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Review

Big Data and Artificial Intelligence in Policy Making: A Mini-Review Approach

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Abstract: The digitization era in public affairs is increasingly disrupting Indonesia. Governance in Indonesia is forced to implement aspects of digitalization in its public services. Big data and artificial intelligence have been used in other scientific activities that provide colour to governance with various scientific disciplines. This study discusses the use of big data and artificial intelligence in policymaking in Indonesia by focusing on the ability of policymakers in policymaking. The method used in this paper is qualitative research with a literature study approach. We reviewed articles with related themes as many as 25 articles published in the last five years from ScienceDirect. The result of this research is that the dynamics that exist in the implementation of public services require appropriate and fast decision-making, considering that this is a community demand. Therefore, public leaders need to disrupt themselves in public services so that these services can be served quickly by enriching skills in big data and artificial intelligence. In conclusion, the critical aspect of the public policy decision-making process is similar to that of any other stage in the policymaking process. Like the preceding steps in the public policy process, the decision-making stage differs depending on the nature of the policy subsystems involved and the degree of consensus faced by decision-makers. The presence of big data in the public sector cannot be disputed as an intriguing approach, particularly during the policy formation cycle. Also, big data and artificial intelligence can help public leaders make decisions to deliver the best policies.

Keywords: big data, artificial intelligence, policy, and decision-making.

1. Introduction

The new currency of digitization in public affairs is increasingly disrupting Indonesia (Supriyanto et al., 2021). Governance in Indonesia is forced to implement aspects of digitalization in its public services, which is commanded by the Ministry of Administrative Reform and Bureaucratic Reform by building an electronic-based government system roadmap (Kim, 2021). The outbreak of the COVID-19 pandemic has forced all elements of government to implement digitalization as an effective way to maintain distance between humans so that the effects of spreading COVID-19 do not spread out of control (Agustino, 2020). On the other hand, the policy is a scientific action that requires

multidisciplinary contributions to be processed in decision-making (Timur et al., 2021). Policy formulation is different from other policies because it includes an important process to produce several alternatives for solving public problems (Courtney Mustaphi et al., 2019). In this case, big data and artificial intelligence can be a method, tool, or instrument in formulating public policy in decision-making activities—using research results as an instrument for the government in decision-making (Zhang et al., 2022).

Big data and artificial intelligence have been used in other scientific activities that provide colour to governance with various scientific disciplines (Lacam & Salvetat, 2021). This process can be used as an instrument from the main base to show whether the policies implemented will be effective or not. Evidence in public policy is commonly known as an evidence-based policy which comes from the results of a survey or census of the data needed in a policy, such as data on health, education, transportation, and population administration. However, this data can also be taken from the behaviour of social media users (Grewenig et al., 2020; Karaivanov et al., 2021). Here we can use artificial intelligence to manage data taken from social media APIs (Papakyriakopoulos et al., 2018). However, due to the limitations of data infrastructure, the quality of the data produced is not optimal, especially in developing countries (Madsen, 2018). Policymakers can utilize big data from social networks, cloud applications, software, social media, data warehouses, appliances, technology networks, legal documents, online business websites, meteorological data, and sensor data (Merhi & Bregu, 2020). Big data is a social phenomenon that can be used as an instrument and method of analysis in solving public problems. This study aims to discuss the use of big data and artificial intelligence in policymaking in Indonesia by focusing on the ability of policymakers.

2. Literature Review

In terms of digital literacy, the term big data was coined by Fremont Rider, a librarian from the United States, in 1914, before the industrial revolution 4.0. Big data was first mentioned concerning the growing volume of books, the difficulties of storing them, and how to use them as study material. Since social networking sites like Facebook, Twitter, Line, and Instagram began to light the digital globe, the era of big data started to become a fierce debate once more (Simonofski et al., 2021). Users of the internet are not simply consumers of available data but also producers of that material. Big data can reveal a pattern or shape that shows new information (Drosou et al., 2017). When this data issue covers how this data is placed and located and how this data might be employed and valuable for the benefit of human advancement, this significant data phenomenon becomes increasingly appealing to debate. The government uses big data to speed up the implementation of government activities. Big Data's advantages in government can be applied to government initiatives, empowering citizens and increasing openness and involvement among all stakeholders (Taylor, 2017).

With multiple government organizations, Big Data in the government system can develop a variety of speedier, more accurate, and less expensive policies. Big Data organizes information using an analytical approach, resulting in more structured outputs. Big Data plays a vital role in government and public services because it uses data analytics to translate external data into information. Then, using that data, create a policy that will aid government performance. Using Big Data technologies, the government can accomplish some goals. First, the rise in government performance is due to the increased efficiency of using Big Data, which reduces traditional work. The utilization of big data may also be a solution to government financial issues. The funding process may be streamlined and made more effective by utilizing Big Data. It is envisaged that improved government performance will positively impact the country's survival and people. The government may use Big Data to convert data into information quickly, precisely, and cheaply to develop policies that meet the requirements of its citizens. Second, incorporating Big Data into the administrative system can result in more revenue for the state. The utilization of Big Data will minimize the pressure on infrastructure, allowing the government to spend less money. These data will be analysed with the help of Big Data technology. It will also be beneficial in various government areas, including export-import, agriculture, trade, and even tourism, all of which contribute to increased state revenue. The third advantage of employing Big Data in government is the data's transparency. It will be highly beneficial for the public to have more transparent access to government data to realize Open Government, which will boost public trust in the government.

The 4.0 industrial revolution is connected to artificial intelligence and autonomous robotics in terms of technical literacy. Artificial intelligence is a method of simulating human intellect in computers so that they can match human intelligence. Humans are aided in dealing with a variety of challenges and complicated environmental occurrences by Artificial Intelligence. An autonomous robotic can-do task without the assistance of humans. These robots can assist humans in various scenarios, including on land, in the air, and at sea. Artificial intelligence can help the government organize and speed up public services. Fake intelligence implementation is a type of service transformation that incorporates e-services, community monitoring, and a more vital innovation environment. Artificial intelligence in public services can be used at the service unit's help desk, to analyse service complaints, route complaints to the appropriate agency, and even respond to objections. In this fast-paced environment, it is critical to accelerate the use of artificial intelligence and support the state's civil service. Technical labour, such as administration and data processing, formerly done by hand, may now be done more efficiently and in less time by leveraging technology. To provide integrated and

high-quality data and information, artificial intelligence is applied. It can be used for document processing in government administration, such as speech recognition and text or script.

Improving service quality through technology also removes bureaucratic roadblocks, allowing the government to be more flexible and make decisions more rapidly. The establishment of service standards and the following business processes are the keys to the government bureaucracy's length and breadth. By treating the community as a subject rather than an object of service, the government can deliver the best service possible through the bureaucracy. It is intended that by taking this approach, public trust in the bureaucracy will be established and strengthened. We can observe that artificial intelligence (A.I.) in the e-commerce, logistics, banking, and financial industries is still limited. The recently developed National A.I. Strategy will be critical in promoting economic development and public services. A Presidential Regulation (Perpres) on Indonesia's strategy in the use of artificial intelligence in all aspects, including A.I. talent development, Ethics, and A.I. policy studies, A.I. Infrastructure and Data, A.I. Industry Research and Innovation, as well as Priority and Quick win A.I. implementation, will be strengthened by the Artificial Intelligence National Strategy.

Robotics, artificial intelligence (A.I.), nanotechnology, quantum computing (quantum computing), biotechnology, internet of things (IoT), industrial internet of things (IIoT), fifth-generation (5G) wireless technology, additive manufacturing/3D printing, and the fully autonomous vehicle industry were among the technological breakthroughs of the fourth industrial revolution. Artificial intelligence, sometimes known as A.I., is an area of computer science that promises to provide many benefits in the future by responding to human requirements (Li et al., 2021) For example, in the health industry, A.I. is now being used to assist in developing a Covid 19 vaccine (Corona Virus Disease 2019), which has a 90% success rate in detecting persons infected with COVID 19 (Kurniawan et al., 2021). As an accelerator, facilitator, and regulator of Indonesia's digital transformation, the Ministry of Communication and Information will, of course, continue to contribute to increasing the use and adoption of A.I. technology in a prudent, thrifty, and trustworthy manner while adhering to the national identity, through three strategic steps. The three strategic tasks are setting and creating digital talent capable of A.I. technology, facilitating ecosystem development, and preparing legislation and governance.

3. Materials and Methods

Using a library research approach, qualitative research methods become the approaches used in this study by examining books, national and international journal articles, and research papers on big data and artificial intelligence in policymaking. Secondary data was employed in this study, such as e-government evaluations, service levels, and public participation in government services. We conduct a review analysis of papers relevant to this issue using data from articles on ScienceDirect and the Web of Science (WoS). Twenty pieces from renowned international magazines were reviewed.

4. Results and Discussion

4.1. Policy Making in Public Policy

The sound characteristics of good public policy, including validity, importance, usefulness, novelty, and practicality, must be considered while making decisions in the creation of public policies. The reality in the context of public policy analysis refers to the logical derivation of conclusions that lead to the resolution of problems and the identification of policy-goal relationships. The link between theoretical and policy interests is essential in the context of excellent public policy. The usefulness of a policy plan is determined by its benefits and the extent to which it may be implemented and adapted by various organizational environments. Originality stresses the novelty of previously implemented policies, whereas feasibility illustrates how well these policies can adapt to changing circumstances, issues, and general requirements. These five aspects are crucial in the policy development stage of the decision-making process. As a result, decision-making procedures continue to evolve to meet all of the requirements of excellent public policy.

The traditional technique of decision-making was incremental initially. The gradual procedure is a decision-making method that considers existing policies and makes slight changes compared to earlier policies (Wijaya & Camba, 2021). If they ignore pre-existing policies, decision-making to tackle public concerns will create new problems. As a result, the incremental method avoids creating new difficulties by making decisions that do not deviate significantly from existing policies. However, some argue that the comprehensive approach will be unable to adapt to the evolution of current public problems due to problems and the environment that will continue to evolve rapidly. For example, in the United Kingdom, residents gradually implement health policy (healthcare) while waiting to establish the National Health Service (Syaharuddin et al., 2020).

The participative technique is another strategy that is commonly utilized in the decision-making process. Because it prioritizes the fulfilment of overall goals, participatory differs from other tools or methods. By promoting accountability, openness, and community action, this technique stresses the involvement of many individuals or groups in the formulation of a policy (Courtney Mustaphi et al., 2019). The government (top-down) or community movements (bottom-up) can both launch this participatory technique (bottom-up). External organizations can be involved in this strategy as

long as the external organization's goals are aligned with the challenges to be solved. In policymaking, the participatory method is also known as the democratic deliberative approach. The post-disaster recovery stage in Bantul, which applies the idea of fairness to every disaster victim, is an example of participatory decision-making. The government and the community believe that providing aid to catastrophe victims is based on the capacity of the victims' resources rather than the type of harm they have sustained.

Along with the growth of the deliberative approach in the decision-making process, experts have voiced some concerns regarding the approach's application's flaws (Corredor, 2020). The meditative practice is thought to have several drawbacks, the most notable of which is the high level of external involvement and political interest in the development of public policy (Zhang et al., 2022). Various organizations with various interests will be presented during the deliberative process to disrupt the decision-making process. The presence of these distinct groups will generate group polarization, enhance the possibility of conflict, and obstruct decision-making. Applying the deliberative approach necessitates considerable resources, ranging from individuals to relatively significant sums of money. As a result of these constraints, the public sector began to explore additional ways to improve decision-making efficiency. The use of research in decision-making was then developed into an option chosen because it benefits the public sector.

The use of research is also one of the decision-making methods and has been growing until now. Decision-making in public policy that considers the research results is the closest method to the term good elements of good public policy. Decision-making based on research will have strong validity and good theoretical and policy interest relations because theoretical tests in the analysis support it. Decision-making using research will also help develop alternative problem-solving because of the evolving nature of research. Therefore, the research approach is still often used today. Research adaptations in the decision-making process are also increasingly diverse. The method most frequently used by the public sector is a survey.

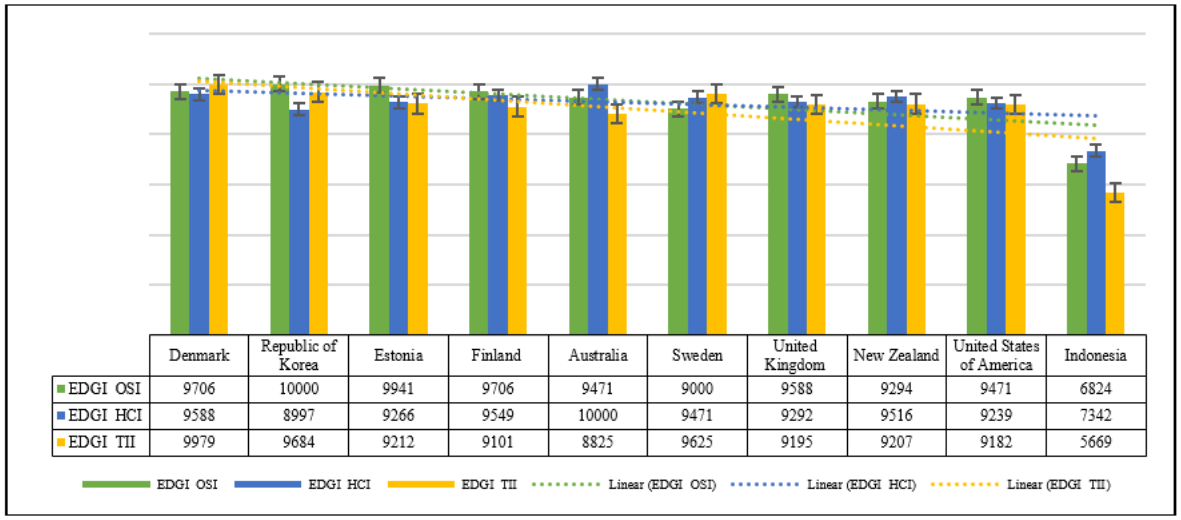
The survey method is the most common in the public sector to analyse each target community's opinions, perceptions, and behaviours. The survey method is also widely used in research and is associated with the decision-making process in public policy. The survey method is carried out to test or evaluate pre-existing policies to test the effectiveness of health policies in several countries. The survey also prioritizes decision-making through an evidence-based policy approach by prioritizing policy accuracy based on actual conditions in the field. However, this survey method requires extensive resources and a long time, whereas policy formulation requires strong evidence and urgency to anticipate dynamic environmental changes (Falcone et al., 2019). Departing from this condition, various institutions then began to look for fast and appropriate decision-making methods with attention to efficiency for the public sector (Yalcin et al., 2022). Ways of making efficient decisions but right on target are then increasingly being developed. Big data is finally here by offering efficiency and accurate analysis of public problems. Big data has various advantages in today's digital era by providing accurate results and more efficient resources (Awan et al., 2021). This approach can also make it easier for users to process large and diverse information. Therefore, big data is finally increasingly being used in public and private sectors to make decisions.

The utilization of big data is sometimes seen as an example of data-driven policy in action (Yang et al., 2021). Big data has altered the approach to decision-making from evidence-based to data-driven policy by allowing for more effective and measurable policymaking (Hasan et al., 2021). The data-driven policy can establish data-centric policies by developing a strategy that integrates data and evidence into a single holistic vision (Yu et al., 2021). The data-driven policy allows for more complete and detailed storage and retrieval of input, output, productivity, and process data than earlier techniques. The data will be integrated into a system that can leverage the resharing and reuse process to make all of the data available to other systems. The data-driven policy is thus seen as a promising strategy since it can provide high validity accuracy, which past techniques have not been able to provide. Several institutions, ranging from international organizations like the Organization for Economic Cooperation and Development (OECD) to governments in a country like New Zealand's Prime Minister and Cabinet, have begun to use a data-driven policy approach to make better policies based on data and evidence.

4.2. Policy Making with Big Data and Artificial Intelligence

Governments all across the world have tried and failed to give e-government services to their citizens (Purbokusumo & Katangga, 2021). One of them is through the e-government media portal, which serves as an integrated service centre for residents and businesses to execute transactions with the government without dealing with them face to face. As a result, e-government implementation has emerged as a critical technique for improving administrative governance and public services efficacy and efficiency in the current state of affairs (Kandt & Batty, 2021). However, overcoming the hurdles of e-government adoption will take more than a few months and will necessitate an integrative architectural framework approach to putting government information and services online. Most countries that have launched e-government agendas and set diverse growth methods are aware of this situation. However, the projected outcomes aren't quite as good as they could be. Furthermore, according to the U.N.'s E-government Survey report (2020), 39.5 percent of 133 countries are still at the Low and Middle EDGI levels in 2020 (United Nations, 2020).

Furthermore, Figure 1 displays the U.N.'s Determination of E-Government Development Index, conducted every two years, is based on a combined assessment of three critical aspects of e-government: online service provision, telecommunication connection, and human capacity. Most developed countries, such as Denmark, the Republic of South Korea, the United States, and others, were at the top of the EDGI 2020, according to the results of the e-government study. They used some different systems, platforms, data formats, methods, and protocols. Then, countries with a high-value E-Government Development Index (EDGI 2020) use portal technology to facilitate e-government development implementation, which provides high-quality services to citizens and contributes considerably to their success.



	Denmark	Republic of Korea	Estonia	Finland	Australia	Sweden	United Kingdom	New Zealand	United States of America	Indonesia
EDGI OSI	9706	10000	9941	9706	9471	9000	9588	9294	9471	6824
EDGI HCI	9588	8997	9266	9549	10000	9471	9292	9516	9239	7342
EDGI TII	9979	9684	9212	9101	8825	9625	9195	9207	9182	5669

Figure 1. E-Government Development Index (EDGI 2020)

Source: EDGI United Nations (2020)

The performance of leading countries featured in the top E-Government Development Index is determined by three key elements in the expansion of e-government (EDGI 2020). (Human Capital, Telecommunication Infrastructure, and Online Service) The EDGI dimension catechism is linked to the development of interoperability. The main focus is on e-government and solving the same case, such as providing well-integrated network services, system integration, and activities extending to greater collaboration and integration between institutions. In Indonesia, the use of big data and artificial intelligence in policymaking would undoubtedly necessitate e-Government innovation in decision-making. The essential components are necessary for a company's proper functioning that encourages its innovation have been established based on a literature review. An organization must have (1) resources and (2) innovation-based creativity through technology to implement and manage the invention (Lacam & Salvetat, 2021).

Big data is also regarded as a practical example of a data-driven policy. Big data has perfected the approach to decision-making from evidence-based to data-based policy by providing outstanding and effective policymaking. By establishing systems that integrate data and evidence into a single holistic view, data-driven policies can lead to focused data. Input, output, productivity, and process data may be kept and retrieved more thoroughly and in greater detail with data-based policies than with earlier techniques. Whenever it relates to the data volume, its ability to quickly collect information and provide easy access, especially if the data is public and accessible, makes it a very successful strategy. The enormous demand for data gathering, utilization, and sharing in the digital age is the driving force behind the growth of big data. Digitization (the conversion from analogue to digital) is becoming more popular in numerous industries since it simplifies all aspects of organizational and research management, including planning, analysis, and assessment. Administrative reform, security, public infrastructure, economy and employment, policy modernization, and public services benefit significant data analysis in public administration. On the other hand, comprehensive data analysis must consider the context and other data units for the subsequent decisions to be more accountable.

Privacy and data protection regulations must also be fulfilled. Striking a balance between the socially beneficial use of big data and the possible harm to privacy and other values is crucial in public management. Big data has many advantages, but it also can limit people's freedom. Several government systems are undeniably reliant on substantial data analysis to make decisions. For example, the United States (U.S.) government uses detailed data analysis to judge national security force recruiting (U.S. Army). The U.S. government examines all official, commercial, and social media data to uncover any patterns or information associated with army candidates in the United States. 21.7 percent of applicants have major financial issues, domestic offenses, or drug usage, according to the findings. In addition, to establish a high-performing policy framework, the New Zealand government employs substantial data analysis in every

decision-making process. The New Zealand government has a department that assesses the quality of each policy plan before it is approved. The study is carried out using policy measuring tools that make use of data from a variety of sources.

The agency will be involved in every policymaking process in New Zealand and will assess the effectiveness of every policy plan that is passed. A policy capacity and capability framework, a capability framework, and a quality framework are among the policy testing instruments. Another example is Boston's Road Bump app, which was utilized to assess the smoothness of cars traffic-utilising individual mobile phone motions to collect infrastructure-related data through citizen involvement (Höchtl et al., 2016). The data obtained aids the government in getting preliminary reports for the execution of important policies, notably those about the designation of priority locations for infrastructure improvement. The information can then be used in open policy discussions to determine the best cost-effective implementation strategy. Big data has been proved to have an impact on government policymaking, including the modification of procedural and substantive policy instruments.

5. Conclusions

The critical aspect of the public policy decision-making process is similar to that of any other stage in the policymaking process. Like the preceding steps in the public policy process, the decision-making stage differs depending on the nature of the policy subsystems involved and the degree of consensus faced by decision-makers. When pressured to provide suggestions right away, these decision-makers are unable to perform in-depth research. When confronted with personal and organizational competition, these decision-makers are wholly justified in their desire to become more clandestine. In both everyday life and governmental management, the context determines what is reasonable. The presence of big data in the public sector cannot be disputed as an intriguing approach, particularly during the policy formation cycle. Extensive data analysis in public policy formulation not only delivers efficiency in the public sector (both in terms of money and resources), but also provides a new perspective in the form of openness from a previously closed public sector. The interchange of information between the government and the community and the government and other agencies is more dynamic after the era of big data, as it is now.

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