

The Challenges of Industrial Revolution 4.0: An Evidence from Public Administration Ecology in Indonesia

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Abstract

As predicted by experts, RIN 4.0 will be an era that can determine an organisation's life and death, including government/state organisations. This research aims to determine the ecology of public administration in Indonesia in the face of the Industrial Revolution 4.0. the formulation of the problem raised in this paper is how the challenges of the Industrial Revolution Era 4.0 (RIN.4.0) and how the ecology of Indonesian Public Administration. The study's primary design is to present evidence and facts about public administration ecology in Indonesia, which are then analysed to obtain a comprehensive conclusion. The study found that the Challenges of the Industrial Revolution Era 4.0 (RIN.4.0) are about (1) the development of information technology and the increasingly critical demands of the public pushing for public administration reforms in all governance of public organisations. (2) the development of information technology and the public's increasingly critical demands encourage public administration reforms in all public organisation governance. (3) as the influence of RIN 4.0, the demand for quality public services in the community is increasing rapidly, but the capacity of public organisations still limited; and (4) education in the field of public administration, both curriculum development, and in the method of learning, in general, is still conventional in its research. In summary, the results of a study on strategic conditions regarding public administration are the pillars of public administration development that greatly influence the implementation of public policies, both within the central government and local and even village governments.

Keywords:

Public administration; Ecology, Globalisation, and Industrial Revolution 4.0

1. Introduction

One of the most apparent forms of change is the globalisation environment. Interaction between individuals, between communities, to between nations occurs fast. Virtual boundaries only insulate the connected world. Change always gives a real sign and has a trace in human life. Many things mark changes in the phase of human life: the digital revolution and the era of technological corruption currently popular with the term Industrial Revolution 4.0 (RIN.4.0), which has a unique characteristic of artificial intelligence organisational activities. RIN.4.0 is predicted by experts to be an era that can determine the life or death or the back and forth of an organisation, including government/state

organisations. The snowball that has been rolling shows that some business organisations have been crushed, and several countries are experiencing shocks that raise various serious problems. Even if not careful, some countries have entered as "failed states". The snowball will be enlarged along with discoveries in the field of information technology. For organisations, including government organisations that are smart and quick to change and can take advantage of opportunities RIN.4.0 will have high competitiveness; otherwise, if not, it will be a victim.

1.1 Objectives

Every major organisation of the government should immediately respond to various environmental factors that either directly or do not affect it. Academics and public administration practitioners must immediately make various efforts because RIN.4.0 is not only the realm of the industry, but its influence has entered all lives, including government organisations. The early thinkers of public administration (Weber, Fayol, Taylor, and followed by other experts, including Fred Riggs) based on their studies and thoughts, expressed the importance of technology as one of the ecological factors influencing public administration practice. Public administration experts prove through research that information technology, as one of the biological revolution's sons, can increase organisations' effectiveness and efficiency and improve the quality of public services.

2. Literature Review

2.1 Challenges of the Industrial Revolution Era 4.0

Conceptually, the Industrial Revolution's challenges began from industry 1.0, 2.0, 3.0, to industry 4.0. The industrial phase is essentially a real change from existing changes. Industry 1.0, began in the 18th century through the use of steam power and mechanisation of production, is characterised by the mechanisation of production to support the effectiveness and efficiency of human activities; Industry 2.0, began in the 19th century through the discovery of electricity and assembly line production, is characterised by mass production and quality standardisation; Industry 3.0, began in the '70s in the 20th century through partial automation using memory-programmable controls and computers, was marked by adjustments to mass production and manufacturing flexibility based on automation and robots, and Industry 4.0, which came to be called the Industrial Revolution 4.0 (RIN.4.0), is a term derived from a German government project to promote computerisation of manufacturing and to replace the industrial revolution of industry 3.0 characterised by the Cyber-Physical System (CPS) and manufacturing collaboration and therefore smart factories, in which production systems, components and people communicate via a network and production is nearly autonomous (Hermann et al, 2016).

According to Lee et al. (2013) that RIN.4.0 is characterised by an increase in digitalisation of manufacturing driven by four factors, namely: 1) an increase in data volume, computational power, and connectivity; 2) the emergence of analysis, capabilities, and business intelligence; 3) the occurrence of new forms of interaction between humans and machines; and 4) improvement of digital transfer instructions to the physical world, such as robotics. Lifter and Tschienner (2013) added that the basic principle of RIN.4.0 is the integration of machines, workflows, and systems by implementing intelligent networks along the chain and production process to control each other independently. Hermann et al., (2016) added, there are four design principles of RIN.4.0. In simply, the principle of RIN.4.0 as seen in Table 1 below:

Table 1. Design Principle of IR 4.0

Technical Assistance (4) Virtual Assistance Physical Assistance	Interconnection (1) Standard Collaboration Security
Decentralised Decisions (3)	Transparency (2) Data analysis Provision of data

Source: Hermann et al., in Yahya (2018)

First, the interconnection of machines, devices, sensors, and people's capability to communicate via the Internet of Things (IoT) or the Internet of People (IoP). This principle requires collaboration, standards, and security. Second, information transparency is the ability of information systems to create a virtual copy of the physical world by enriching digital models with data sensors, including data analysis and information provision. Third, technical assistance includes; (a) the ability of an aid system to support people by consciously combining and evaluating information to make the right decisions and solve urgent problems in a short time; (b) the ability of the system to support people by performing tasks that are unpleasant, too tiring or unsafe; and (c) includes visual and physical

assistance, and the Fourth principle, namely decentralised decisions which are the ability of virtual physical systems to make their own decisions and carry out tasks as effectively as possible.

Baur and Wee (2015) mapped RIN.4.0 with the term Digital Compass, which is the labour component, must meet the requirements, which have human collaboration with robots; remote control and control; digital performance management; and automation of work knowledge. Similarly, the other components are used as instruments for implementing RIN.4.0. Revolution digital and technological disruption era is another term from RIN.4.0. Called the digital revolution because of the rapid spread (proliferation) of computers and the automation of records in all fields will make the industrial world's movement and work competition become linear. RIN.4.0 is said to be an era of technological disruption due to automation and connectivity.

Understanding of Industry 4.0, as mentioned above, varies. It is because Industry 4.0 is still in the research and development stage. According to German Chancellor Angela Merkel (2014), Industry 4.0 is a comprehensive transformation of all aspects of production in the industry by merging digital and internet technologies with conventional industries. German Trade and Invest in MacDougall (2014) explains in more detail that "Smart industry or Industry 4.0 refers to the technological evolution from embedded systems to cyber-physical systems. Industry 4.0 represents the coming fourth industrial revolution on the way to the Internet of Things, Data and Services. Decentralised intelligence helps create intelligent object networking and independent process management, with the interaction of the real and virtual worlds representing a crucial new aspect of the manufacturing and production process ". Based on this explanation, it can be concluded that several technologies support RIN.4.0. The technologies are Cyber-Physical Systems, Internet and Network, Data and Services, and manufacturing technology. A more easily understood explanation might refer to the opinion of the German Industrial Federation / BDI (2016) which explains that Industry 4.0 has the following properties.

Social Machines. Sophisticated machines interact with each other, like humans with online social media. The machines work together and organise themselves to arrange the production process according to schedule. They can predict earlier if there are possible problems so they can be dealt with immediately (Lee et al., 2013). It resulted in a more effective and efficient production process. Besides, they are also connected in real-time with IT systems in the company to communicate with the maintenance, sales, R&D or other parts.

Global Facility and Virtual Production. The company's machines are connected to the provider and customer systems. If there is a change, then they will immediately look for an optimal solution and act independently (for example, if the provider cannot send material). Operators can use virtual technology (augmented reality) to monitor and control the production process. This condition allows control of production can be done at a distance so that workers are freer. Also, virtual simulations can also help company experts optimise the production process in real-time.

Smart Products. Each resulting product stores data (operations, status, materials, origin providers, consumers, and so on) in the form of RFID chips. Through this technology, an unfinished product can tell the machine what to do to process it. Customers can be involved to monitor the production process.

Smart Services. Products that have been marketed and are in the hands of consumers can still collect and send data related to the behaviour of using these products. Furthermore, the data collected will be analysed by the manufacturer. Manufacturers will make improvements and product development so that they can provide better service to customers.

Industry 4.0 will provide benefits in increasing productivity, efficiency, flexibility, and a high level of product customisation for the industrial world. However, on the other hand, every change can have other adverse effects. In the opinion of Schwab (2015), the presence of Industry 4.0 will have several impacts, namely; (1) the existence of significant gaps related to "low-skill / low-pay" and "high-skill/high-pay" workforce, (2) the biggest profit takers are those who have capital and technology, (3) world instability business because of speedy changes; (4) the government's unpreparedness to compensate for rapid changes in the community; (5) data security and privacy issues; (6) the emergence of the phenomenon of "robotisation" of humanity. Wolter in Sung (2017) identifies various challenges faced, namely, 1) information technology security issues; 2) the reliability and stability of the production machine; 3) lack of adequate skills; 4) unwillingness to change by stakeholders; and 5) the loss of much work because it turns into automation. Although the challenges of RIN 4.0 are more nuanced to the business sector, but because of good governance, where the government/state sector, business sector, and society are included in a system of state government administration, the actions or experiences of the business sector directly or indirectly affects the

government/state and community. In other words, RIN.4.0 is an ecological factor of public administration that must be calculated.

The influence of Industrial Revolution 4.0 has changed the configuration of public administration from initially manual-based to information technology. Across the state, changes are required with the full involvement of governments/states, businesses, and communities based on the application of e-government. Although there are many Kendal, there are many benefits in implementing e-government, especially in public services. The experience of several countries that have implemented e-government has influenced the level of national competitiveness. If it is not completed immediately, then the competitiveness of a nation, in this case, the Indonesian nation continue to decline.

3. Methods

This study applied a combination of descriptive methodology and development study methodology. A descriptive methodology used in this study attempted to explain the challenges of the Industrial Revolution Era 4.0 (RIN.4.0). Meanwhile, a methodology of the development study used since this study attempted to develop RIN. 4.0 concept was extracted from related concepts, opinions from experts and practitioners in some regions in Indonesia.

4. Data Collections

4.1 Data Source and Data Collection Technique

The data source in this research was secondary data. The secondary data were collected through methods document and literature study, including related concepts and case studies/examples found on the internet. This initial analysis was used to compile the concepts and research instruments, while document and literature study collecting, analysing, and interpreting data was intended to add and complete data to obtain quality study results. Data collected in this study was then collected using qualitative methodology. Based on this method, data were organised and sorted into the pattern, category, and unit of fundamental analysis to formulate challenges of the industrial revolution era 4.0 (rin.4.0) and ecology of Indonesian Public Administration.

5. Results and Discussion

Looking at the RIN.4.0 era's challenges, from an ecological, public administration perspective, Indonesia faces increasingly severe challenges. Some of Indonesia's challenges that must be immediately sought for a solution include; (1) the government's unpreparedness to compensate for rapid changes in the community; (2) a reluctance to change by stakeholders; (3) instability in the business world due to rapid changes; (4) loss of much work because it turns into automation; (5) there are great gaps related to "low-skill / low-pay" and "high-skill / high-pay" workforce; (6) data security and privacy issues; and (7) the emergence of the phenomenon of "robotisation" of humanity. Related to the challenges of rin.4.0 impact, ecological factors of Indonesian public administration are also faced with ecological factors that have a natural perspective. It consists of factors of geographical location, natural resources, conditions and level of ability of the population. In addition to social factors including ideology, politics, economy, social, culture, security, and technology that includes information technology and innovation that supports the development of public administration automation. Considering many considerations, on this profitable opportunity, there were only a few factors, and the main factors were directly related to RIN.4.0.

Indonesia's geographical factors show that Indonesia is between two continents and two oceans. The total area of Indonesia is 7.81 million km² which consists of 2.01 million km² of land, 3.25 million km² of the sea, and 2.55 million km² of the Exclusive Economic Zone (EEZ), is a country with a greater water area than land area; therefore Indonesia is called the Maritime Country Number of islands 17,499 islands (according to the 11th conference of the UNCSD session) with an island named 14,572 islands), sea area 5.8 million km², land area 2.9 million km², with a beach length of 99,093 km (Geospatial, 2013). The most strategic geoeconomics position in the world. 45% of all goods and commodities traded in the world with a US \$ 1,500 / year are shipped by the Indonesian sea (ALKI; UNCTAD, 2012). Indonesia also has a large and diverse wealth of natural resources.

In terms of population, the population of Indonesia is 245 million. It is the fourth largest in the world with a middle-class population of 45 million and is expected to reach 135 million by 2030 (Mc, Kinsey, 2013). The People of Indonesia are merely committed to maintaining the ideology of Pancasila. The Unitary State of the Republic of Indonesia (NKRI) is the price of death. The Constitution of the Republic of Indonesia is the Basic Law of 1945, and the Unity in Diversity. Indonesia's political system is a Pancasila democracy that is different from democratic practices in other countries, Bhineka Tunggal Ika, which means different but remains united in the Republic of Indonesia's bond. Tolerance was developed among religious people who are much admired in the countries of the world. Despite

being challenged lately in various forms of undermining the ideology of Pancasila and the Unitary Republic of Indonesia, but under the protection of Almighty God, the Indonesian people can defend it.

Economic factors, according to the World Bank regarding Indonesia's economic growth in 2018. Recent World Bank predictions say Indonesia's economic growth in 2018 will reach 5.2 per cent. This projection is lower than the previous World Bank predictions. In April 2018, the World Bank released a projected growth in Indonesia in 2018 of 5.3 per cent. Despite lowering the projected figure, the World Bank assesses Indonesia's economic prospects continue to be positive until the end of this year. In addition to the decisive domestic demand factor, high global commodity prices are also expected to encourage investment and produce the fastest capital growth in more than five years. "Strong macroeconomic fundamentals in Indonesia continue to provide a solid buffer against increasing global turmoil. Good economic management has kept inflation under control, and the debt level is only about half of the legal threshold, "Socio-cultural factors, that socio-cultural change is a symptom of changing social structures and cultural patterns in a society. It is in accordance with socio-cultural change of the nature of society that always wants experience changes. Hirschman said that human boredom is the cause of change. The factors of socio-cultural change are divided into two, namely the factors that encourage and inhibiting factors.

Factors that encourage social-cultural change include contact with other cultures, formal education systems, the level of community tolerance. People who have a high tolerance attitude will simply accept social-cultural changes. There are several factors that inhibit change, such as; (i) the lack of intensive communication relationships with other communities; (ii) slow development of science and technology; (iii) very traditional nature of society; (iv) there is an ingrained interest in society; (v) negative prejudices about new things; (vi) fear if there is a shake-up in society if there is a change; (vii) ideological barriers; and (viii) influence of customs or values.

The importance of mapping the challenges and opportunities of RIN.4.0, referred to with the ecology of public administration, is intended to prevent various impacts on people's lives, one of which is unemployment. Work Outlook Social Outlook Trend 2017 predicts the number of unemployed people globally by 2018 is expected to reach 204 million with an additional increase of 2.7 million. Almost the same as the conditions experienced by western countries, Indonesia is also predicted to experience the same thing. As an illustration, the population factor in 2017 in that Indonesia's population is estimated to reach nearly 262 million people. This large population is dominated by a productive age, so that the dependency rate tends to decrease. The dependency rate, namely the number of unproductive age population towards the productive population in 2016, was 48.4 per cent. This figure is much lower than in 1971, which reached 86.6 per cent. It is related to residents' ability to process and utilise their natural resources to improve people's welfare. The quality of a country's population can be known from the factors that influence it, namely population income, education level, and health level.

Unemployment is also still a challenge and even tends to be a threat. Indonesia's open unemployment rate in February 2017 was 5.33% or 7.01 million of the total 131.55 million workforces (Source: BPS 2017). 2017 BPS data also shows the number of unemployed people who came from Vocational High School (SMK) was in the top rank of 9.27%. Next is the High School (SMA) graduates by 7.03%, Diploma III (D3) by 6.35%, and Higher Education graduates by 4.98%. Recognized, the cause of the high contribution of vocational education to the number of unemployed in Indonesia is one of them caused by the low special skills and soft skills possessed. The problem of unemployment and the competitiveness of human resources is a real challenge for Indonesia.

The challenges facing Indonesia are also compounded by the demands of companies and the industrial sector. The World Bank (2017) reported that the job market requires multi-skills graduates forged by education units and systems, both secondary and higher. Indonesia is also predicted to experience a demographic bonus in 2030-2040, with a more productive population than non-productive populations. The population of productive age is estimated to reach 64% of Indonesia's total population, which is estimated at 297 million. Therefore, the large number of productive age people must be followed by an increase in quality, both in terms of education, skills, and technical abilities.

Other data shows, based on the Global Innovation Index (GII), which measures the level of innovation of countries globally, Indonesia is still ranked below the majority of Asian and ASEAN countries. GII 2016 and 2017 data show that Indonesia only rose one rank from 88th to 87th. In contrast, Vietnam shows a significant increase from ranking 59th in 2016 to 47th in 2017. It shows that innovation has not been a priority of the Indonesian government's national economic, social and cultural development.

The world economic forum also launched; the 21st-century skills structure will change. In 2015, the skills structure was as follows; 1) solving complex problems; 2) cooperation with others; 3) management of human resources, 4) critical thinking; 5) negotiation; 6) quality control; 7) service orientation; 8) assessment and decision making; 9) active listening; and 10); creativity. In 2020 it is predicted, the work structure will change to; 1) solving complex problems; 2) critical thinking; 3) creativity; 4) people management; 5) cooperation with others; 6) emotional intelligence; 7) assessment and decision making; 8) service orientation; 9) negotiations; and 10) cognitive flexibility (Irianto, 2017). Thus, the RIN.40 era raises challenges and opens opportunities if the organisation can make rapid and

planned changes. Conversely, if it is too late, it will be crushed by the current of the industrial revolution 4.0 and unforgiving globalisation. Facing the ecology of an increasingly unfriendly public administration requires a review of various public policies primarily related to public administration ecology's critical factors.

One of the keywords in increasing the ability of the population is education. Education is one of the primary keys to achieve the progress of a country. Sooner or later, a country in increasing its economic progress is very dependent on the country's success in providing education to its population. The higher level of education of the population shows the higher quality of the country's population. Education will increase residents' ability to process natural resources owned so that it will improve the welfare of the population.

From the ecological factors of technology as stated as the Industrial Revolution 4.0, all countries must make fundamental changes. For developing countries like Indonesia, technology development, especially information technology, has changed the way things work. The implementation of public administration, which was initially been manual and slow, resulted in its low competitiveness. The public demands that bureaucratic services that are faster, better, safer, more convenient, and cheaper cannot be thoroughly done by the government. For Indonesia, which is the largest archipelago, its management is not possible in an old-fashioned way. Communities that are very far from the centre of government often experience not even well served. The impact is that the increasing number of poor people is the wider influence is the declining level of public trust in the government/state. Abstentions in the election / regional election and even the presidential election signal that the level of public confidence in the government is declining.

The public's slow information / government policies are also often used by unscrupulous individuals to take advantage of themselves. Moreover, the dissemination of information that is not supported by adequate information technology has influenced public administration's effectiveness and efficiency. The development of increasingly complex public issues and issues will lead to a governance crisis. The state becomes weak and helpless, facing massive changes due to economic, political, and technological globalisation. However, on the other hand, if a country has a good response and readiness to respond to the effects of globalisation, the country will reap the benefits of advancements, such as technological progress. Technological progress is the condition *sine qua non* of RIN.4.0 globalisation that can be utilised directly by a country in many ways, including running its public administration system. One of them is by applying e-government systems, namely the government's application or use of information technology to provide services to the public, business affairs, and other matters relating to government. In public administration activities, e-Government can improve efficiency, convenience, and better accessibility of public services.

One issue that arises from public administration is the credibility of government bureaucrats. The longing for an accountable and professional government is a big dream that is expected by all people. Especially regarding transparency, which is an absolute requirement for a government in a democratic country. (Elli: 2001). The emergence of many cases of performance violations from public bureaucrats such as corruption, collusion, and nepotism is one of them due to the lack of public access to participate in monitoring government activities and the lack of accountability of the government itself. Therefore, this is where roles or benefits can arise technological advancements to support these public bureaucrats' performance while creating a process of good public accountability with e-government systems.

In order to realise the e-Government concept, there are several obstacles faced by the government today, namely the lack of availability of adequate infrastructure, the cost of using telecommunications services that still tends to be expensive, and the many public service providers both at the centre and in the regions that have not coordinated their public services with amenities Internet. but in the end, if the concept of e-Government is successfully applied in the bureaucracy, then this provides direct benefits to the community. As an example, in terms of public services, such as improving the efficiency and effectiveness of public services, increasing transparency, control, and accountability of government administration to realize a free government budget. Also, to empowering the community and other parties as partners of the government in the decision-making process in formulating public policy evenly and democratically. Some of the obstacles faced by Indonesian public administration in implementing e-government are (a) The lack of regulations governing the application of e-government both at the central and regional levels; (b) There is no tradition of mutual information (no culture of sharing); (c) No culture documenting; (d) HR professionals in the IT field and the public who are mostly still lacking knowledge in the IT field are still limited to the use of mobile phones; (e) Inadequate infrastructure, and (f) Limited access to certain places ((Hardjaloka (2014).

Study results from several countries (Indrajit, 2013), namely: (a) Constraints relating to key creation success (crucial success factor) in the development of e-government that connects people with the government (front office technology). The problems faced in this case are 1) Type of technology, 2). Equitable existence throughout the region, and 3). Strategies that should be implemented; (b) Constraints relating to other institutions' involvement outside the government (private commercial parties and other non-commercial parties) in developing the required infrastructure and supra-government structures; 1). Constraints on non-government involvement; 2) constraints related to the

preparation of institutional strategies, especially the problem of investment and operational costs. Changes in e-government programs can run; and (c) Obstacles to Financing, Planning, Developing and implementing the e-gov concept. For this, the principles of managing change: 1). The government must focus on developing e-government, 2). The government needs to think of an incentive framework for those who successfully implement e-government, 3) e-government financing problems.

The government, as the main actor in the formulation, determination, implementation, monitoring, and evaluation of public policies, must continuously improve its analytical skills so that the policies produced are by the public's needs (public). The point is that the state must always be present besides the people who demand public services changes. Viewed from the perspective of RIN 4.0, it appears that quite many policies have not been able to answer the challenges and demands of the current industrial revolution. Quite many public policies are outdated, and even relatively new policies have not been able to anticipate them. The slowness in anticipation was partly because the bureaucratic machine was still running with a very long and convoluted procedure. For example, the procedure for an investment permit is still quite long, namely 96 days. The closest Indonesia, Singapore, has served in only four days (Basuki, 2013).

6. Conclusion

Based on and review as presented, finally, some notes need attention regarding the ecology of public administration in Indonesia facing the era of the Industrial Revolution 4.0 (RIN 4.0) as follows. The challenges of the Industrial Revolution Era 4.0 (RIN.4.0) are (1) the development of information technology and the increasingly critical demands of society; (2) public administration reforms in all governance of public organisations. (3) demands for quality public services in the community; and (4) education in public administration, both curriculum development and learning methods. The development of information technology and the increasingly critical demands of society have led to public administration reforms in public organisations' governance. Technological advances have formed a new world order with no knowledge of national boundaries that accelerates globalisation with the spirit of competition and free markets in various parts of the world and is filled with all regions of the country demanding increased national competitiveness. It also has implications on discipline and system of public administration, both in developing and developed countries.

Meanwhile, some nations have succeeded in utilising technological advancements to improve quality and efficiency, especially in managing services and policies by utilising technology in public administration systems developing as Indonesia must work hard to catch up. It was realised that with the cultural transformation of apparatus resources, the response was still very low (especially in developing countries). It is evident in formulating public policies, creating conducive state government activities, and realising public officials' transparency and accountability. Demands for the need for quality public services in the community, mainly as an effect of RIN 4.0, are increasingly rapid. On the other hand, they are faced with the ability of public organisations that are still limited. This gap must be increased immediately so that the gap is not too far away. One of the urgent efforts to do is a total reform of the education system at the elementary, secondary, and tertiary levels. Human resources as human capital must continue to be improved in terms of their knowledge, skills, and attitude. Thus, it is necessary to develop Good Education Governance that involves the state/government, the business world, and the community in the management of education in Indonesia. Education in the field of public administration, both curriculum development and learning methods, is generally conventional.

The study of the discipline and administration system has not been developed in an interdisciplinary manner. It has not been able to face various substantive problems that are the responsibility of the administration system. In the Industrial Revolution 4.0, the institution that organised education in the field of public administration should be able to implement a digital campus system. The development of all aspects of life that is globalising very rapidly will affect sooner or later on public administration. The role and function of public administration in all sectors of public organisations will be an obstacle in realising good governance if public administration is not able to respond optimally, according to the demands of the times. As an illustration in practice, several obstacles were found, including the system of checks and balances of state institutions has not been implemented optimally, effective law enforcement has not been implemented, cleansing money politics practices such as in eradicating collusion corruption and nepotism is still selective, the lack of commitment and competence in realising national values and national struggles in accordance with UUD 1945.

References

Aoun, J.E. *Robot-proof: higher education in the age of artificial intelligence*. US: MIT Press, 2017

- Afwan, M. *Leadership on technical and vocational education in community college [Versi elektronik]*. *Journal of Education and Practice*, 4 (21), 21-23. 2013
- Baur, C. & Wee, D. *Manufacturing's Next Act?* McKinsey & Company. 2015
- Brofenbrenner, U. *Ecological system theory*. In *r. Vasta (Ed)*. Annals of Child Development (Vol 6). Greenwich: CT, JAI Press. 1989
- Basuki, Johannes. *Administrasi Publik: Telaah Teoretis dan Empiris*. Penerbit Rajagrafindo Perdana, Jakarta. 2018
- Basuki, Johannes. *Budaya Pelayanan Publik*. Penerbit Hartomo Media Pustaka, Jakarta. 2013.
- Best, D, James. *The Digital Organization: All Success with Business Technology*. John Wiley & Son, New York. 1989
- Brown, A., Kirpal, S., & Rauner, F. *Identitas at work*. Netherlands: Springer. 2007
- Edmon, A., & Oluyi, A. *Re-engineering Technical Vocational Education and Training toward Safety Practice Skill Needs of Sawmill Workers against Workplace Hazards in Nigeria [Versi elektronik]*. *Journal of Education and Practice*, 5 (7), 150-157. 2014.
- Hermann, M., Pentek, T., & Otto, B. *Design Principles for Industrie 4.0 Scenarios*. Presented at the 49th Hawaiian International Conference on Systems Science. 2016
- Irianto, D. *Industry 4.0: The Challenges of Tomorrow*. Disampaikan pada Seminar Nasional Teknik Industri, Batu-Malang. 2017.
- Kagermann, H., Wahlster, W., & Helbig, J. *Recommendations for Implementing the Strategic Initiative Industrie 4.0*. Industrie 4.0 Working Group, Germany. 2013
- Kohler, D, & Weisz, J.D. *Industry 4.0: the challenges of the transforming manufacturing*. Germany: BPI France. 2016.
- Lee, J., Lapira, E., Bagheri, B., Kao, H. *Recent Advances and Trends in Predictive Manufacturing Systems in Big Data Environment*. *Manuf. Lett.* 1 (1), 38–41. 2013
- Lembaga Administrasi Negara. *Sistem Administrasi Negara Kesatuan R.I.* (Jilid I, II, III). 2007
- Liffler, M., & Tschiesner, A. *The Internet of Things and the Future of Manufacturing*. McKinsey & Company. (2013).
- Lomovtseva, N.V.. *Roles of VET in generating a new entrepreneur increative economy sector*. Makalah disajikan dalam 3rd International Conference on Vocational Education and Training (ICVET), di Universitas Negeri Yogyakarta. 2014, Mei
- Moestopadidjaja, *Kebijakan Publik*, Lembaga Administrasi Negara. 2014
- Pamudji, Suparni, *Ekologi Administrasi Negara*. Bumi Aksara Jakarta. 2004
- Sung, T.K. *Industri 4.0: a Korea perspective*. *Technological Forecasting and Social Change Journal*, 1- 6. 2017.
- Tjandrawina, R.R. *Industri 4.0: Revolusi industri abad ini dan pengaruhnya pada bidang kesehatan dan bioteknologi*. *Jurnal Medicinus*, Vol 29, Nomor 1, Edisi April. 2016.
- Trilling, B & Fadel, C. *21st-century skills: learning for life in our times*. US: Jossey-Online Source. 2009.
- Davies,R. *Industry 4.0 Digitalisation for Productivity and growth*. <http://www.europarl.europa.eu/RegData/etudes>. 2015.
- BRIE/2015/568337/EPRS_BRI(2015)568337_EN.pdf, Diunduh pada 11 Maret 2017.
- Federasi Industri Jerman. (2016). *What is Industry 4.0?*. <http://english.bdi.eu/article/news/what-is-industry-40/>, Diakses pada 11 Maret 2017.
- From, J., Lindstrom, V., Stahre, J., Winroth, M. *Levels of Automation in Manufacturing*. *Ergonomia- International Journal of Ergonomics and Human Factors*, Vol. 30, Issue 3. 2008.
- Fryer, KJ., Antony, J., Douglas, A. *Critical Success Factors of Continuous Improvement in The Public Sector: A literature review and some key findings*. *The TQM Magazine*, Vol. 19, No. 5, pp. 497-517. 2007.
- Gliemourinsie, D. *Industri Nasional Harus Siap Hadapi Era Industri 4.0*. 2016. <https://ekbis.sindonews.com/read/1141743/34/industri-nasional-harus-siap-hadapi-era-industri-40-1474630359>, Diakses pada 9 Maret 2017.
- Hayden, E., Assante, M., Conway, T. *An Abbreviated History of Automation & Industrial Controls Systems and Cybersecurity*. 2014. <https://ics.sans.org/media/An-Abbreviated-History-of-Automation-and-ICS-Cybersecurity.pdf>. Diunduh pada 25 Maret 2017.

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