Volume 20 Number 2

World Institute
for Engineering
and Technology
Education (WIETE)

World Transactions on Engineering and Technology Education

Editor-in-Chief
Zenon J. Pudlowski
World Institute for Engineering and Technology Education (WIETE)
Melbourne, Australia

MELBOURNE 2022

Volume 20, Number 2, 2022

World Transactions on Engineering and Technology Education

Editor-in-Chief
Zenon J. Pudlowski
World Institute for Engineering and Technology Education (WIETE)
Melbourne, Australia

Melbourne 2022

Commonwealth Science and Technology Academy for Research (C-STAR)
Chennai, India

Faculty of Architecture
Cracow University of Technology
Kraków, Poland

Faculty of Architecture
Gdańsk University of Technology
Gdańsk, Poland

Faculty of Architecture and Design
Slovak University of Technology
in Bratislava
Bratislava, Slovakia

Faculty of Architecture
Wrocław University of Science
and Technology
Wrocław, Poland

Published by:

World Institute for Engineering and Technology Education (WIETE)
141 The Boulevard, Ivanhoe East, Melbourne, VIC 3079, Australia

E-mail: info@wiete.com.au
Internet: http://www.wiete.com.au

ISSN 1446-2257

Articles published in the World Transactions on Engineering and Technology Education (WTE&TE) have undergone a formal and rigorous process of peer review by international referees.

Responsibility for the contents of these articles rests upon the authors and not the publisher. Data presented and conclusions developed by the authors are for information only and are not intended for use without independent substantiating investigations on the part of the potential user.

World Transactions on Engineering and Technology Education

Contents

Digital transformation readiness in Indonesian institutions of higher education

Radiant V. Imbar†‡, Suhono H. Supangkat†, Armein Langi† & Arry A. Arman†

Bandung Institute of Technology, Bandung, Indonesia†
Maranatha Christian University, Bandung, Indonesia‡

ABSTRACT: In this article, the authors present a study which aimed to determine the digital transformation (DT) readiness of institutions of higher education in Indonesia. The researchers have found that the success of digital transformation is strongly influenced by the digital culture within an organisation, as well as transformational leadership and organisational commitment to provide adequate resources. For this research, a tool was developed to measure the level of digital transformation readiness by measuring both the digital culture determinant and leadership readiness along with organisational commitment. The tool was used to investigate 36 institutions of higher education in Indonesia. This study provides data concerning higher education readiness levels with regards to digital transformation towards a smart campus. It is hoped that as a result of this research, institutions will be able to determine their level of digital transformation readiness and subsequently develop appropriate strategies, so that they can be digitally transformed.

INTRODUCTION

The Covid-19 pandemic has affected people's lives in many way [1]. It has also caused dramatic changes in the field of education. Learning that was previously conducted face-to-face went on-line or is mostly carried out in a hybrid mode [2]. The use of digital technology in society, such as social media, artificial intelligence (AI), cloud computing, big data, IoT and digital twin has also had an impact on business due to changes in consumer behaviour and expectations. To succeed in such an era of academic disruption, organisations need to adapt and be willing to accept changes. Their adaptation must accommodate digital transformation (DT) and be aligned with business in order to create value for the organisation/business [3].

Institutions of higher education (HEIs) today are faced with the challenge of pioneering DT and keeping up with digital technology, something that is developing rapidly and affecting the lives of all people [4]. This is similar to what occurred at the beginning of the Covid-19 pandemic, when millions of students experienced changes in their learning methods in just a short time. In-class education shifted to Microsoft Teams, Zoom or Goggle Meet. Students and lecturers were required to learn/teach using digital technology because all educational processes were carried out on-line. This could well be described as the digital transformation of the HEIs [5].

DT in HEIs has been discussed by many researchers. Some have found that leadership is very significant in the successful implementation of DT [6]. Organisational culture is also an influential factor. The challenge for organisations is defined as a clear digital vision and mission, and communicating that to all their stakeholders.

In the study outlined in this article, a tool to measure HEIs readiness in terms of DT was developed based on the factors that determine successful digital transformation.

Accordingly, the following research question was formulated:

How can an instrument be made that can measure the DT implementation readiness of HEIs and what is the maturity level of DT readiness in selected Indonesian HEIs? This research question was prompted by discovering that several HEIs in Indonesia want to build smart campuses, but do not know their current state of readiness to carry this out.

In this research the maturity level of DT readiness of 36 HEIs in Indonesia was determined first; this information was then used as the basis for DT assessment of HEIs. The importance of this research consists in the actual development of a tool that can measure the DT readiness of HEIs. The results of this research can be used as input for leaders of HEIs to help them design roadmaps for implementing DT in their respective HEIs.

RELATED WORK

Digital Transformation

Due to the level of today's digital technology, the entire world is undergoing tremendous transformation. Changing business operations has become a problem for many organisations. As a result, organisations, particularly those in the higher education sector, are looking into available DT technology to increase their organisational agility and flexibility, and be able to adapt to changing environments and meet the demands of governments and customers [7]. However, numerous barriers remain in the way of implementing DT in HEIs; these include: the inability of administrative personnel and lecturers to use technology, the lack of data availability, lack of resources and of financial capacity [8].

DT can help businesses accelerate their operations, processes and competencies in order to fully capitalise on developments and opportunities in digital technology and their influence on society in a strategic and prioritised manner [9]. DT can be described as the integration of digital technology into all elements of an organisation; it can radically change operations and give added value to consumers. DT is defined as changes in working techniques, activities and business practices as the result of digital technology being utilised in a company [10].

The practice of DT involves introducing digital solutions; these often require changes in the way people work, as well as changing organisational processes and roles, and changing business models. Innovative technologies must be applicable to the problems an organisation faces; this must also include taking into account the organisation's values and experiences in order for DT to be successful [11].

Leadership ability and organisational agility significantly influence DT, while digital transformational leadership also affects organisational agility. Leadership needs to be developed in every organisation. Similarly, successful DT involves digital strategies that guide the efforts of leaders in generating new value propositions, and combining enterprise capabilities with technologies, such as, social media, machine learning, digital twin, AI and IoT. Those heading up organisations, especially managers involved in DT, can ask their staff to participate in meetings on strategic information technology (IT) issues. Thus, DT can be seen as a digital orchestra and a HEI leader as the conductor [12].

DT experts have identified key leadership qualities in dealing with emerging leadership challenges in the digital age. Leaders must be oriented to task achievement as pioneers of digitisation; they must be innovators, managers, and people-oriented in order to be enablers, mentors and networkers. Thus, the role of digital pioneers and mentors has the strongest relationship with DT and people orientation. The challenges and difficulties of implementing DT are often the result of employee resistance. This resistance could be related to habits, fear of the unknown, fear of losing one's job, seeing only adverse outcomes related to transformation or a low tolerance for change. Therefore, leaders conducting introductory and explanatory meetings play an important role in creating digital culture in organisations.

Besides the important role that leadership plays in DT, culture also has an important role in the success of DT, according to Tuukkanen [13]. Based on a Boston Consulting Group (BCG) study, organisations that utilise culture in DT are five times more likely to succeed than organisations that dismiss the impact of culture [14]. Digital culture should be seen as a new form of culture, where the use of digital technology has become a lifestyle and long-lasting habit. To ensure the success of DT, leadership must require commitment from the organisation in implementing DT, especially regarding the availability of resources, such as funds, policies and human resources [8].

Maturity Model

Methods are needed to support HEIs in starting and accelerating their digital transformation journey. The *maturity model* (MM) can be considered as the first step in digital transformation. The main purpose of the MM is to provide an evaluation of an HEI from the perspective of digital transformation readiness in terms of digital culture, digital leaders and organisational commitment.

Table 1: Maturity levels of DT readiness.

Level	Characteristics
Absence	Management is sceptical of the business value of using digital technology. There is no digital culture as yet. There is no commitment or support for the DT process.
Ad hoc	Management begins to develop a digital vision. Commitment and support from leadership for the DT process is starting to take shape.
Existence	Management is starting to take active steps to build a digital culture, but initiatives are still fragmented by the department. There is support and commitment from the leadership for the DT process but it is still limited.
Mature	Strong in digital vision. Digital culture exists in every department. Digital initiatives are well-coordinated. Support and commitment from all stakeholders for the DT process is very high.

Transformed	Transformation has become an actual component of corporate culture. All activities are coordinated, automated and efficient. Digital culture is very strong and there is good governance. The organisation continues to increase the competitive advantage they have obtained from implementing DT.

The basic concept of the MM is to guide decision-makers in attaining the appropriate level of digital transformation maturity for the specified dimensions. A maturity model was designed using perspective levels to measure maturity in digital transformation readiness. The maturity model referred to is the capability maturity model (CMM), which is the best model for measuring organisational maturity, as it is able to check whether the measured indicators have been implemented. Models such as CMM utilise a Likert questionnaire to assess maturity [15].

The terms, *readiness* and *maturity*, are both relative and interconnected. The term *DT readiness* has been defined in this study as the maturity of digital HEI transformation readiness. Table 1 above contains the maturity levels of DT readiness.

RESEARCH METHODOLOGY

For this study, the authors have designed a questionnaire for measuring digital transformation readiness and maturity level with the help of specialists from the Bandung Institute of Technology's Smart City and Community Innovation Centre, both in Indonesia. The conversation took place digitally via a Zoom on-line meeting that took around 15 minutes and was used to clarify the questioner and maturity level proposed.

A descriptive approach has been taken to determine the HEI level of readiness for DT. A self-evaluation research survey was conducted through Web sites that are accessed by each HEI. The questionnaire consisted of 11 multiple choice questions. The collected data was used to assess the readiness of DT (digital culture, digital leadership, resource and commitment) of each participating HEI.

All questionnaire items satisfied the specified measuring standards. Cronbach's alpha was used to assess the reliability of the tools used. Based on the collected data the resultant score was 0.823, which means the tool has a high level of reliability as it exceeded the value of 0.8, which is regarded as acceptable [16]. The Pearson product-moment correlation coefficient was used to test the validity of the data. The criteria that determine the questions in the questionnaire are valid if the sig (p-value) < 0.05 and the value of r count $\geq$ r table. In this study, r count was larger than r table, so it can be concluded that all the questions and the data were valid.

A self-evaluation research survey of 36 HEIs in Indonesia was conducted from October 2021 to February 2022. The 36 Indonesian HEIs selected were separated into private or state HEIs. Samples of universities, institutes, colleges and polytechnic schools were taken and a total of 24,893 respondents were selected from among the 36 HEIs. The results of the questionnaire were validated by random interviews of campus and community administrators.

FINDINGS

As mentioned previously, the research question posed in this study was: What is the maturity level of DT readiness of an Indonesian HEI in terms of digital culture, digital leaders and resources and commitment from the organisation?

Table 2 shows the readiness level for DT of 36 HEIs in Indonesia. To understand the digital culture readiness of an HEI, respondents were asked to score several aspects of their organisation, such as digitalisation goals, management structure, work styles, levels of agility, decision-making strategies and work ethic while transitioning from traditional culture to digital culture. The results of the questionnaire showed that most HEIs were at level 4, which can be described as *mature* since the HEIs at this stage have a digital vision and digital culture is already existent in each department. Those HEIs have also made innovations in terms of policies and changes in their work operations in light of the Covid-19 pandemic. Policy changes have also been made regarding incentives and work key performance indicator (KPIs) of employees in regard to digital culture so that digitalisation has become the culture and lifestyle of all staff, lecturers and students.

To assess a leader's readiness for DT, respondents were asked to rate how HEI leaders communicate with staff. The questions that were asked included: Has there been collaboration between units in solving problems? Does the leader of the HEI promote DT at regular meetings, and is there any socialisation related to DT in the HEI? Based on the results of the questionnaire, it was found that most HEIs were still at level 3. At this level, leadership support of DT is still limited. Numerous leaders at this level tend to be comfortable with existing conditions and do not want to change. As a result, the HEIs must seek executives with transformational leadership qualities in order to digitally alter their operations and remain relevant in the marketplace and meet the demands of their community. Transformational leadership can have a far-reaching impact on boosting a company's organisational agility since it can help a business change quickly to meet the demands of DT.

To assess the maturity level of the HEI commitment in providing resources for DT, respondents were asked to rate the level of change in the organisational structure to accommodate digital strategy in adapting to change. Those in leadership were asked whether there was a budget increase to accommodate investment in digital equipment and

the implementation of DT, as well as whether digitisation was part of the HEI's long-term plans? Based on the results of the questionnaire, it was found that half of the HEIs assessed were at level 3. This level indicates that the organisation's support for DT is good. However, in times of financial crisis, organisational investment in digital equipment loses its priority because the tendency is to focus on daily operational funds. HEIs that have large student bodies and adequate funding, tend to make greater investments related to digitalisation and DT to improve consumer experience.

Table 2: Measurement results of DT readiness of HEIs in Indonesia.

No	Campus name	Digital culture	Digital leadership	Resource and commitment	Digital transformation maturity level
1	Private A University Jakarta	4.33	3.1	3.00	Existence
2	Private B University Jakarta	4.34	3.66	3.69	Existence
3	Private C University Jakarta	4.55	4.45	4.64	Mature
4	Private D University Riau	4.15	3.39	3.76	Existence
5	Private E University Bandung	4.09	3.37	3.78	Existence
6	Public A University Bandung	3.96	3.42	3.66	Existence
7	Private F University Jakarta	4.69	4.31	4.59	Mature
8	Public B Institute Surabaya	4.22	3.83	4.08	Mature
9	Private G University Surabaya	4.35	3.67	4.1	Mature
10	Private H Polytechnic Riau	4.41	4.15	4.41	Mature
11	Private I University Medan	4.3	3.56	4.18	Mature
12	Private J Institute Garut	4.2	3.53	3.7	Existence
13	Public C University Bandung	4.12	3.36	3.74	Existence
14	Private K University Jakarta	4.2	3.53	3.7	Existence
15	Private L University Bandung	4.24	3.26	3.5	Existence
16	Public D University Padang	4.36	3.91	4.4	Mature
17	Private M University Medan	4.29	3.82	4.13	Mature
18	Public E Institute Bogor	4.2	3.75	4.06	Mature
19	Private N University Jogjakarta	4.18	3.53	4.21	Existence
20	Public F University Medan	4.07	3.65	3.82	Existence
21	Public G Polytechnic Semarang	4.07	3.56	3.12	Existence
22	Public H Institute Bandung	4.21	3.65	3.44	Existence
23	Public I University Jember	4.17	3.61	4.14	Existence
24	Private O University Jogjakarta	4.23	3.47	3.9	Existence
25	Private P Institute Jakarta	4.58	4.15	4.12	Mature
26	Private Q University Jakarta	4.09	3.42	3.92	Existence
27	Public J University Semarang	4.22	3.76	3.87	Existence
28	Private R University Bandung	4.28	3.18	2.84	Existence
29	Private S Institute Bogor	2.88	3.26	3.75	Existence
30	Private T University Bandung	4.59	4.44	4.67	Mature
31	Private U University Jogjakarta	4.31	3.73	4.15	Mature
32	Private V University Tegal	4.21	3.93	3.89	Mature
33	Private W Polytechnic Salatiga	4.4	3.25	3.42	Existence
34	Private X Institute Majalengka	3.39	2.23	1.16	*Ad hoc*
35	Public K University Ambon	4.2	3.5	4.2	Existence
36	Private Y Institute Indramayu	4.27	3.69	3.62	Existence

EVALUATION OF FINDING

To test the research question, a survey was used to collect data from leaders of HEIs. The questionnaire was filled in by the HEIs representatives can be seen in Figure 1. The following questions were asked:

- Q1: Are the results of the digital transformation readiness level assessment for your HEI in accordance with the HEI's current real conditions?
- Q2: Will the results of this study help institutions to know the condition of DT readiness, so that they can develop the appropriate strategy for carrying out digital transformation?

Table 3: Survey results.

No	Question	Score (Yes)	Score (No)
1	Q1	25 (70%)	0 (0%)
2	Q2	25 (70%)	0 (0%)

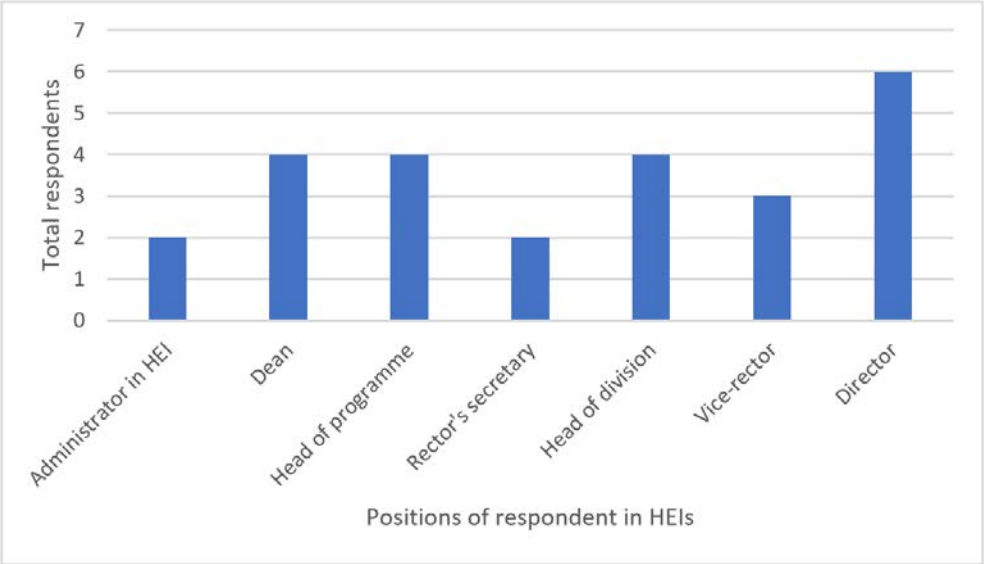

Figure 1: Total respondents per positions.

From the 36 HEIs that took part in this study, 25 HEIs (70%) provided feedback by filling out the questionnaires and stated that the results of the assessment of the DT readiness level of HEIs were in accordance with their institution's current conditions and that the results of this study helped HEIs in formulating DT strategies.

CONCLUSIONS

For this study, a tool has been developed that can measure the DT readiness of HEIs. From the literature review, it can be seen that the main factors influencing the success of digital transformation, as discussed by previous researchers, are digital culture, digital leadership and organisational commitment to provide sufficient resources for DT.

Based on descriptive research, the findings of this study indicate the HEI DT readiness level in Indonesia is still at the *existence* level. At this level, the digital vision of the HEI already exists; and the HEI management has begun to take active steps to build digital skills and culture; however, the DT initiative has not been integrated into all departments and still depends on the individual leadership of each department. Leadership support and commitment towards DT is still limited to the individual leader's knowledge of DT.

This article may contribute to the body of knowledge about DT in the field of HEIs as the measurement tool developed successfully estimated the maturity level of HEI DT readiness in Indonesia. Although this research was conducted in the context of HEIs in Indonesia, this measurement tool can be used for HEIs in other countries as well because all HEIs worldwide face the same digitalisation challenges.

The limitation of this research is apparent in that the HEI samples could be increased to determine the average maturity level of digital transformation readiness of HEIs throughout Indonesia.

REFERENCES

1. Rauzana, A. and Dharma, W., The effectiveness of on-line learning at an Indonesian university during the Covid-19 pandemic: students' perspectives. *World Trans. on Engng. and Technol. Educ.*, 20, **1**, 71-75 (2022).
2. Jasiołek, A., Nowak, P. and Brzezicki, M., On-line, face-to-face or hybrid teaching in architectural education? *World Trans. on Engng. and Technol. Educ.*, 19, **1**, 90-95 (2021).
3. Moreira, F. and Rocha, Á., A special issue on digital transformation: a new challenge for education and training. *Telemat. Informatics*, 38, 59-61 (2019).
4. Limani, Y., Hajrizi, E., Stapleton, L. and Retkoceri, M., Digital transformation readiness in higher education institutions (HEI): the case of Kosovo. *IFAC-Papers OnLine*, 52, **25**, 52-57 (2019).
5. Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Burton, R., Magni, P.A. and Lam, S., COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *J. of Applied Learning and Teaching*, 3, **1**, 1-20 (2020).

6. Bygstad, B., Øvrelid, E., Ludvigsen, S. and Dæhlen, M., From dual digitalization to digital learning space: Exploring the digital transformation of higher education, *Computers & Educ.*, 182, **2** (2022).
7. Núñez-Canal, M., de Obesso, de las M. and Pérez-Rivero, C.A., New challenges in higher education: a study of the digital competence of educators in Covid times. *Technological Forecasting and Social Change*, Elsevier, 174 (2021).
8. Alnuaimi, B.K., Kumar, S., Ren, S. and Budhwar, P., Mastering digital transformation: the nexus between leadership, agility, and digital strategy. *J. of Business. Research*, 145, 636-648 (2022).
9. Bican, P.M. and Brem, A., Digital business model, digital transformation, digital entrepreneurship: is there a sustainable *digital? Sustainability*, 12, **13**, 1-15 (2020).
10. Kraus, S., Durst, S., Ferreira, J.J., Veiga, P., Kailer, N. and Weinmann, A., Digital transformation in business and management research: an overview of the current status quo. *Inter. J. of Infor. Manage.*, 63 (2021).
11. Cavalcanti, D.R., Oliveira, T. and de Oliveira Santini, F., Drivers of digital transformation adoption: a weight and meta-analysis. *Heliyon*, 8, **2**, 1-17 (2022).
12. Porfírio, J.A., Carrilho, T., Felício, J.A. and Jardim, J., Leadership characteristics and digital transformation. *J. of Business Research*, 124, 610-619 (2021).
13. Tuukkanen, V., Wolgsjö, E. and Rusu, L., Cultural values in digital transformation in a small company. *Procedia Comput. Science*, 196, 3-12 (2022).
14 Boston Consulting Group, How to Drive a Digital Transformation: Culture Is Key (2022), 01 April 2022, https://www.bcg.com/capabilities/digital-technology-data/digital-transformation/how-to-drive-digital-culture.
15. De Carolis, A., Macchi, M., Kulvatunyou, B., Brundage, M. and Terzi, S., Maturity models and tools for enabling smart manufacturing systems: comparison and reflections for future developments. *Proc. 14th IFIP Inter. Conf. on Product Lifecycle Manage.*, Seville, Spain, 517, 23-35 (2017).
16. Allen, I.E. and Seaman, C.A., Likert scales and data analyses. *Qual. Prog.*, 40, **7**, 64-65, (2007).