Digitalisation trend in education during industry 4.0

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Abstract. This study synthesizes the findings of a study of the trend of digitalization of the education world in the face of the industrial revolution 4.0. The researched journal starts from 2015 to 2019. This paper focuses on the challenges and opportunities of industry 4.0, the development of industry 4.0 is characterized by the development of big data and artificial intelligence. Skills needed in this era or called big data and artificial intelligence, including advanced analytics, Internet of Things, and digital security. All fields of both education and industry in the world will be affected by the development of industrial revolution 4.0, a new pattern when disruptive technology is present so quickly that all circles especially education must be able to immediately adjust to industrial development 4.0. Therefore, the world of education and industry must be able to develop industrial transformation strategies by considering the human resources sector that has competence in their field. This is a challenge for the world of education in preparing the quality of human resources in order to adapt to industry 4.0. From several studies that have been carried out the trend of digitalization in the world of education as one of the dominant solutions carried out in the face of the industrial revolution 4.0, this is in line with the new pattern found in industry 4.0 namely disruptive technology.

1. Introduction

Today the fourth wave of revolution is in the midst of life, marked by a wave of sophisticated technology and the emergence of various digital industries through the transformation of 9 pillars of advanced technology [1,2]. The challenges of knowledge and competencies that are closely related to the era of disruption and industrial revolution 4.0 require a new strategy to prepare Human Resources (HR) that can compete and meet various needs that continue to evolve [3,4]. The industrial revolution 4.0 will direct a substantial reduction in various low skills based on applicable standards in the world of work and increase in high-skill activities, including planning, control and tasks related to Information Technology (IT) [2,5,6] This is also reinforced by various 4.0 technologies that are used in the industry to increase the productivity and effectiveness of the production process [7].

In addition, this 4.0 industrial revolution will show the dependence of industry and work environment on Cyber Physical System (CPS) and its implementation in the smart factory [1]. Various aspects including the most important competency skills will be affected by the industrial revolution 4.0 which is accompanied by a very rapid disruption phenomenon [8]. Workers in the future will be highly
demanded to have a high level of skill and skill in the use of various CPS-based technological advances that are clearly very different from the current industry conditions [9-11].

Various skills competencies in vocational secondary education must begin to think of new strategies in the intense competition between robots and humans, such as human-machine cooperation which will be widely used by smart factories [12,13]. Then it is necessary to pay attention to the various competencies prepared by the vocational school to produce graduates who can compete and pay attention to the competence relevance of expertise with dynamic and rapid industrial development conditions based on industrial needs in the middle of the industrial revolution era 4.0 as well as various challenges and shifts that occur in this disruption phenomenon.

This study aims to examine the trend of digitalization in the world of education as one of the dominant solutions carried out in the face of the industrial revolution 4.0, this is in line with the new pattern found in industry 4.0, namely disruptive technology (disruptive technology). Educators and researchers can use this information to identify unanswered issues or questions in the literature and define the direction of future research on the trend of digitalization in the world of education in the face of the industrial 4.0.

2. Methods

Literature review was identified by following the Web of Science database, followed by Scopus by including the keywords "trend digitalization" and "industry 4.0." As a result, 40 articles in the last 5 years with vulnerable time between 2015 and 2019. Of the 40 articles obtained then read, analyzed and coded using a spreadsheet program.

2.1. Encoding schemes

The coding scheme was adapted from a structured/systemic approach to literature review. The approach uses four main categories in analyzing articles, namely the following:

- Basic data: author, year of publication, journal, place of study
- Research methods: research approaches, methods, themes, data collection, methods of analysis, research results
- Content analysis: trend digitalization, technology, industry 4.0, the content area and pathway designed (i.e. how researchers/educators prepare education for students in the face of industry 4.0)
- Discussion: issues discussed, future instructions, personal comments

| Basic Data | Research Methods | Analysis of Content | Discussion |
|------------|------------------|---------------------|------------|
| Consequences of Industry 4.0 on the Human Labour and Work Organization Linda Bonekamp & Matthias Sure 2015 | Literature review | Literature review on recent research analysis of the implications of industry 4.0 and cyber physical systems on | The main findings indicate that Industry 4.0 would lead to substantial decreases in standardized low-skill and increase in high-skill activities, embracing planning, control and IT-related tasks. |

3. Literature review result

3.1. Industry 4.0

Industry 4.0 is the name of the latest automation and data exchange trends in factory technology. This term includes cyber-physical systems, the internet for everything, cloud computing, and cognitive computing [14]. Industry 4.0 can produce "smart factories" [15-17]. In smart factories that are structurally structured, cyber-physical systems oversee physical processes, create copies of the physical world virtually, and make decisions that are not centralized [18]. Through Internet of Things (IoT), cyber-physical systems communicate and cooperate with each other and humans together. Through
cloud computing, internal and cross-organization services are provided and utilized by various parties in the value chain [14,19].

Industry 4.0 in digital technology is a combination with other key technologies in changing how to design, produce, commercialize, and produce value from related products and services. Technological advancements such as Internet of Things (IoT), 5G, cloud computing, data analysis, and robotics change products, processes and business models in all sectors ultimately creating new industrial patterns as the global value chain shifts [20]. Industrial revolution 4.0 refers to systemic transformation that includes impacts on civil society, governance structures, and economic identity and manufacturing [21]. The first industrial revolution began with the mechanization of production using hydropower and steam; the second industrial revolution then introduced mass production with the help of electric power, followed by digital using electronics and information technology to automate further production [22]. The term "fourth industrial revolution" has been applied to significant technological developments for many years, and its meaning is based as material for academic debate [14]. The Industrial Revolution 4.0 has four design principles that are wholly interrelated between one another, namely: The ability of machines, devices, sensors, and people to connect and communicate with each other through the Internet of Things (IoT) or the Internet of People (IoP) [23].

![Figure 1. Design principles industry 4.0](image)

This principle requires collaboration, security, and standards. Transparency of information containing the information system's ability to create a virtual copy of the physical world with the digital factory model to enrich sensor data [24].

3.2. Impact and challenge

3.2.1. Impact. The basic principle of Revolution Industry 4.0 is connecting machines, workflows and systems, businesses applying intelligent networks along the chain to control each other independently [25]. An example of Industry 4.0 is a machine that can predict failures and trigger self-managed or self-regulated logistics processes that react to unexpected or unusual changes in operations. This example will show the rationalization of the driving forces behind Internet of Things [26]. But it also means that the complexity of internal operations and external supplier networks will grow very large. So far, networks and processes have been limited to one factory. However, in the Industrial 4.0 era, these individual factory boundaries are likely to be gone. On the contrary, the limit will collapse to connect several factories and cover a larger geographical area.

The key to success in modern industry is to provide high-quality, low-cost services or products, and industrial factories try to increase performance as much as possible to increase their profits and reputation [27]. As Industry 4.0 runs, traditional manufacturing business models change, and new models emerge. Thus, old players must quickly recognize and react to this new competitive challenge. In particular, executives must consider the following options - and supervise other people who might use them. Eighty-four percent of manufacturing suppliers surveyed expect new competitors to enter the
market soon [28]. "Platform," where products, services, and information can be exchanged through a predetermined stream. Consider open source software that is applied to the manufacturing context.

3.2.2. Challenge. It is very important to recognize and evaluate the impact of Industry 4.0, namely digitalization. This development involves major challenges in the company, education and politics. The most challenging aspect in implementing Industry 4.0 is information technology security risk [29]. Industry 4.0 will require online integration between several entities, and this online integration will provide space for security violations and data leaks. Cyber theft will be another danger as a threat, the problem is not individual, and this will substantially harm the producer and may even damage their reputation [21]. Therefore, security is a crucial problem that must be dealt with seriously. The transformation to Industry 4.0 will require a large investment in new technologies, and decisions for these transformations must be taken. Even so, risk must be taken into account and taken seriously [30].

Although it is still too early to speculate on employment issues with the advent of Industry 4.0, it is safe to accept that workers need to acquire different or completely new skills [31]. This can help work to have higher rates, but it will also alienate large sectors of workers. The sector of workers whose jobs may be repetitive and routine will face challenges that are difficult to maintain their jobs [11] [32].

3.3. Trend digitalization industry 4.0 in education

The industrial revolution 4.0 deals with the development of information and communication technology that brings the most profound changes in the world of education [33-35]. The application of information and communication technology, especially in the development of education, is now a must. The development of digital technology has triggered a shifting trend in the world of education from conventional (face-to-face) education to more open education [36]. In several countries in Asia, using "Flexible Learning", namely online education services [37]. A field of science that we call Educational Technology has increasingly played an important role in this era. This serves to help the learning process and improve performance by making, using, and managing adequate technological processes and resources. As well as creating an effective and efficient learning innovation [38].

The rapid use of digital technology in the world of education will be reflected in changes in the learning model, namely the growing growth of distance learning where educators and students do not need to be in the same place [39], and the increasing number of available learning resources such as electronic books (e-books), easy to access digital applications such as e-libraries, e-forums, e-journals and so on [40]. Technology has enabled the creation of a standardized global learning environment that places students in the middle of the learning process, surrounded by various learning resources and electronic learning services. For this reason, the conventional education system should show a friendly attitude with new ways of learning that are loaded with digitalization.

The number one priority in the current digital transformation process is to empower both academic and non-teacher staff to be given the best tools to engage students both inside and outside the classroom in the digital transformation process. However, only 39% of respondents think that their institution has interconnected technology that enables these employees to work off campus [41].

This is followed by involving students as part of the transformation process, where schools adopt digital technology, interactive and personal content, and prepare students with skills to succeed in today's dynamic work world. When asked about factors that hindered their digital transformation process, respondents highlighted the problem of cyber threats and security, lack of organizational leadership skills, and lack of skilled digital workforce, as the main barriers [41,42].

Educators clearly agree on the integral role that technology plays in improving pedagogy. This leads to the gap between recognizing the need for transformation, and the availability of clear strategies for moving forward. However, now is the time for educational institutions to turn their organizations into digital organizations, to remain relevant and ensure that students are ready to face the changing needs of future generations of work, especially in the face of industry 4.0.
4. Conclusion
Industrial revolution 4.0 into a challenge for all nations in preparing qualified human resources. Industrial revolution 4.0 is a challenge for all nations in preparing quality human resources. Digitalization and intelligence is the need to face the current industrial revolution 4.0. The Industrial Revolution 4.0 has changed the educational innovation landscape. In the field of education Industry 4.0 prepares graduates for more complex jobs, where smart robots will replace people in certain activities divisions, education must be utilized in information and capabilities that cannot be replaced by robots. Distortion in the industrial revolution 4.0 makes education focused on skills and advanced development, namely big data and artificial intelligence. The skills needed in this era are advanced analytics, Internet of Things, and digital security. The trend of digitalization in education is a solution in facing industry 4.0 challenges. Integration between education and technology can revolutionize the teaching and learning process. Even further, technology can improve the overall quality of education. Reliability, availability, and security of technology applications are the spearhead of the education digitalization process. Innovation and human resources are an integral part in realizing the process of digitizing the educational model.

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