

## DIGITAL TRANSFORMATION AND HUMAN RESOURCES READINESS: A STRATEGIC CONCEPT HIGHER EDUCATION VALUE

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**Abstract:** The readiness and availability of superior Human Resources (HR) is an important aspect in accelerating development. As an effort to improve the quality of human resources, universities need to be encouraged to prepare an ecosystem that is relevant to the times. In order to be able to play a role in the industrial revolution 4.0, it is necessary to prioritize efficient technology and increase human resource competencies in accordance with the needs in the industrial era 4.0. The availability of technology, support for competent human resources in models and designs within the framework of the technology ecosystem are important and are challenges as well as opportunities for universities to reach the level of the industrial revolution 4.0. The readiness of universities to respond to changes can increase competitiveness so that they can play a role and benefit from the industrial revolution 4.0. This article proposes an approach based on the assessment of the digital transformation readiness of higher education institutions on the following aspects: 1) assessment of higher education architecture; 2) information and technology infrastructure; 3) process management; 4) the potential of human resources; and 5) financial instruments

**Keywords:** *industrial revolution, digital transformation, readiness assessment, universities*

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### 1. Introduction

Currently all countries, including Indonesia, are facing the era of the industrial revolution 4.0, where the development of technology and communication is becoming increasingly global. Indonesia's readiness to enter the era of the industrial revolution 4.0 is very dependent on the ability of human resources in terms of mastering and utilizing science, technology and innovation. Innovation is the key in managing the transformation process of Indonesia's economic structure towards a technology-based industry. To support readiness to enter the era of the industrial revolution 4.0, higher education policies must be designed quickly, precisely and in accordance with global developments. Higher education must actively adapt, have innovative ideas to take advantage of opportunities and face the challenges of the industrial revolution 4.0. Nationally, In order to prepare superior human resources, President Joko Widodo has launched the Making Indonesia 4.0 roadmap strategy. In the implementation of the Making Indonesia 4.0 roadmap strategy, university synergy is needed (Kemenperin\_ Making Indonesia 4, (n.d.)).

Digital technology in universities does not stand alone. This process depends on digital literacy, professionalism in the classroom or workspace, and recognition of the value of challenges. In the coming years, the use of new technologies is inevitable and necessary (Limani et al., 2019). The process of digital transformation in higher education institutions in the industrial revolution 4.0 has raised important challenges in how digital universities (university 4.0) are deployed effectively. Lack of a clear understanding of digital transformation will hinder the ability to compete and will ultimately affect the organization's business continuity (Sanchez & Zuntini, 2018). This article proposes an approach based on assessing the digital transformation readiness of higher education institutions in the following 4 areas: 1) assessment of enterprise architecture and process management; 2) information and technology infrastructure; 3) the potential of human resources; and 4) financial instruments.

## **2. Literature Review**

### **2.1. Industrial Revolution (Knowing More about the Industrial Revolution 4.0)**

The Industrial Revolution 4.0 was initiated by a group of representatives from various fields from Germany in 2011 at the Hannover Trade fair. Then in 2015, German Chancellor Angela Merkel introduced the idea of the Industrial Revolution 4.0 at the World Economic Forum (WEF). Germany has disbursed €200 million to support academia, government and business to conduct cross-academic research on the Industrial Revolution 4.0. In addition to Germany, the United States is also driving the Smart Manufacturing Leadership Coalition (SMLC), a non-profit organization consisting of manufacturers, suppliers, technology companies, government agencies, universities and laboratories that has the goal of advancing ways of thinking in the era of the Industrial Revolution 4.0.

The industrial revolution 4.0 is a concept that applies the concept of machine automation, requiring very minimal human power. Machine automation is an important thing that can help the industrial world in terms of time efficiency, human labour and costs. Factories/industries that have implemented the industrial revolution are known as smart factories. In addition, by using the internet network, currently data retrieval or exchange can be done on time when needed. Work, production processes and financial records can be carried out more easily by interested parties at anytime and anywhere as long as the internet is connected. Innovations in the industrial revolution 4.0 include the Internet of Things (IoT), big data, 3-dimensional printing, Artificial Intelligence (AI), driverless vehicles, genetic engineering.

*Internet of Things (IoT)* has the ability to connect and facilitate the communication process between machines, sensors and humans via the internet. If in the previous era we transferred money through ATM machines or bank tellers, now we can transfer money anywhere, from anywhere, anywhere and anytime as long as we are connected to the internet network. Through applications on gadgets and internet network connections, we can monitor financial activities anywhere, from anywhere and anytime.

*Big data* is the storage of all data in cloud computing. Through big data analysis and cloud computing, it helps early detection of production defects so as to prevent production failures, increase productivity and product quality based on recorded data. Increased productivity is possible because of big data analysis with the 6 C system, namely connection, cyber, content/context, community, and customization. The 6 C system is able to provide benefits for factory/industrial management. Data is processed by sophisticated methods (analytics and algorithms) to produce logical information. The processed data can also help with visible or invisible problems in factories/industries. The information algorithm must be

able to detect unseen problems such as engine degradation or component wear. Indonesia is currently starting to work on the concept of the industrial revolution 4.0 seriously. Through the Ministry of Industry, a roadmap for Making Indonesia 4.0 was created.

## 2.2. Digital Transformation

Digital transformation is emerging as an interesting topic and this is reflected in the abundance of research papers and empirical works. These works show that digital transformation is the basis of organizational strategy. Digital transformation represents a deep transformation of business activities and processes; and process organization; competencies and models to capitalize on differences and opportunities incorporating digital technologies and accelerating their impact across society in strategic ways and changing priorities now and in the future. Digital transformation efforts and strategies are often more urgent and present in highly commodified markets. The digital transformation strategy aims to create the ability to take advantage of new technologies and their impact quickly and innovatively in the future (Bones in (Limani et al., 2019)). The digital transformation process requires an organized approach, strong planning, and the involvement of all stakeholders. There are several reasons companies undergo digital transformation. The main reasons are related to the problems of competitive advantage and survival. The digital transformation of an organization is an objective process capable of responding to environmental changes (Limani et al., 2019). The dimensions, issues and implications of digital transformation for managers are presented in table 1 below:

**Table 1. Digital Transformation: Dimensions, Issues and Implications for Managers**

| <b>Dimension</b>                                    | <b>Strategy, Organization, Business Model</b>                                                                                                                                                   | <b>Main Topic</b>                                 |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Digitalization strategy goals                       | <ul style="list-style-type: none"> <li>• Which analytical method to choose in the company?</li> <li>• What are the spaces for development and value creation?</li> </ul>                        | Define and analyze value creation                 |
| Level of digitization strategy                      | <ul style="list-style-type: none"> <li>• What is the relative importance of the platform?</li> <li>• What kind of typology?</li> <li>• Which governance structures drive innovation?</li> </ul> | Define and analyze ideas to create new platforms  |
| Speed of digitization strategy                      | How to define an innovative offer                                                                                                                                                               | Fast and systematic analysis of phenomena         |
| Source of value, creation based on digital strategy | What are the sources of value creation in the digital space?                                                                                                                                    | Determine the proposed value in the digital space |

Source: Bounfour in (Limani et al., 2019)

## 2.3. Overview of Digital Transformation in Higher Education

One of the conditions for the success of a digital transformation program can be seen from the level of cloud adoption. Indonesia is considered as a country in the early stages of adopting cloud computing technology. The industrial sector and government institutions have adopted cloud computing technology a lot. On the other hand, universities have not been optimal in utilizing cloud computing technology, even though they already know the

potential benefits of cloud computing. With the development of cloud computing technology and services, universities must be ready to take advantage of this technology. Studies related to cloud computing service readiness state that the factors that influence the readiness to adopt cloud computing in universities are the availability of IT infrastructure and good IT planning. By adopting cloud computing, (Soni Fajar Surya & Nugroho, 2018). The trend or trend of digitalization development in higher education is as shown in table 2 below:

**Table 2. Digital Education- trends and examples of development**

| <b>Education service category</b> | <b>Examples of new digital trends</b>                                                                                                                                                                                                                                                                                              |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Administration                    | applications for registration, registration for examinations, creation of grade mirrors, class schedules, literature downloads - increasingly being digitized as part of e-government programs and student requirements                                                                                                            |
| Communication                     | Communication between lecturers, students, and others is also a field with a high level of digitization. With collaborative platforms that are collaboratively accessible, colleges can save time and provide easier and more flexible online communication - provided students are prepared and have sufficient skills and access |
| Teaching and preparing lessons    | With the continuous development and growth of digitization, the replacement of traditional literature, books and prints with online learning resources, as well as the organization and preparation for the exchange of knowledge and practice are also being replaced.                                                            |
| Learn how to teach                | Traditional direct interactions between professors and students are developing slowly, while online forms of learning and learning are emerging                                                                                                                                                                                    |
| Reviews and Exams                 | Reviewing letters, tests, and exams is also part of class time. This area is currently being digitized, although the market appears to be rooted in the digitization of teaching materials and teaching in general                                                                                                                 |

Source: OECD in (Limani et al., 2019)

In Vietnam, the government and the ministry of education and training embarked on a plan to turn a top university into a digital university. A survey-based quantitative study for digital university readiness was conducted among students and staff of Hanoi University of Science and Technology, Vietnam.(Giang et al., 2021)Analyzing the characteristics of the digital university model to identify the criteria for assessing the availability of the digital transformation process. This study contributes to a better understanding of the four basic aspects of a digital university: Educational Program, Learners, Training Services, and Governance. The results of the study introduce a digital transformation readiness framework as a reference for other higher education institutions. In addition, the trend of digital transformation is indispensable for universities in Vietnam, contributing to improving the quality of higher education and international integration in the context of the industrial revolution 4.0.

(Clavert, 2017), 21st century skills often involve competencies linked to learning and innovation, digital literacy and career and life. Changes in the world of work and facing the challenges of work in the future are unknown, it is important to identify the skills students need regardless of discipline or field of work. In addition to technical skills about technology,

it takes people who are able to make the right decisions. As digitization, robotization, artificial intelligence and the internet industry enhance immaterial work, the ability to share ideas and think critically is required. Two approaches that the education system can use towards the industrial revolution 4.0 are: educating students as followers; or as a change maker. Followers have the skills to react to changes in their work environment, adapt their performance, and learn to cope with technological developments. Educational institutions must work closely with industry, government agencies and student/alumni organizations to keep abreast of developments in the needs of competencies and skills needed to create change.

(Duc et al., 2020) developing a conceptual model of a smart university has generalized as a digital transformation-oriented higher education institution using digital infrastructure (digital law, digital human resources, digital data, digital technology and digital applications) to provide personalized learning services for students of all generations in the world. countries and around the world. It meets the requirements of individual and country lifelong learning and sustainable development. Smart universities are described through the V-SMARTH model, which consists of 6 basic components of digital resources: open access learning materials, virtual learning environments, individual education, interactive learning and digital platforms. These elements are united in the three pillars of digitization, the digital learning model.

(Sánchez, 2017) conducting studies related to organizational readiness for digital transformation emphasizes the importance of a clear strategy and leadership. All sustainable transformation processes must rest on an orderly and solid organization that helps sustain any initiative. The absence of a digital leader hinders digital maturity and this can result in lost opportunities and inefficiencies. Failing to adopt emerging technologies can put organizations at risk of not meeting stakeholder expectations and wasting public budgets.

(Dolganova, 2020), assessing the readiness of universities for digital transformation in four aspects: organizational architecture, process management, human resources, and financing tools. Since each of these areas has its own characteristics, the assessment is carried out using different methods and approaches: TOGAF, CMMI, BPMM, PCF APQC and others. In order to enable analysis, evaluation and monitoring of changes in the level of digital transformation readiness, as well as to facilitate the analysis of available information for each research area or the university as a whole, it is proposed to use the dashboard method.

### **3. Results and Discussion**

#### **Multi-Criteria Assessment Of Readiness For Digital Transformation**

Within the framework to prepare an ecosystem that is relevant to digital transformation, the author tries to adopt the developed multi-criteria assessment of university readiness for digital transformation (Dolganova, 2020) on assessing the readiness of educational institutions for digital transformation. It is proposed to evaluate the maturity level of the organization's architecture using the Capability Maturity Model (CMMI) which is adapted to the university's specifications. Namely on the aspects of: 1) the assessment of higher education architecture; 2) information and technology infrastructure; 3) process management; 4) the potential of human resources; and 5) financial instruments. To assess the maturity level of process management, the Business Process Maturity Model (BPMM) methodology is recommended.

##### *a) Assessment of the readiness of university architecture for digital transformation*

The assessment is carried out by means of a step-by-step analysis of the suitability of the existing organizational architecture with criteria such as:

- a. Correlation with university mission
- b. Administrative involvement in the architectural development process
- c. Business unit participation
- d. Description of the architectural development process itself
- e. Standard profile development
- f. Distribution of architectural descriptions for introduction between organizational units
- g. Standard implementation control
- h. Architecture development project management
- i. Availability of enterprise architecture at the scale of educational organizations
- j. Coordination and organization of financing for IT infrastructure development

The requirements for university internal IT competence can be distinguished as follows:

- a. Ability to assess university needs in supporting IT activities and quickly respond to changing needs
- b. Using IT to ensure the effective functioning of business units
- c. Ensuring the integration of new technologies into the company's existing IT infrastructure
- d. Manage the implementation of digital transformation in areas related to changes in IT infrastructure and services
- e. Finding optimal ways to implement digital transformation, taking into account information and data security requirements, as well as target indicators of transformation efficiency

To assess the organization of IT activities, an expert assessment method is recommended. It is proposed to use the following main criteria:

- a. IT budgeting is flexible, there is a possibility to change priorities
  - b. Marketing and information technologies are consolidated to create a single roadmap for digital transformation
  - c. Implement a flexible iterative approach to the development and implementation of new IT solutions
  - d. Applying the type of modern architecture
  - e. The results of activities carried out by business units using appropriate IT solutions are considered when evaluating IT department activities
  - f. The data obtained about customer experience (internal and external) is used to improve information and technology support for university activities and their interactions in the external environment
  - g. Digital tools are widely used to ensure collaboration, interaction with students and potential customers, as well as to ensure the mobility of all participants in the organization and implementation of the educational process
- b) Assessment of the readiness of university's IT infrastructure for digital transformation*
- Higher education information technology architecture that prefers to follow the digital transformation method, fulfills the following requirements:
- a. Use of ERP and CRM systems
  - b. Use of integrated solutions for planning and managing the educational process
  - c. Absence of isolated (local) technology solutions
  - d. Provides access to corporate networks and the internet throughout the college

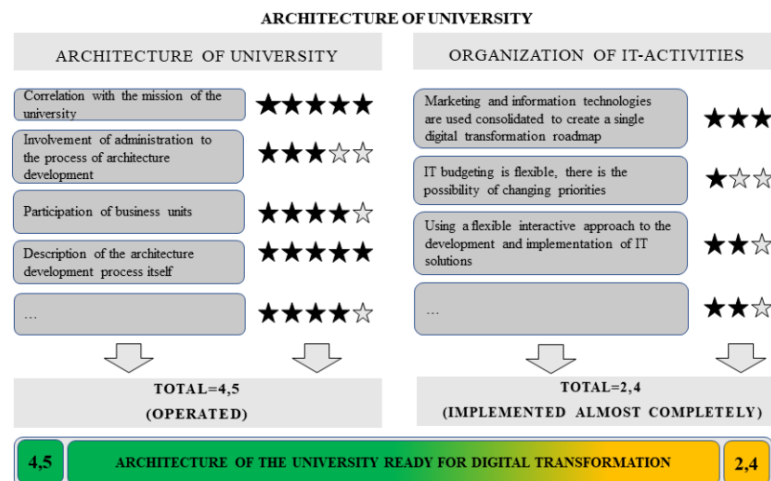


- e. Remote access to university IT resources; use of cloud computing and peripherals, if more effective than common
- f. Information security
- g. The decision to introduce information technology is taken depending on the real needs of the college
- c) *Assessment of the readiness of the university process management for digital transformation*
  - a. How is process management implemented and improved at the organizational level?
  - b. How is the implementation of strategic and tactical management?
  - c. How are key processes managed?
  - d. How are key processes implemented?
  - e. How is the support process implemented?
- d) *Assessment of the competence of university staff to digital transformation*
  - a. competency assessment: knowledge, practical skills
  - b. performance evaluation: comparison between planned and completed tasks
- e) *Evaluating the effectiveness of application of the university financial instruments when implementing the digital transformation*

An educational institution is considered ready for digital transformation in terms of the effectiveness of using financial instruments if more than 50% of the following criteria meet generally accepted standards: assessment of investment costs, allocation of funds by project stage, allocation of budget and off-budget funds, term of payment, timeliness and completeness of financing, refund mechanism, project financial risk, profitability.
- f) *Dashboard for visualizing the results of assessing the readiness of a university for digital transformation*

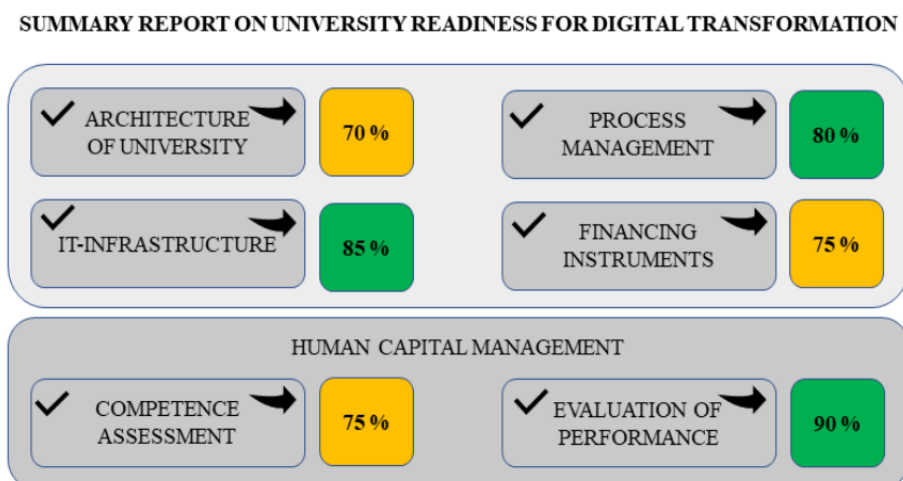
It is proposed to use the dashboard as a tool to visualize the results of assessing the current readiness of universities for digital transformation, as well as to plan and formulate targets. This dashboard structure can be represented in the form of 5 tabs: organizational architecture, IT infrastructure, process management, digital competencies, financing tools. A separate tab provides a summary of the college's readiness for digital transformation. Each tab can contain subsections and detailed information, its own tab, which allows studying in more detail the problem area for each aspect and criterion investigated.

Each tab shows the results of the evaluation of each aspect studied according to predetermined criteria. The results and level of readiness for digital transformation of the studied elements are also shown. The results of the analysis are displayed on the dashboard in a visualized form, where the points earned and the corresponding maturity level in two directions are displayed. After summarizing the results, the system formulates a conclusion whether the enterprise architecture is ready for digital transformation or not.



**Figure 3.1. College Architecture Dashboard**  
Source: (Limani et al., 2019)

In the summary report on the dashboard (figure 2), closing information about the readiness of universities for digital transformation is represented in the research area. This allows getting an overview of the potential of higher education architectures and process management, information and technology infrastructure, human resources and financial instruments, their readiness for digital transformation, to solutions to new strategic problems and prospects for further development.



**Figure 3.2. Dashboard summary information**  
Source: (Limani et al., 2019)

#### 4. Conclusion

This article provides recommendations on a complex assessment of the readiness of higher education institutions for digital transformation. It is proposed to evaluate the maturity level of the organization's architecture using the Capability Maturity Model (CMMI) which is adapted to the university's specifications. It is determined that for a successful digital transformation, the architecture must have a maturity level of at least 3. To assess the maturity level of process management, a methodology is recommended *Business Process*



*Maturity Model* (BPMM). If the process management organization is at least compliant with maturity level 3, then it can be concluded that process management will not be an obstacle to the effective implementation of digital transformation. In the human resource assessment guidelines, it is proposed to analyze the competencies of the main employees of higher education institutions, mainly relying on digital knowledge and skills. Criteria are formulated to determine how efficiently existing methods, approaches and tools are used to support digital transformation finance. This framework is intended to be a starting point and will be adapted in its implementation.

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