leaders

The administrators of the university possess leadership characteristics and are able to build motivation that draws participation from personnel in the organization's digital transformation process.

Table 1. Indicators for organizational digital transformation of Thai universities

Key indicators	Sub-indicators	Criteria for evaluation	Opinions of informants			Expert judgment	
			Yes	No	Interpretation	IOC	Interpretation
1. Digital strategies	The university has clear strategies to transform into digital to propel the organization, and the strategies are continuously used as guidelines for the work.	Announcements/resolutions of the University Council/ Resolutions of the University's administrative committee on policy and strategies for digital transformation	236 (90.1%)	26 (9.9%)	Agree at a high level	0.88	Acceptable
2. Digital culture	The university has digital DNA at the core, by clearly intervening the profound parts of the organization with digital.	The target number assigned to faculties and departments in the university to use digital as the core business	223 (85.8%)	37 (14.2%)	Agree at a high level	0.55	Acceptable
		Personnel's level of attitudes and willingness to transform into digital	190 (73.9%)	67 (26.1%)	Agree at a moderate level	0.33	Not acceptable
3. Organization leaders	The administrators of the university possess leadership characteristics and are able to build motivation that draws participation from personnel in the organization digital transformation process.	The level of confidence of personnel toward administrators in leading the transformation toward a digital organization	227 (87.0%)	34 (13.0%)	Agree at a high level	0.66	Acceptable
4. Digital technology	The university has the basic infrastructures of suitable and sufficient digital technology for the requirement of stakeholders, and these are evidently used in propelling the organization toward the transformation.	Number and quality of the advanced technologies that support organizational digital transformation.	229 (87.4%)	33 (12.6%)	Agree at a high level	0.55	Acceptable
5. Personnel	The university personnel are literate in digital and able to use digital technology in their work toward the goals.	Number of personnel and their level of digital literacy	225 (86.2%)	36 (13.8%)	Agree at a high level	0.88	Acceptable
6. Budget	The university allocates sufficient and continuous budget for deploying organizational digital transformation.	The percentage of the allocated budget for organizational digital transformation per year	222 (84.7%)	40 (15.3%)	Agree at a high level	0.77	Acceptable
7. Operation	The university operates under the core business approach by using digital technology in the form of systems and platforms that allow online operations.	The number of projects/ activities/job systems that have transformed the work under the digital environment	237 (90.5%)	25 (9.5%)	Agree at a high level	0.55	Acceptable
8. Process	The university has clear and continuous processes of organizational digital transformation.	The number of projects/ activities/job systems with clear and systematic framework and steps	225 (86.2%)	36 (13.8%)	Agree at a high level	0.77	Acceptable
		The percentage of personnel who take part in the organizational digital transformation	198 (76.2%)	62 (23.8%)	Agree at a moderate level	0.55	Acceptable
9. Information management	The university uses big data solutions by constantly compiling, storing, and analyzing the data in a digital format that is open so that personnel all over the organization can use the digital information.	The number of solutions with systematic management of big data	208 (80.0%)	52 (20.0%)	Agree at a high level	0.22	Not acceptable
10. Innovation	The university has the digital innovation or concretely and constantly uses digital technology.	Empirical innovations emerging from organizational digital transformation (product innovation, process innovation, or service innovation)	221 (84.7%)	40 (15.3%)	Agree at a high level	0.77	Acceptable

Evaluation criteria: The level of confidence of personnel toward administrators in leading the transformation toward a digital organization.

Key Indicator Four: Digital Technology

The university has the basic infrastructures of suitable and sufficient digital technologies for the requirement of stakeholders, and they are evidently used in propelling the organization toward the transformation.

Evaluation criteria: The number and quality of the advanced technologies that support organizational digital transformation.

Key Indicator Five: Digital Literate Personnel

The university personnel are digital literate and able to use digital technology for the goals.

Evaluation criteria: The number of personnel and their level of digital literacy.

Key Indicator Six: Budget

The university allocates sufficient and continuous budget for deploying organizational digital transformation.

Evaluation criteria: The percentage of the allocated budget for organizational digital transformation per year.

Key Indicator Seven: Operations

The university operates under the core business approach through the use of digital technology in the form of systems and platforms that allow online operations.

Evaluation criteria: The number of projects, activities, or job systems that have transformed the work to be under the digital environment.

Key Indicator Eight: Processes

The university has clear and continuous processes of organizational digital transformation. There are two criteria for the evaluation of this indicator:

1. The number of projects, activities, or job systems with clear and systematic framework and steps.
2. The percentage of personnel who take part in the organizational digital transformation.

Key Indicator Nine: Innovation

The university has digital innovation or concretely and constantly uses digital technology.

Evaluation criteria: The empirical innovations emerging from organizational digital transformation (for example, product innovation, process innovation, or service innovation).

DISCUSSION

The data analyses showed that nine key indicators are appropriate to evaluate the quality of organizational digital transformation in the context of Thai universities. The most appropriate indicators are the digital strategies and personnel. The informants saw that if the university has a clear strategy in digital transformation for deploying digital technologies in the organization, and the strategy is used as the guidelines for continuous operations, then the organizational digital transformation will be effective. Digital transformation is the matter of strategy for transforming the organization and using digital technology as the support (Numnon, 2022). The digital business strategy is important and

necessary in supporting an organization to achieve its objective of digital transformation (Nwankpa & Roumani, 2016; Leischnig et al., 2017). Organizational strategies, in general, are congruent with the customers' and consumers' demands, but the digital strategies must be adjusted to meet the demand of the customers, the internal organizational strategies, and the information system. In other words, digital strategy cannot be put into action unless there are supports from other parts of the organization. If an organization has a quality digital strategy, organizational transformation in other areas will also include quality processes (Schmidt et al., 2017; Dugstad et al., 2019). On the other hand, if the organization has an unclear digital strategy and operation, evaluating the transformation effectiveness will be difficult (Zhou & Dong, 2021).

In addition, the indicator for personnel is another aspect suitable as an indicator for the transformation of which the university should be aware. It means the importance placed on the development of staff to be digital literate and able to use digital technology to work toward the goal. This algins with research by Baum (2019), who mentioned that having digital-capable personnel, and personnel with knowledge, ability, skill, and understanding to work under the digital environment, as well as ability in multiple applications of digital technology with appropriateness and efficiency in different venues and situations, will assist in promoting the success in digital transformation (University of Derby, 2019). Baum (2019) additionally discussed the promotion competency development method for personnel; namely, that an organization should provide a common working space and build understanding of basic digital technology. Others added that personnel are the important part of digital transformation (Mueller & Renken, 2017; Petrikina et al., 2017). Motivating personnel to willingly accept and take part in digital transformation is important. An organization should cooperate with the internal units or stakeholders and support them to participate in the digital transformation process so that misunderstanding and obstruction from personnel will be lessened (Petrikina et al., 2017).

Nevertheless, according to the results of this study, the indicators in the university context are similar to the digital transformation indicators of other organizations. However, there are some differences in the prioritization of each indicator. In the context of universities, this study indicated that digital strategy is the most important indicator. On the other hand, a digital organization focusing on infrastructure is the most significant indicator according to diversified sources and studies from literature reviews. However, the university also has budget indicators that are parts of the evaluation of digital organization. Information management indicators were not taken into account from the results of this study. Nevertheless, it has been listed as one of the key digital transformation indicators in other organizational contexts (DGA, 2018; Knoema, 2018; Dell Technologies, 2018).

CONCLUSION AND RECOMMENDATIONS

In the age when digital technologies have inevitably disrupted all operating activities of an organization, the attempts to deploy digital technologies in the organization and enable existence under the tense condition result in awareness of both state and private organizations, as well as academic institutions, of the importance of digital transformation. The organizational strategies have been developed as the means for propulsion toward the set goals. Nevertheless, digital transformation in the context of Thai universities still does not have clear indicators to measure the operations. The results of this study show that university administrators see the greatest importance of the indicators of digital strategy and personnel. These indicators are considered as the appropriate evaluation for the organization in the context of digital transformation. There are also other appropriate indicators—namely, indicators for budget, process, innovative digital culture, organization leaders, digital technology, operation, and the order of their significance. This study therefore assists in recommending the scope of knowledge related to the indicators and criteria for organizational digital transformation in the context of Thai universities.

However, these indicators have been derived from the study of the autonomous group of universities that are deploying and transforming toward being a digital organization for a certain level. Thus, if other types of universities have not started the transformation, and want to use these

indicators, then they need to select and adjust the indicators according to their context, concept, process, and target of each university—for example, consideration of various resources, including budget, personnel, or infrastructure. The university must establish clear policies and communicate the project's goals and methods to its personnel within the organization to become a digital organization. In addition, these indicators should be used for evaluating the implementation related to digital technologies so that the impact on the development of standard of digital transformation in the context of Thai universities will be clearer.

Finally, this study has some limitations pertaining to the development of indicators and criteria for evaluating the transformation to digital organizations of Thai universities. Because there is no practical evaluating process for Thai universities, we therefore deem it appropriate to conduct a study using the indicators to measure and evaluate the performance of Thai universities' digital organizations. This study is unable to encompass the entire groups of university in Thailand; only independent universities were chosen to study. In conclusion, we agreed that further studies should be carried out as a way to stabilize the standard of digital transformation among Thai universities for future organizational development.

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