

# How Can Artificial Intelligence Reshape Health Governance in Post Pandemic Era?

Maratun Saadah<sup>1,\*</sup> Sayuti<sup>2</sup> Dedeck Kusnadi<sup>3</sup>  
Agustiyara<sup>4</sup>

<sup>1,2,3</sup> UIN Sultan Thaha Saifuddin Jambi

<sup>4</sup> Universitas Muhammadiyah Yogyakarta

\*Corresponding author. Email: [saadahalfikri@gmail.com](mailto:saadahalfikri@gmail.com)

## ABSTRACT

We live in a time when our institution seems to lack the capacity to deal with uncertainty and change; for example, the COVID-19 pandemic has tested Indonesian institutions for the past year. It is clear that the Indonesian government is not prepared, one pointing the finger at others for responsibilities. Not to mention the vagueness of authority between the local and central government in managing the pandemic. The pandemic has exposed the healthcare system's weaknesses. The overwhelm within society is genuine. This research aims to analyze the potential use of Artificial Intelligence (AI) to reshape the governance in the healthcare system in this post-pandemic era. AI can help related stakeholders to perform their role toward better health governance. This research used the qualitative method of which the primary data were collected through literature review. This study indicated that governance does matter in the post-pandemic era; countries with high governance index are exhibiting a better response and results in coping with the pandemic than poorly governed countries. The presence of AI can help to shape and strengthen health governance with nine consciousnesses of AI.

**Keywords:** Artificial Intelligence, Health Governance, Health System, Post Pandemic.

## 1. INTRODUCTION

The world is currently facing unprecedented challenges caused by the saga of coronavirus disease (COVID-19). Since being declared a global pandemic in March 2020, COVID-19 has brought a dramatic loss to people's lives worldwide. The pandemic presents tremendous challenges from the health sector, economy, and food distribution. For more than a year, the coronavirus has infected more than 183 million people globally, with a death toll of 3.9 million people. Pandemic gives a collapse impact, and governments around the world are reeling from the pandemic aftermath. The pandemic has prompted a wide range of government responses to battle against the impact the pandemic has caused. One of the crucial demands is technology adaptation in a government system.

Artificial Intelligence (AI) is among the subjects that have found great applications in tackling the problem in many aspects. Artificial Intelligence has brought significant changes to society, making the environment and values in society more diverse and complex [1]. Digital transformation has brought society to the era of society 5.0, and this opportunity must be used for all aspects of life, including the health sector.

Indonesia is currently struggling to cope with the second wave of COVID-19 infections, putting it on the edge of the crisis [2]. Over 2.3 million cases have been reported in Indonesia so far, with a record that the government predicts could exceed 50,000 cases daily. This number became the highest in Southeast Asia, making Indonesia the new epicenter for the pandemic in Asia. Report from April 28, the government's official count of positive cases

surpassed 9,500 after tests were performed on 62,000 people, less than 0.02 percent of the total population. The country has recorded 773 deaths, including more than 40 doctors and nurses [3]. This number is the third highest daily case number globally, while the testing rates are among the lowest globally, which is hugely concerning. Currently, oxygen supplies are running low, hospitals are overflowing, and Indonesia is still weeks away from the peak [4]. The government also acknowledged the presence of over 213,000 suspected cases waiting to be tested. Indonesian citizens are banned from entering several countries, such as Singapore [5]. The Indonesian government may not be able to cope with the rising numbers of patients requiring hospitalization. These conditions pushed Indonesia's health system to collapse.

The paralysis of the health system shows the weakness of governance in the health sector in Indonesia so far. The question then is, who is the one to blame for these conditions? We do have a government, and indeed they are responsible for public issues such as a pandemic. The government's policies have been under the spotlight since the beginning. Some believe that low containment measures surged the death toll. However, public problems need 'the public' to solve the problem, thus why participation from all societal actors is a must. Virus control policies in the health sector are not always followed by compliance from the public or other actors such as the private sector and support from, for example, the mass media [6]. Undeniably, the sequence of denial and reluctance from society contributes to setting the curve high. In the study of public administration, this phenomenon is known as a paradigm shift from government to governance, marked by the participation of various stakeholders [7].

The pandemic has exposed the disparities in governance practices around the world. States with a high rank of governance index show better response toward pandemic than poorly governed nations [8]. States like Germany and Nordic countries performed excellently in various governance dimensions in handling the pandemic. When most states with rich natural resources perform weak governance standards, and a weak health system is one of the issues.

Health system weakness will not be solved by the government alone. The World Health Organization defines governance in the health sector as a broad range of steering and rule-making responsibilities carried out by governments and

decision-makers to achieve national health policy objectives. It also refers to public health governance where the action to pursue health is integral to well-being through both whole-of-government and whole-of-society approaches. Identification of the involvement of actors in the post-pandemic era toward the health system is very important to describe the participation of actors in dealing with uncertainty as a result of the pandemic. Information technology applications such as Artificial Intelligence in government can help enhance citizens' trust in government [9], which is important to address in handling the pandemic. Additionally, AI is game-changing to shape governance in the health system in the post-pandemic era through the public policy process.

This paper goes into detail about the potential use of AI to reshape governance in the health system in the post-pandemic era. AI can help related stakeholders to perform their role toward better governance.

## 2. METHODS

The object of this research focuses on Artificial Intelligence application toward shaping Indonesian health governance in the post-pandemic era. This research is built upon previous research on how AI can help health governance respond to the pandemic better. Schaar et al. explain how AI can help the healthcare system respond to COVID-19 [10]. In comparison, Zhu et al. describe the function of AI to help the government respond more effectively to serious health emergencies such as the pandemic [11]. Nevertheless, both articles neglected the fact that health issues do not stand alone. Health is a system. Thus, it involves many stakeholders, which is why it is an urgent call to capture the health system from governance. Therefore, this research is trying to capture what artificial intelligence can do to maximize governance actors' performance in the health system.

This research uses a descriptive qualitative study; this was conducted to identify new information [4]. The type of research based on its implementation is development research to develop practical models or formations. The primary data collection through structured or unstructured interviews and observations, qualitative interviews can be seen as partners in participant observation, where researchers try to identify and see the reality [5]. To support primary data, the author gathered various sources such as the news from the media, government regulations, awards, and assessments from related

stakeholders, to use as material to support the research analysis of this study.

### **3. RELATED WORKS**

Discussion about Artificial Intelligence application has been widely reviewed by researchers worldwide with the growing trend of interest in AI for the public sector [12]. Public sector dependency on technology began with the rise of the Smart City initiative, followed by the strengthening effort of its pillars, one of which is smart governance [13][14][15][16][17]. Other sectors influenced by the development of AI are the public health sectors, particularly during the pandemic. The use of artificial intelligence to cope with pandemics are wide and varied. It ranges from the economic sector [18], education [19], media, and news in controlling fake news about the pandemic [20]. AI technology has been broadly used to detect various diseases in the health sector, including covid-19 symptoms [21]. AI is important for data sharing in order to detect emerging outbreaks with novel symptom patterns, monitoring data in order to combat covid-19 spread [22], tracing efforts such as developing smart cameras [23], disease modeling [24], and also for prediction and patient management [25]. Although many interesting works apply AI in handling the problems that the pandemic has caused, as mentioned here, there are still many areas that can be explored. This pandemic has provided a challenging test for AI to prove its practicality in unprecedented real-world problems [26].

**Table 1. AI for the Health Governance and Application of Artificial Intelligence in Health Sector.**

Authors	Definition
M. van der Schaar et al., 2021	<ul style="list-style-type: none"> <li>AI can help the health system in its important challenges: managing limited health resources, developing personalized patient management and treatment plans, and enabling effective collaboration by informing policies.</li> </ul>
Yigitcanlar et al., 2020	<ul style="list-style-type: none"> <li>Although the tools used to govern have yet to be cataloged, measurements can be linked based on governance dimensions or their potential to build specific interactions between actors.</li> <li>Control, coordination, collaboration, and communication are tools used to enable better governance in the health system.</li> </ul>
Barbazzza & Tello, 2021	<ul style="list-style-type: none"> <li>AI adoption can effectively solve and prevent the transmission of the COVID-19 virus.</li> <li>AI can improve the government's ability to respond to emergencies in the health sector, as well as level to respond to major public health emergencies, and also raise the public's opinion toward the government.</li> </ul>
Bullock, 2019	<ul style="list-style-type: none"> <li>AI strongly influences discretion and decision-making</li> <li>AI can help improve the overall quality of administration.</li> </ul>
Androutsopoulou et al., 2019	<ul style="list-style-type: none"> <li>AI can Improve communication between citizens and the government.</li> <li>Leveraging data from government agencies with natural language processing, machine learning, and data mining technologies developed new digital channels for communication.</li> </ul>

- |                              |   |
|------------------------------|---|
| Zhu et al., (2021)           | <ul style="list-style-type: none"> <li>AI adoption can effectively solve and prevent the transmission of the COVID-19 virus.</li> <li>AI can improve the government's ability to respond to emergencies in the health sector, as well as level to respond to major public health emergencies, and also raise the public's opinion toward the government.</li> </ul> |
| Bullock, 2019                | <ul style="list-style-type: none"> <li>AI strongly influences discretion and decision-making</li> <li>AI can help improve the overall quality of administration.</li> </ul>   |
| Androutsopoulou et al., 2019 | <ul style="list-style-type: none"> <li>AI can Improve communication between citizens and the government.</li> <li>Leveraging data from government agencies with natural language processing, machine learning, and data mining technologies developed new digital channels for communication.</li> </ul>  |

#### **3.1 Artificial Intelligence Capacity**

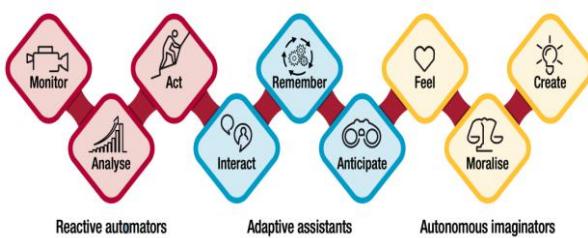
AI is a technology that can think humanly, act humanely, think rationally, or act rationally. John McCarthy first coined the term AI itself and Marvin Minsky at the Dartmouth Summer Research Project on AI in 1956 [27]. At the same event, they agreed on the proposal that every aspect of learning or any other feature of intelligence can be so precisely described that a machine can be made to simulate it' [28]. Later on, Marvin Minsky introduced technical approaches in overcoming the problem of AI limitations [29], and there the optimism on AI continued. AI then experienced rapid development at the end of the 1980s [30]; in 1988, AI development was used in various sectors starting a century after that [31].

Despite the reality that artificial intelligence has been a major topic for many years, there is no broadly recognized literature definition. AI is the ability of a system to identify, interpret, make inferences, and learn from data to achieve predetermined organizational and societal goals [32].

AI aims to reach any area of human activities to reduce the efforts of people related to boring daily jobs [33]. The application of AI has provided efficiency due to automation which makes work more efficient, and AI is helping humans read and process data into decisions.

Capgemini structures the nine levels of consciousness into three evolutionary stages; reactive automation, adaptive assistants, or autonomous imagination. Like the human brain, AI is also multi-layered (in humans, different brain components have

different functions for speech, memory, etc. [36]. AI can incorporate different levels of consciousness to fulfill different functions. Based on nine different consciousness levels, Capgemini Consulting defines AI as a technology that allows digital systems to monitor, analyze, act, interact, remember, anticipate, feel, moralize and create [36].



**Figure 1. Nine consciousness levels along with AI's evolutionary path**

Source: [36]

This paper focuses on the use of AI in health governance; hence, the authors will emphasize the nine consciousness of AI to maximize the potential benefit of AI for governance.

### 3.2 Health Governance

The concept of governance has become a watchword in social science studies for the last two decades [37]. Although there is still debate on the theoretical conceptualization of the term to date [38]. The governance journey cannot be separated from the paradigm shift from Weberian to the New Public Management and end up to the New Public Service. Bevir [39] defines governance as a transformation in the government which includes at least change in state activity from laws and commands to negotiation and diplomacy and the incorporation of non-state actors into the policy process, greater levels of public involvement in decision-making, and a reliance on more reflexive and responsive modes of public policy. The question then arises how to govern the health system, particularly in a post-pandemic situation. Commonwealth Health Hub describes health governance as the actions of governments and other actors to steer communities, whole countries, or even groups of countries in the pursuit of health as integral to well-being through whole-of-government and whole-of-society approaches [40].

There are several approaches related to public

health governance. A substantial number of studies have discussed the various concepts of health governance, although there is still conceptual chaos caused by the lack of consensus on the nomenclature, models, and measures for health governance [41]. There is an absence of consistent, evidence-based tools available to assist health system stewards in fulfilling their responsibilities [41].

The Commonwealth Health Hub develops health governance into six (6) indicators, including public health legislation, policy process, strategy, financing, organization, and quality assurance. Nevertheless, the governance paradigm has emphasized the role of social actors in making and implementing the policy, especially the role of networks [42]. Starting from this argument about governance, at least there are two points of view; one style emphasizes the need to improve service delivery quality, organizational management, and democratization of the services. Another style emphasizes the need to coordinate participation of the public in the political process. Thus, to capture the approaches of health governance, this paper will be built based on these two arguments.

Accordingly, Barbazza and Tello [41] developed various tools to govern health governance based on their literature review work. Even though various tools can be identified in the literature, they have aligned two tool types to distinguish two different orientations of governance. One is the tools that enable carrying out governance functions. The other one is a tool that enables the relationship of networks among stakeholders. Accordingly, the authors propose a perspective to govern the health system in the post-pandemic era by bringing together the two concepts of health governance. This paper will focus on the six sectors of health governance developed by Commonwealth Health Hub and two governance orientations of Barbazza and Tello that target governance function and target the form of relationship among stakeholders.

## 4. FINDING AND DISCUSSION

Indonesia's health system is on the verge of collapse due to the COVID-19 outbreak. Hospitals across the archipelago are running out of beds, oxygen, medicines, and even staff. The Indonesian government has enacted several policies in order to combat the virus. However, over the pandemic's first year, the number of cases has fluctuated. The capacity of the country's healthcare system to absorb and accommodate varying healthcare demands must be assessed.

In general, healthcare systems are not prepared to fulfill the needs of large-scale calamities like pandemics [43]. Even high-income countries' healthcare systems have been overburdened [2]. The Indonesian government must indeed ramp up the nation's health system capacity. However, the pandemic has exposed more than just the capacity of the health system and all societal actors. Pandemic shows how society reacts, responds, adapts to the dramatic change it brings. This paper provides an analysis of the shape of Indonesian health governance, capturing how the government and the whole societal actors deal with the pandemic better with the help of Artificial Intelligence Capacity.

#### **4.1 Public Health Legislation**

Public Health Legislation (PHL) means how the government does cross-cutting the budget and focuses on COVID-19 handling. The Indonesian government has been reallocating the state budget since the pandemic's beginning through the Minister of Finance Sri Mulyani. The Government of Indonesia stipulates Joint Decrees of the Minister of Home Affairs and the Minister of Finance Number 119/2813/SJ and 117/KMK.07/2020 concerning Acceleration of Adjustment of the 2020 APBD in the Context of Handling Covid-19, as well as Securing Public Purchasing Power and the National Economy (SKB Minister of Home Affairs and Minister of Finance), and Regulation of the Minister of Finance Number 35/PMK.07/2020 concerning Management of Transfers to Regions and Village Funds FY 2020 in the Context of Handling the Covid-19 Pandemic and Facing Threats That Endanger the National Economy (PMK No.35/2020). This regulation instructs all local governments to adjust their APBD to focus on handling COVID. Funds that can be allocated are official travel budgets, meeting expenses, and purchases of non-priority items. Local governments that do not report the APBD amendment report will be given a sanction in the form of delaying the disbursement of part of the DAU or DBH funds. It is done so that the local government is cooperative in reallocating the budget to accelerate the response to COVID-19.

In addition, during the second wave of the pandemic that hit Indonesia, the government established an emergency PPKM followed by a reallocation of the budget. The Central Government increased the budget in the Social Protection, Health, Business Incentives sector and reduced the

budget in the MSME & Corporate Support sector and Government Priority Programs due to efforts to reduce social activities. Another regulation that regulates budget spending during the pandemic is President Joko Widodo's law in March 2020 regarding the flexibility of officials in spending the budget. Many officials cannot be prosecuted civilly and criminally while carrying out their original duties based on good faith. Then the government increased BPJS Health contributions to class I and II participants amid a pandemic with the excuse of maintaining the sustainability of BPJS operations. Underlining things, in this case, is that participants in these classes may have lost their jobs or been economically affected by the pandemic. It is not ethical to increase rates for all insurance participants.

AI capabilities can ensure that budgets will be reallocated to priority sectors for handling COVID. Central and regional coordination can also be carried out more optimally with AI capabilities. The Central Government can easily check local governments that have not reallocated and provide warnings before the deadline set with AI capabilities. AI systems that analyze can process information, detect patterns and recognize trends (e.g., algorithms and Big Data analytics). With 'analyze' Consciousness, AI can process information and detect patterns and also recognize trends. This capability can be used to help local governments reallocate the budget according to the priority scale. Although in the end, there are still voices who insist that the process' automation must also share the blame with the economic and political aspect[44].

#### **4.2 Policy Process**

The governance paradigm requires the active involvement and participation of all societal actors in the public policy process. So then, the policy will be bottom-up rather than top-down. Many studies on the use of AI in the public policy process have been carried out, for example, on how complaints can be directly linked to the ongoing planning provided by related agencies, for example, through the e-planning system.[45].

The policy process also means how the government embeds public health urgency across the policy. Policy adjustments during the new normal, of course, must take into account health aspects, especially those related to controlling the spread of COVID-19. For example, in the tourism sector, the Indonesian government has implemented the CHSE (Cleanliness, Health, Safety, and Environment) procedure for public places and facilities in the

ministry of tourism and creative economy as a pioneer in this regard. The CHSE guidelines reference local government, business associations, and professions related to tourist attractions to formulate policies in the new normal era by prioritizing four aspects of CHSE. Another policy, for example, in the transportation sector during the Implementation of Level 1-4 Community Activity Restrictions (PPKM) is Circular No. 17 of 2021 concerning Travel Provisions for Domestic People During the 2019 CoronaVirus Disease Pandemic, which requires a vaccine card of at least dose 1, as well as a negative COVID-19 PCR test. All of these changes just revealed how the world must deal with the COVID-19 pandemic. AI can help in many sectors of CHSE implementation with the nine capabilities. For example, with 'detect' capabilities, AI can detect crowds in public spaces, and with 'act' capabilities, AI can command the crowd to do physical distance immediately.

In addition, policies on an international scale are equally important. Hence, to answer the challenges of Health in the new-normal era, public health diplomacy is an integral part of the policy process. Indonesian health diplomacy that is currently in the spotlight is in terms of vaccines. The Government of Indonesia has succeeded in initiating the resolution of the UN General Assembly, namely "Global Health and Foreign Policy: Strengthening Health System Resilience through Affordable Healthcare for All." Through this resolution, Indonesia highly emphasizes the importance of accessible and affordable health services to strengthen the global health resilience system and show a joint commitment to tackle the pandemic [46].

Nevertheless, the implementation of Indonesia's foreign policy related to the Covid-19 pandemic is still less significant. Domestic factors, especially the marginalization of diplomacy's position in national crisis management, are obstacles to the performance of the Ministry of Foreign Affairs, in addition to the functional and institutional weaknesses of the Indonesian diplomatic bureaucracy [47].

Hence, it is necessary to carry out a health diplomacy strategy to increase diplomatic capacity by paying attention to changes in diplomacy tools and means that prioritize digital diplomacy. Digital diplomacy, for example, is very beneficial for the formation of a country's image in the eyes of other countries, and AI can make it even more effective and efficient.

### **4.3 Strategy**

Health governance emphasizes strategy in terms of 'Whole-of-society' approaches; again, it means stakeholder engagement. The Whole-of-Society Approach means to consider engaging multi-sectoral stakeholders and facilitate their active participation in the decision-making process to take appropriate measures together. WHO puts a whole-of-society approach, which means government engaging all stakeholders, including the civil society, communities, academia, media, private sector, NGOs, other voluntary associations, families, and individuals, to strengthen the resilience of communities and society as a whole [48]. South Korea, for example, undertook a broader whole-of-society approach, the engagement of all stakeholders in addressing public health issues not only by holding dialogue among the stakeholders but also about the formulation of mutual strategy and program on how the partnership can actively collaborate and stand on carrying out collective work to resolve the crisis and arrest the deadly virus. To achieve it, AI capabilities can help in various ways.

First, AI can sense the pattern of need. AI can analyze what problems and public sentiment are currently discussed on various social media platforms [45]. Second, to develop evidence-based programs, for example, Information on the needs of the Health sector during a pandemic must be available in real-time. People often run out of main Covid-19 drugs at the nearest pharmacy; the government claims this is due to distribution and import problems, which are again related to the government's health diplomacy capacity and embed public health across the policy. Import policy needs to be deducted from taxes/import duties and needs to be prioritized. AI can generate insights fast, allowing government leaders and policymakers to take swift action. By analyzing government capacity, private-sector and society needs at large and social media data, the policy can be generated to anticipate the spread of COVID-19 faster and more affordably than previously possible. Third, the implementation does matter; through automation and near real-time analysis of feedback from the field, AI capability can help get rules implemented more efficiently. Finally, AI tools can help speed up the evaluation of things that need to change by identifying areas where a policy lacks or is vulnerable to fraud.

### **4.4 Organization**

Organization means roles clarification of organizations that deliver public health functions.

Since the very beginning of the pandemic, there has been extreme confusion over authority division in the health sector as an effort to deal with the virus. There was a tug of war on the authority of the central and regional governments in handling COVID-19; both of them have not found the right coordination pattern [51]. Large-Scale Social Restriction (PSBB) Policy through Government Regulation (PP) No. 21 of 2020[52] is articulated differently by each autonomous region [53]. Some regions choose to impose activity restrictions that are assumed to be a lockdown [54], of course, considering decentralization principles [55]. Some other regions interpret PSBB as a policy of 'stay at home' recommendations [56]. AI capability 'interact' and 'remember' can help citizens find 'who is doing what. A chat box for all COVID-19 related info can be used to inform the public about the nearest authorities in the neighborhood. The chat box will automatically direct the public to the relevant agency according to the service they want to access.

#### 4.5 Quality Assurance

The government must ensure quality assurance in accordance with the practice of the 5th Pancasila, namely social justice for all Indonesian people. Quality Assurance can be achieved with transparency and accountability. Medical supply chains have been highlighted as being vulnerable as a result of the pandemic [2]. Specifically, during the pandemic, society needs transparency in vaccine distribution. Fair and equal access to vaccines must be guaranteed since we see there is still a wide gap in vaccine access throughout the country. The large number of people is a challenge for the Indonesian government, along with all societal actors in it. The whole process of vaccination requires a large amount of data that must be handled and maintained in a Cloud that is open to all stakeholders. AI can help monitor real-time details about the vaccine supply chain in remote areas of a country. The government can minimize this problem by using location-based analytics, which can assist in any form of vaccine supply chain problems. For example, the Indian government has launched a start-up challenge to improve the intelligence platform through innovative technology solutions to resolve the problems of the vaccine supply chain.

Another challenge is that limited vaccines require strategic allocation capabilities, AI can help develop strategic ways to distribute vaccines [57]. AI will make allocation of resources like testing kits more efficient, accurate patient risk scores that will

help clinical professionals decide who needs urgent treatment (and resources), and when. There are four main paths for AI activities related to the supply chain and access to medicine [58]. First, AI can choose where and when to ship doses to vaccinate as many people as possible in as little time as possible. Second, in order to model impact and triage, AI can determine which population groups should be vaccinated in which order to bring the pandemic to an end as soon as possible. Third, in supply chain management, AI can keep an eye out for obstacles in the vaccine production and distribution networks. Fourth, AI can keep an eye out for any signs of adverse side effects from the vaccine that was not discovered during clinical trials.

### 5. CONCLUSION

Based on the research result and discussion elaborated in Chapter 4, it can be concluded that no country is prepared for the pandemic. The pandemic has exposed more than just the capacity of the health system but also all societal actors. Since health is a system, thus it involves many stakeholders, so it is an urgent call to capture the health system with the perspective of governance. However, the pandemic has exposed the disparities in governance practices around the world. States with a high rank of governance index show better response toward pandemic rather than poorly governed nations. Health system weakness will not be solved by the government alone. Governance in the health sector is a broad range of steering and rule-making responsibilities carried out by governments and decision-makers to achieve national health policy objectives.

Information technology applications such as Artificial Intelligence in government can help enhance citizens' trust in the government, which is important to address in handling the pandemic. AI is a game-changing way to shape governance in the health system in the post-pandemic era through the public policy process. AI can help in 5 (five) health governance indicators:

1. Health governance requires strong public health legislation; with the AI capability, reallocation of the budget has never been easier. With 'analyze' Consciousness, AI can process information and detect patterns and recognize trends, and this capability can be used to help local governments reallocate the budget according to the priority scale.
2. In a post-pandemic era, AI can help policy processes to embed with public health

- urgency with ‘act’ and ‘interact’ capability.
3. In order to establish a strategic policy process in which governance is relied on, the participation of societal actors is important. AI can help the whole policy process by ensuring transparency and easiness of the policy process to be accessed by the public.
  4. The clarity of roles is everything for citizens in a difficult time like the pandemic. AI can help citizens find the right man in the first place by providing a chat box that is easier and accessible for all citizens.
  5. To provide quality assurance, AI can help in various ways such as for vaccine distribution, related to whose to be prioritized, and where to find vaccine stock.

The major benefits of AI are undeniable. Researchers believe there is a 50% chance of AI outperforming humans in all tasks in 45 years and automating all human jobs in 120 years [34]. However, this causes AI to receive broad criticism from various circles and create new challenges to the existing laws [35]. Therefore, the societal and ethical complexities of these applications require further reflection.

## REFERENCES

- [1] A. Nurmandi, D. Kurniasih, Supardal, and A. N. Kasiwi, *Teknologi Informasi Pemerintahan*. Yogyakarta: UMY Press, 2020.
- [2] Y. Mahendradhata et al., “The Capacity of the Indonesian Healthcare System to Respond to COVID-19,” *Front. Public Heal.*, 2021, doi: 10.3389/fpubh.2021.649819.
- [3] S. Jaffrey, “Coronavirus Blunders in Indonesia Turn Crisis Into Catastrophe ,” 2021. <https://carnegieendowment.org/2020/04/29/coronavirus-blunders-in-indonesia-turn-crisis-into-catastrophe-pub-81684> (accessed Jul. 17, 2021).
- [4] Reliefweb, “Indonesia teetering on the brink as COVID crisis intensifies – CARE staff in Jakarta report - Indonesia | ReliefWeb,” Jul. 07, 2021. <https://reliefweb.int/report/indonesia/indonesia-teetering-brink-covid-crisis-intensifies-care-staff-jakarta-report> (accessed Jul. 16, 2021).
- [5] Y. Lai, “Countries put Indonesia on travel ban list as COVID-19 crisis worsens,” *TheJakartaPost*, Jul. 14, 2021. <https://www.thejakartapost.com/news/2021/07/14/countries-put-indonesia-on-travel-ban-list-as-covid-19-crisis-worsens.html> (accessed Jul. 16, 2021).
- [6] D. Gandasari and D. Dwidienawati, “Content analysis of social and economic issues in Indonesia during the COVID-19 pandemic,” *Heliyon*, vol. 6, no. 11, p. e05599, Nov. 2020, doi: 10.1016/J.HELION.2020.E05599.
- [7] T. K. P. Dang, I. J. Visseren-Hamakers, and B. Arts, “A framework for assessing governance capacity: An illustration from Vietnam’s forestry reforms,” *Environ. Plan. C Gov. Policy*, vol. 34, no. 6, pp. 1154–1174, 2016, doi: 10.1177/0263774X15598325.
- [8] R. Nunkoo, “Governance and sustainable tourism: What is the role of trust, power and social capital?,” *J. Destin. Mark. Manag.*, 2017, doi: 10.1016/j.jdmm.2017.10.003.
- [9] M. Mansoor, “Citizens’ trust in government as a function of good governance and government agency’s provision of quality information on social media during COVID-19,” *Gov. Inf. Q.*, p. 101597, Jun. 2021, doi: 10.1016/j.giq.2021.101597.
- [10] M. van der Schaar et al., “How artificial intelligence and machine learning can help healthcare systems respond to COVID-19,” *Mach. Learn.*, 2021, doi: 10.1007/s10994-020-05928-x.
- [11] L. Zhu, P. Chen, D. Dong, and Z. Wang, “Can artificial intelligence enable the government to respond more effectively to major public health emergencies? —Taking the prevention and control of Covid-19 in China as an example,” *Socioecon. Plann. Sci.*, 2021, doi: 10.1016/j.seps.2021.101029.
- [12] W. G. de Sousa, E. R. P. de Melo, P. H. D. S. Bermejo, R. A. S. Farias, and A. O. Gomes, “How and where is artificial intelligence in the public sector going? A literature review and research agenda,” *Government Information Quarterly*, 2019, doi: 10.1016/j.giq.2019.07.004.
- [13] Z. Allam and Z. A. Dhunny, “On big data,

- artificial intelligence and smart cities," Cities, 2019, doi: 10.1016/j.cities.2019.01.032.
- [14] A. Zuiderwijk, Y. C. Chen, and F. Salem, "Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda," Gov. Inf. Q., 2021, doi: 10.1016/j.giq.2021.101577.
- [15] T. Deng, K. Zhang, and Z. J. (Max) Shen, "A systematic review of a digital twin city: A new pattern of urban governance toward smart cities," J. Manag. Sci. Eng., 2021, doi: 10.1016/j.jmse.2021.03.003.
- [16] G. D. Sharma, A. Yadav, and R. Chopra, "Artificial intelligence and effective governance: A review, critique and research agenda," Sustain. Futur., 2020, doi: 10.1016/j.sfr.2019.100004.
- [17] A. P. Casares, "The brain of the future and the viability of democratic governance: The role of artificial intelligence, cognitive machines, and viable systems," Futures, 2018, doi: 10.1016/j.futures.2018.05.002.
- [18] P. R. Jena, R. Majhi, R. Kalli, S. Managi, and B. Majhi, "Impact of COVID-19 on GDP of major economies: Application of the artificial neural network forecaster," Econ. Anal. Policy, 2021, doi: 10.1016/j.eap.2020.12.013.
- [19] S. J. H. Yang, H. Ogata, T. Matsui, and N.-S. Chen, "Human-centered artificial intelligence in education: Seeing the invisible through the visible," Comput. Educ. Artif. Intell., 2021, doi: 10.1016/j.caeari.2021.100008.
- [20] Y. Madani, M. Erritali, and B. Bouikhalene, "Using artificial intelligence techniques for detecting Covid-19 epidemic fake news in Moroccan tweets," Results Phys., 2021, doi: 10.1016/j.rinp.2021.104266.
- [21] R. Karthickraja, R. Kumar, S. Kirubakaran, L. Jegan Antony Marcellin, and R. Manikandan, "COVID-19 prediction and symptom analysis using wearable sensors and IoT," Int. J. Pervasive Comput. Commun., 2020, doi: 10.1108/IJPCC-09-2020-0146.
- [22] Z. Allam and D. S. Jones, "On the Coronavirus (COVID-19) Outbreak and the Smart City Network: Universal Data Sharing Standards Coupled with Artificial Intelligence (AI) to Benefit Urban Health Monitoring and Management," Healthcare, 2020, doi: 10.3390/healthcare8010046.
- [23] M. Alhasan and M. Hasaneen, "Digital imaging technologies and artificial intelligence applications during COVID-19 pandemic," Comput. Med. Imaging Graph., 2021, doi: 10.1016/j.compmedimag.2021.101933.
- [24] [24] A. C. Chang, "Artificial intelligence and COVID-19: Present state and future vision," Intell. Med., 2020, doi: 10.1016/j.ibmed.2020.100012.
- [25] [25] L. Lan et al., "Artificial intelligence-based approaches for COVID-19 patient management," Intell. Med., 2021, doi: 10.1016/j.imed.2021.05.005.
- [26] M. H. Tayarani N., "Applications of artificial intelligence in battling against covid-19: A literature review," Chaos, Solitons and Fractals, 2021, doi: 10.1016/j.chaos.2020.110338.
- [27] A. Kaplan and M. Haenlein, "Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence," Business Horizons, 2019, doi: 10.1016/j.bushor.2018.08.004.
- [28] [28] U. W. Eisenecker, "Ai: The tumultuous history of the search for artificial intelligence," AI Commun., 1995, doi: 10.3233/AIC-1995-8108.
- [29] M. Minsky, "Steps Toward Artificial Intelligence," Proceedings of the IRE, 1961, doi: 10.1109/JRPROC.1961.287775.
- [30] A. Entwistle, "WHAT IS ARTIFICIAL INTELLIGENCE?," Eng. Mater. Des., 1988.
- [31] S. Harvey and R. Harvey, "Introduction to artificial intelligence," Appita J., 1998, doi: 10.2207/qjjws1943.57.490.
- [32] P. Mikalef and M. Gupta, "Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance," Inf. Manag., 2021, doi: 10.1016/j.im.2021.103434.
- [33] V. Scotti, "Artificial intelligence," IEEE

- Instrum. Meas. Mag., 2020, doi: 10.1109/MIM.2020.9082795.
- Appl., 1991, doi: 10.1016/0957-4174(91)90091-R.
- [34] [34] K. Grace, J. Salvatier, A. Dafoe, B. Zhang, and O. Evans, "Viewpoint: When will ai exceed human performance? Evidence from ai experts," *Journal of Artificial Intelligence Research*. 2018, doi: 10.1613/jair.1.11222.
- [35] W. Barfield and U. Pagallo, "REGULATION OF ARTIFICIAL INTELLIGENCE," in *Research Handbook on the Law of Artificial Intelligence*, 2018.
- [36] et al. Tinholt, D., "Unleashing the potential of Artificial Intelligence in the Public Sector," Capgemini, 2017.
- [37] A. Jordan, "The governance of sustainable development: Taking stock and looking forwards," *Environ. Plan. C Gov. Policy*, 2008, doi: 10.1068/cav6.
- [38] H. Pechlaner, L. Ruhanen, N. Scott, B. Ritchie, and A. Tkaczynski, "Governance: a review and synthesis of the literature," *Tourism Review*. 2010, doi: 10.1108/16605371011093836.
- [39] M. Bevir, *Democratic governance*. 2010.
- [40] Commonwealth, "Governance ,," The Health Hub, 2021. <https://www.thecommonwealth-healthhub.net/governance/> (accessed Jul. 23, 2021).
- [41] E. Barbazza and J. E. Tello, "A review of health governance: Definitions, dimensions and tools to govern," *Health Policy*. 2014, doi: 10.1016/j.healthpol.2014.01.007.
- [42] B. G. Peters, "The Two Futures of Governing: Decentering and Recentering Processes in Governing," *NISPacee J. Public Adm. Policy*, vol. 2, no. 1, pp. 7–24, 2009, doi: 10.2478/v10110-009-0002-0.
- [43] E. W. Barasa, P. O. Ouma, and E. A. Okiro, "Assessing the hospital surge capacity of the Kenyan health system in the face of the COVID-19 pandemic," *PLoS One*, 2020, doi: 10.1371/journal.pone.0236308.
- [44] A. S. Hollander and R. C. Icerman, "Capital budgeting in governments: The feasibility of Artificial Intelligence technology," *Expert Syst.*
- [45] M. Saadah, "Artificial Intelligence for Smart Governance; towards Jambi Smart City," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 717, no. 1, p. 012030, Mar. 2021, doi: 10.1088/1755-1315/717/1/012030.
- [46] H. Wangke, "Diplomasi Vaksin Indonesia untuk Kesehatan Dunia," *Pus. Penelit. Badan Keahlian DPR RI*, 2021.
- [47] I. G. W. Wicaksana, "The Problem of Indonesia's Health Diplomacy in the Age of Pandemic," *J. Glob. Strateg.*, 2020, doi: 10.20473/jgs.14.2.2020.275-288.
- [48] Voice, "The whole-of-society approach to the COVID-19 pandemic | Association for Progressive Communications," Apr. 20, 2020. <https://www.apc.org/en/news/voice-whole-society-approach-covid-19-pandemic> (accessed Aug. 03, 2021).
- [49] Z. S. Ulhaq, R. A. Kristanti, A. A. Hidayatullah, L. N. Rachma, N. Susanti, and A. Aulann'i'am, "Data on attitudes, religious perspectives, and practices towards COVID-19 among Indonesian residents: a quick online cross-sectional survey," *Data Br.*, 2020, doi: 10.1016/j.dib.2020.106277.
- [50] L. Liaropoulos and I. Goranitis, "Health care financing and the sustainability of health systems," *International Journal for Equity in Health*. 2015, doi: 10.1186/s12939-015-0208-5.
- [51] S. Chadijah, A. Suyadi, and T. Tohadi, "Tarik Menarik Kewenangan Pemerintah Pusat Dan Pemerintah Daerah Dalam Penanganan Pandemi Covid-19," *Rechtsregel J. Ilmu Huk.*, 2020.
- [52] "PP No. 21 Tahun 2020 tentang Pembatasan Sosial Berskala Besar dalam Rangka Percepatan Penanganan Corona Virus Disease 2019 (COVID-19) [JDIH BPK RI]."  
<https://peraturan.bpk.go.id/Home/Details/135059/pp-no-21-tahun-2020> (accessed Jul. 02, 2021).
- [53] R. Wadi, "Konstitusionalitas Pemerintah Daerah dalam Menetapkan Kebijakan Lockdown pada Penanganan Covid-19," *SALAM J. Sos. dan Budaya Syar-i*, 2020, doi: 10.15408/sjbs.v7i5.15319.
- [54] N. R. Yunus and A. Rezki, "Kebijakan

- Pemberlakuan Lock Down Sebagai Antisipasi Penyebaran Corona Virus Covid-19,” SALAM J. Sos. dan Budaya Syar-i, 2020, doi: 10.15408/sjsbs.v7i3.15083.
- [55] R. Sulistyanto Luhukay, “Urgensi Penerapan Local Lockdown Guna Pencegahan Penyebaran Covid-19 Ditinjau dari Perspektif Negara Kesatuan,” ADIL Indones. J., 2019.
- [56] F. E. B. Setyawan and R. Lestari, “CHALLENGES OF STAY-AT-HOME POLICY IMPLEMENTATION DURING THE CORONAVIRUS (COVID-19) PANDEMIC IN INDONESIA,” J. Adm. Kesehat. Indones., 2020, doi: 10.20473/jaki.v8i2.2020.15-20.
- [57] R. Kumar and K. Veer, “How artificial intelligence and internet of things can aid in the distribution of COVID-19 vaccines,” Diabetes and Metabolic Syndrome: Clinical Research and Reviews, vol. 15, no. 3. Elsevier Ltd, pp. 1049–1050, May 01, 2021, doi: 10.1016/j.dsx.2021.04.021.
- [58] J. Iyer and T. C. Lefebvre, “Opinion: How AI can push for equitable access to COVID-19 vaccines,” DEVEX, Nov. 18, 2020. <https://www.devex.com/news/opinion-how-ai-can-push-for-equitable-access-to-covid-19-vaccines-98565> (accessed Jun. 30, 2021).