

The Artificial Intelligence Readiness for Pandemic Outbreak COVID-19: Case of Limitations and Challenges in Indonesia

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ABSTRACT

Artificial intelligence (AI) technologies continue to play significant roles during the Coronavirus 2019 (COVID-19) pandemic in the world. However, health is an area where the rules are stringent and inflexible. This can be justified because it deals with human life. Nevertheless, at the same time, a large number of tests, certifications, and panels will lead to innovations in AI for healthcare that are longer, more complex, and difficult to incorporate into real-world applications. Indonesia has a lot of AI research, which is challenging to commercialize in medicine. These researches are not yet effective due to several limitations in terms of (i) the readiness of a skilled workforce to develop and use AI, (ii) the readiness of regulations that regulate the ethics of using and utilizing responsibly, (iii) the readiness of computational infrastructure and supporting data for AI modeling, and (iv) readiness industry and the public sector in adopting AI innovations. In pandemic outbreak COVID-19, AI technology should help the medical industry more significantly, caused by such limitations, and it has not yet been impactful against COVID-19 in Indonesia. In the future, AI technology exists as a complementary facility to increase the productivity of medical personnel and acts as a disease prevention facility.

Keywords: Artificial intelligence, COVID-19, AI readiness

1. INTRODUCTION

Though still in their infancy, artificial intelligence (AI) products and services are being introduced across finance, healthcare, retail, transport, manufacturing, and agriculture [1][2][3]. However, the different roles played by AI during pandemics *Coronaviruses 2019* (COVID-19) are early warning and alerts [4], prediction and detection of an outbreak of diseases [4][5], real-time disease monitoring worldwide [6], analysis and visualization of spreading trends [7], prediction of infection rate and infection trend [8], rapid decision-making to identify the effective treatments [6][8], study and analysis of the pathogens, and drug discovery [8][9]. The COVID-19 pandemic is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). There were 2,973,219 positive cases reported in Asia countries, with 70,555 cases of death and 2,064,179 cases was recovered in August 2020 [10][11][12]. Coronavirus infection is known as a self-limiting disease. Although it can heal independently, this disease also causes 80% of the patients to have no symptoms, while the remaining 20% will show symptoms, with 5% of them showing critical symptoms [12]. Therefore, a strategy is needed to handle it in optimal ways.

Based on experience handling viral infections COVID-19 in China, the implementation of early detection strategies for critical patients and early

intervention critical patients effectively reduced the mortality rate (3.8%) [13]. To produce the accurate diagnosis of infected by COVID-19, the Reverse Transcriptase PCR (RT-PCR) and confirmed by sequencing techniques are carried in Indonesia [14]. Examination of specimens done in the laboratory using RT-PCR. However, PCR laboratory tests, which are the gold standard or the most accurate testing, are still minimal compared to the total population of several countries in ASEAN, including Indonesia [14][15]. Furthermore, the small sensitivity of RT-PCR and the shortage of testing kits in epidemic areas increase the screening burden, and many infected people are thereby not isolated immediately [16-18].

At present, one of the immediate strategic efforts to reduce the death rate due to the spread of COVID-19 is to increase the speed of detecting and finding infected patients with a high degree of accuracy. This strategy means that the faster to do it, the sooner to be given medical treatment to reduce the number of positive patients and deaths from COVID-19. As part of realizing its commitment to helping the world combat the COVID-19 outbreak, AI can accelerate and provide better accuracy in diagnosing COVID-19 patients [17][18]. In other words, if medical treatment uses AI quickly and adequately, it can have a positive impact in the form of reducing mortality. However, the use of AI-driven algorithms for early detection of pandemics is currently in the maturation stage and maybe a potential pathway soon to better improve human preparedness for another pandemic [18][19]. It is expected that with the accuracy of this technology, it will continue to advance so that it will have a more significant role in promoting the formulation of novel health policies. Therefore, an AI readiness is needed to deeply investigate to deal with the COVID-19 pandemic or other pandemics. This paper discusses an assessment of the current situation, as well as the readiness of policies, human resources, and infrastructure; apart from that, it also discusses existing limitations and challenges, especially in Indonesia, for having better preparedness.

2. MATERIAL AND METHOD

2.1 DATA

Some of the data is collected as representative areas between healthcare infrastructure and human resources in ASEAN countries to apply AI technology. That is in line with the current pandemic will be explained, such as regarding the existing health infrastructure, the use of AI in pandemic prevention, and seeing the number of research publications that use AI. The data visually compared to the reported seasonality of AI readiness in pandemic COVID-19. All data measurements are taken as follow; the data on infectivity of COVID-19 in Indonesia were collected from the COVID-19 dashboard [20]; the ratio number of doctors and other medical staff, the ratio of the hospital bed, and the last as the ratio of the government health spending for healthcare infrastructure from World Bank, and Health Ministry of Indonesia [21][22][23]; AI Readiness index, and ICT development index in ASEAN from The Oxford Insights and International Development Research Center, International Communication Union, and World Economic Forum [24][25]. The analysis is conducted for ASEAN country, which give an overall picture of the AI readiness with the appropriate comparison. Descriptive analysis was carried out to

see the relationship between each data to conclude the limitations and challenges in Indonesia.

2.2. INFRASTRUCTURE AND HEALTH SPENDING

The population of countries in the ASEAN region will continue to increase by 40 percent by 2050 [26] to further encourage the demand for health care. However, at present, demographic changes are not accompanied by additional health staff, or in other words, hospitals are short of health personnel. So that health care systems must intervene in ASEAN member countries. The health care sector needs to find innovative solutions to be more effective and efficient without overpricing. This is where technology comes into play. Rapid technological developments, especially AI penetration in the medical system, can help complement the healthcare industry in the ASEAN region. Especially Indonesia, the largest archipelago in the world, with an estimated total of more than 267 million [26]. Some problems in the medical and health realm in Indonesia include the availability of doctors. According to the calculation ratio from the World Health Organization (WHO), the ratio between doctors and patients should be 1: 1,000. This ratio means one doctor can serve 1,000 people [14][20][23]. However, based on Figure 1, the number of doctors in Indonesia is the second-lowest in Southeast Asia, which is 0.4 doctors per 1,000 people [14][23]. On the other hand, it is describing that Indonesia only has four doctors serving 10,000 people. This ratio number is much lower than Singapore, which has 2:1,000.

Apart from the eligibility ratio for the number of doctors, other health workers are also still limited. The availability of nurses and midwives also have the worst position among other countries. The current ratio of nurses per 1,000 people is 2:1, which means that two nurses serve 1,000 people [14]. Also, there are issues regarding healthcare costs, which are quite large and the Indonesian health and insurance industry's innovation, which are still far behind compared to other industries. Indonesia needs at least 1,500 doctors and 2,500 health workers to face the COVID-19 pandemic. Moreover, Indonesia only has one hospital bed per 1,000 patients [23]. Simultaneously, patients who are positive for COVID-19 who experience severe symptoms need intensive care with equipment and regular monitoring to needed medical devices such as ventilators or breathing devices inside the intensive care unit (ICU) room. The ICU room bed capacity only 2.7 for 100,000 patients (refer to Figure 1), which means that three-bed serve 100,000 patients [10][14][23].

As a part of Group Twenty (G20) countries since 2008, Indonesia knows to have an important role and influence in the global arena [21]. All the members of G20 are recognized to almost 89% controlling the world economy. Besides, Indonesia is also the 4th most populous country after China, the United States, and India. Although included in the G20 countries, Indonesia in 2014, spends only 2.8% of GDP on health according to world development indicators (refer to Figure 1). This value is below the ASEAN countries' average expenditure, which is 4.6% [21][27]. It can be concluded that the condition of Indonesia's healthcare infrastructure is still limited or minimal. It is necessary to have a significant change so that healthcare can be optimum. Therefore, using a combination of adequate technical or technological expertise, financial sustainability, and socio-political

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commitment embedded in a healthy psycho-cultural context can lead to a smooth transition to the AI-supported healthcare sector in Indonesia. Concerning these data, the health industry players should begin to change their work systems by utilizing new technologies, AI technology.

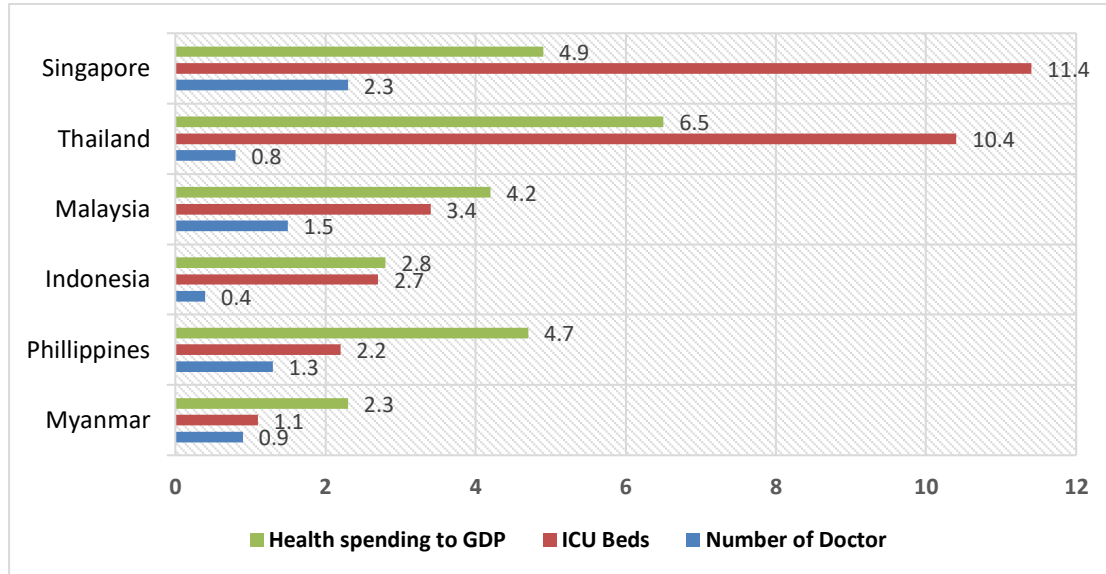


FIGURE 1. The comparison of healthcare condition in the ASEAN region

2.3. INDONESIAN RESEARCH FOCUSED ON COVID-19

In the clinical field, the main application of AI is to assist doctors in examining and analyzing patients so that doctors can find out whether the patient is suffering from a disease or not. Based on this explanation, AI technology cannot replace doctors to determine the patient's condition [12][13]. Nevertheless, in some of the most challenging cases, AI can rank even more accurate diagnoses than human doctors because AI has very high algorithmic accuracy [15][22][28]. Besides, it can scientifically mark treatment priorities. In a pandemic COVID-19 situation, AI technology will also increase the speed of analyzing COVID-19 significantly. The result can support the radiologist and doctors more accurate when diagnosing, which means helping more patients simultaneously [4-7, 29-32]. The algorithm is carried out by this AI-based diagnostic system by rearranging the expertise and experience of a team of doctors from various medical disciplines, and also can be added to other medical record patients. This technology can help facilitate the performance of medical officers in scoring and diagnosing patients based on reading the results that have been carried out by the patient [29][31].

The previous result about the AI implementation to fight COVID-19 in several countries has been developed. In China, AI-based Computed Tomography (CT) scan image analytic technology has been used in more than 160 hospitals and successfully helped doctors diagnose 60 times faster than human labor [33]. In the United States, more than 85,000 X-ray photographs to practice the AI algorithm and successfully analyzed the risk of death for patients with very high accuracy [33][34]. Many major hospitals in Queensland have implemented smart telepresence robots in their COVID-19 wards to facilitate doctor-patient communication [36]. A major

trauma hospital in Melbourne is trialing an AI program to monitor patient's COVID-19 at home. Simultaneously, the software monitors the vital signs of "green" patients whose illness is less severe [35]. While in Indonesia, in dealing with COVID-19, various institutions are trying to do their best and develop various innovations using AI-based computer-aided diagnosis to analyze lungs infected with COVID-19 or other research in pandemic [36][37].

Increasing the availability of AI technology in Indonesia can protect this healthcare, reduce the interaction, and increase virus detection. AI has the potential to be a tool in the fight against COVID-19. However, from the above rapid scan of the current state of play, AI systems are still at a preliminary stage, and it will take time before the results of such AI measures are visible. By involving all sectors in Indonesia as described above, AI can become a tool to fight COVID-19 and similar pandemics. As for the benefits of implementing and increasing the availability of AI technology in hospitals throughout Indonesia, it can improve health facilities, reduce interactions, and increase virus detection. However, currently, the implementation of AI systems in Indonesia, even in ASEAN, is still at an early stage, and it will take time before the results of these AI actions can be seen.

3. THE ARTIFICIAL INTELLIGENCE READINESS IN INDONESIA

Currently, digital technology plays an essential role in significant health sector problems, including disease prevention. Health emergencies around the world are presently seeking technological support to tackle COVID-19. Especially AI technology includes the internet of things (IoT), computer vision, big data analytics, machine learning, deep learning (DL), and blockchain technology [28] have been proposed to overcome several issues in the COVID-19 pandemic. The whole process is developed for epidemic monitoring, detection, and prevention strategies; and to identify the impact of the epidemic on the health sector [29]. All the methodologies can enhance the detection and diagnosis of COVID-19 [29][35][36]. AI in the health sector has developed rapidly. In its development to implement AI in the healthcare community, it is necessary to build and foster various parties' ecosystem, both in healthcare and software development. The ones that can encourage or create such an ecosystem for the AI domain are major technology companies. It is essential to maintain an interconnected ecosystem between government regulators, information technology in hospitals, doctors and medical professional associations, software developers, the entire health information technology community, and most importantly, patients [28].

To see the healthcare community's readiness in implementing AI in ASEAN countries by looking at the 2019 Government AI Readiness Index (refer to Figure 2) reported by The Oxford Insights and International Development Research Center [34]. As might be expected, the top rankings of the 2019 Government AI Readiness Index is dominated by countries with strong economies, good governance, and innovative private sectors. In comparison, the Indonesian government reaches AI readiness rank 5 in ASEAN [34]. Meanwhile, in the world ranking, Indonesia is in position 57 out of 194 countries with 5.42.

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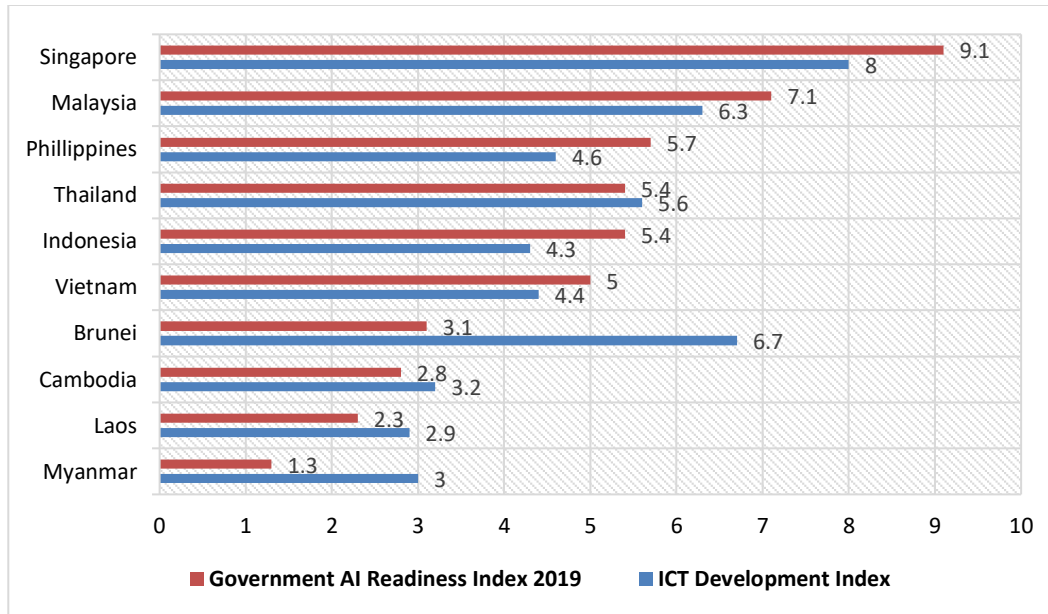


FIGURE 2. Government AI readiness index vs. ICT development index 2019 in ASEAN region

Indonesia has been driving in AI reception in Southeast Asia, according to an International Data Corporation (IDC). AI reception rate in Indonesia tops 24.6 %, higher than that of Thailand (17.1 %), Singapore (9.9 %), and Malaysia (8.1 %), respectively [27][28]. With the pandemic accelerating the selection of brilliant innovations and data analytics worldwide, AI will continue being a region of development for Indonesia, with its fertile and incipient computerized framework, the enormous population of more than 267 million, and relating volumes of information being critical drivers of growth. However, Indonesia's Information and Communications Technology (ICT) development lag behind other G20 member countries, as shown in Figure 2. Indonesia is at the position of 114, with the index obtained was 4.33 points [24].

Implementing ICT in each country can also be seen from the ranking based on the Networked Readiness Index (NRI). That is the performance of country economies in leveraging information and communications technologies to boost competitiveness, innovation, and well-being. Indonesia has 73 ranks from 139 countries. It means the Indonesian government has a clear implementation plan for utilizing ICTs to improve its overall competitiveness. Regarding the AI readiness index, ICT development index, and NRI index, Indonesia is ready to implement AI in healthcare services. Nevertheless, AI technology may warrant more regulatory consideration if it generates substantial public welfare risks [24][28].

4. LIMITATION AND CHALLENGES

AI technology has become an important part of supporting the pandemic outbreak. But several limitations arise in the implementation for the real application. AI has been proposed in some hospitals infrastructure in developing countries in. Alternative diagnostic and screening tests for COVID-19 by using AI will be



beneficial. AI has shown promising results in assisting lung disease analysis by using X-Rays and CT scan images. It plays a significant role in the COVID-19 outbreak, due to it can automate the detection of virus severity and infectivity by using medical imaging. It benefits from the strong feature learning ability, and it can mine features related to clinical outcomes from X-rays and CT images automatically [5][7]. Such a process can be used to detect corona infection in a person. AI Technological progress will make it easier. By relying on specific algorithms, the analysis time will be significantly shortened. In the AI process, personal data is needed to evaluate patient information, including accessing patient health data. However, this data is personal data that must be protected. Opening the identity of a positive COVID-19 patient is a dilemma in the public and government. Such a process can prevent transmission, but on the other hand, it has the potential to generate discrimination. The consistency of policies related to the growth and development of the AI innovation ecosystem must-have, it can be a standard to support the AI research.

Through the Ministry of Communication and Information, the Indonesian government is currently drafting a Personal Data Protection Bill (RUU), which is expected to be discussed soon by the People's Representative Council (DPR). This law was made to protect personal data so that the data is used according to its purpose. Do not let the public think that this rule can hinder the industry from innovating. The Ministry of Communication and Informatics is currently formulating various regulations needed to develop AI in Indonesia. Moreover, the Ministry of Research and Technology/National Research and Innovation Agency (BRIN) launched a national AI strategy and an electronic catalog for the innovation product sector. The national artificial AI strategy, which is the national policy direction for 2020-2045, contains focus areas and priority areas for AI technology in Indonesia. Include health services, bureaucratic reform, education and research, food security, mobility, and smart cities. The current AI programs in Indonesia is an AI system for the detection of COVID-19.

Indonesia has launched targeted initiatives and programs that facilitate the adoption of AI systems in strategic sectors and industries, focusing on public-private cooperation to drive adoption. However, in this pandemic COVID-19 situation, it is essential to implement AI in the healthcare system. Providing citizens with good healthcare is one of the most significant challenges facing governments today. Changing population demographics and the prevalence of COVID-19 disease in developing countries are putting tremendous pressure on healthcare systems worldwide. One highly promising solution to these challenges is the application of data analytics. Healthcare systems generate extraordinary volumes of data, and it is clear that if this mountain of information can be efficiently mined, the insights revealed could transform the industry from pharmaceutical research and development to providers' operational management and patient outcomes. To make the AI readiness is an increase in Indonesia, at least three conditions must be considered as follow,

- (i) Strong infrastructural foundations provide reliable and widespread connectivity, allowing individuals and organizations to access digital platforms.
- (ii) Data and information are the key drivers of digital services. It can help data-driven AI technologies learn, grow, and expand.

- (iii) The right enabling regulatory and policy frameworks can support the growth of a national AI value chain, thereby creating a healthy and sustainable AI ecosystem.

The modern medical system is very clear about limiting medical responsibility. Doctors must assume responsibility if they make diagnoses and treatments that are fatal. If the diagnosis of AI is wrong, and the doctor joins the inappropriate therapy according to the recommendations of AI, "is this the doctor's responsibility or the algorithm's responsibility?". There is growing potential risks that AI technologies might pose. As a result, questions are being raised about the legal and regulatory governance of AI. Such technology development can be made for prudence, patience, and a continuing embrace of permissionless innovation as it pertains to modern digital technologies. Permissionless innovation refers to the idea that experimentation with new technologies and business models should generally be permitted by default. Unless a compelling case can be made that a new invention will bring serious harm to society, innovation should be allowed to continue unabated, and problems, if they develop at all, can be addressed later. Policymakers initially may be tempted to pre-emptively restrict AI technologies out of an abundance of caution for the perceived safety, welfare, and market risks these innovations might seem to pose. It can be adequately addressed without needlessly quashing a potentially revolutionary new industry before it even has the chance to develop. In general, policymakers should embrace a vision of permissionless innovation to enjoy as many benefits from innovation as possible.

5. CONCLUSION

In the health sector, AI technology can help with diagnosis, prognosis, and treatment. The application of AI technology had begun to be launched in various industries, more research and application of AI will inevitably be carried out after the pandemic. At present, the adoption of AI technology in Indonesia's medical industry as a support for medical service providers in making decisions will be more appropriate and useful. Thus, doctors still play a role as the final decision-maker. Long before the pandemic, AI's existence had been recognized because it had the potential to contribute to the discovery of new drugs. In the case of COVID-19, several research centers focused on finding a vaccine against COVID-19. AI can speed up discovering new medicines and vaccines by predicting and modeling viral information structures that can help develop new drugs. However, another issue that needs to be considered is regulation. AI technology will be difficult to develop further without the approval of the relevant regulators. If AI implemented without due care for ethics and safety, AI in public services could be at best ineffective, and at worst, very dangerous. The purpose of assessing and scoring governments' AI readiness is not to create or fuel a global race for AI. Instead, it helps policymakers everywhere see where they are performing well and in which areas they may wish to target their attention going forward.

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