ASSESSMENT OF ASPECTS OF ARTIFICIAL INTELLIGENCE IN THE PUBLIC POLICY-MAKING PROCESS

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Abstract
The development and use of Artificial Intelligence (AI) has become a widely discussed topic, not only in Indonesia but also globally. The emergence of ChatGPT in 2022 has led to the rapid development and use of AI in various fields, such as medicine, creative industries, academics, and social entrepreneurship. The history of AI development began with the creation of the Enigma code-breaking machine during World War II by Alan Turing. Since then, AI research has continued to evolve, with the Turing Test serving as the basis for identifying the intelligence of an artificial system. The COVID-19 pandemic has also accelerated the development of AI, particularly in the use of big data for diagnosis. The introduction of ChatGPT, a generative AI program, has further increased public interest in AI. The capability of AI to process vast amounts of data give the opportunity to help public administrators in data analysis for policy-making. The government can utilize AI to assist the government in each stage of the policy process. However, as AI technology continues developing, AI still poses some challenges that need to be addressed before its implementation. The government also needs to ensure its preparedness in both infrastructure and organization before fully utilizing the potential of AI technology in policy-making.
Keywords: Artificial Intelligence, public policy, policy-making, administrative

Introduction

The evolution of human life has been dominated by the Industrial Revolution, which has changed the face of the modern world (Sarfraz et al., 2021). Every industrial revolution is marked by the emergence of new technology or machines that are utilized to do human work that is routine, complex, or dangerous (Demir et al., 2019). The first industrial revolution started with the invention of the steam engine. This innovation led to the transition from manual production methods to those powered by steam or water engines (X. Xu et al., 2021), which changed agrarian life and feudal society towards manufacturing processes. This transition included the introduction of coal as fuel and steam locomotives as the main means of transportation (M. Xu et al., 2018). The second industrial revolution occurred after the discovery of electricity. This invention transformed factories into modern production lines that significantly increased productivity and economic growth. The third industrial revolution began in the 1960s

when the use of computers and communication technology in production processes led to automation (X. Xu et al., 2021).

The fourth Industrial Revolution, also known as Industry 4.0, was introduced in 2011. Built on the digital world that brought by the third industrial revolution, Industry 4.0 has a straightforward and similar objective to the other three industrial revolutions, which is to enhance productivity and achieve mass production using innovative technology (Demir et al., 2019). Compared to previous industrial revolutions, the fourth industrial revolution has evolved exponentially, not linearly, and has disrupted nearly every industrial sector in every country (M. Xu et al., 2018). Some of the technologies that widely used in achieving Industry 4.0 are include the Internet of Things (IoT), robotics and AI, Big Data (BD), and cloud computing, along with other supporting technologies like 3D printing, virtual reality (VR), and others. The vision of Industry 4.0 is to bring these technologies together towards smart manufacturing (Demir et al., 2019). The extraordinary event of the COVID-19 pandemic in 2020 is believed to have triggered a leap in the development of Industry 4.0 towards the fifth Industrial Revolution, where BD and AI have transformed the face of industries. One vision that is emerging for Industry 5.0 is "human-robot co-working," where robots and humans will work together, wherever and whenever possible, with the goal of creating a Smart Society or an intelligent society (Demir et al., 2019), or as Sarfraz (2021) refers to it as Society 5.0.

Broadly speaking, each industrial revolution has changed the face of the world through the invention of machines, or robots, which then make it easier for humans to perform their work, thereby increasing work capacity and productivity. This represents a technological transformation event that leads to fundamental changes in how industries function, and these changes have economic and societal consequences (X. Xu et al., 2021).

1.0 Mechanisation (1784)	2.0 Electrifications (1870)	3.0 Automation (1969)	4.0 Digitalization (2011)	5.0 Personalization (2020)
The innovation of steam powered engine.	The innovation of electrical energy.	The rise of electronics, telecommunications, and computers.	Cyber-physical system.	Robotics and AI, bionics, sustainability and renewable resources.
Introduction of industrial production equipment.	Mass production and division of labor.	IT systems.	Internet of Things, connected devices, cloud computing, big data.	Interdependence of man and machine using cognitive computing.
Mechanical production.	First assembly line.	Automated production.	Further automation processes.	Human-robot co-working, bio-economy, mass customization and human's personalization.

Figure 1. The timeline of the Industrial Revolution
(Source: (Demir et al., 2019; Sarfraz et al., 2021)

In 2022, a company called OpenAI introduced the ChatGPT (Chatbot Generative Pre-Trained Transformer) program, a chatbot program created using the Large Language Model (LLM) algorithm model (Mitchell & Krakauer, 2023). The LLM algorithm processes input in the form of natural conversational language and makes predictions for the next word based on what has been seen previously. The launch of ChatGPT which introduced the utilization of AI for the public quickly gained popularity. ChatGPT is a form of generative AI, a distinct form of AI that has the ability to create new content, either in the form of text, images, audio, and/or video (Fruhlinger, 2023). Although not yet fully reliable, generative AI continues to grow exponentially, and disruption has occurred where many industries have applied generative AI technology to their service or production lines (Girasa, 2020). The ability of generative AI to process text requests into answers is the result of machine learning algorithm modeling. Machine learning is a part of AI and is a field of science that trains devices or software to perform a task and improve its capability by "consuming" data and information, allowing it to "learn on its own" over time, without being explicitly programmed (Girasa, 2020). Thus, the program or algorithm allows the machine to evolve as more data is inputted for training.

The capability of AI to process robust data has the opportunity to help public administrators in processing data in public policy process. The Oxford Dictionary explains administration as an 'act of administering', which can also mean 'managing affairs' or 'to direct or supervise the execution, use, or conduct of' (Hughes, 2012). Considering these functions, one of the government's roles as a public administration executor is to manage the needs and issues of the public in serving their needs. To fulfill these functions, the government creates public policies. Public policy is essentially the government's decision to regulate various areas of life within the country (Kurniawan, 2023). In the policy-making process, there is what is called the policy cycle. Jann and Wegrich (Jann & Wegrich, 2007) divide the stages of the policy cycle into agenda-setting, policy formulation, policy decision-making, policy implementation, and policy evaluation. Public government provides a more holistic or comprehensive approach to dealing with issues in society. The decision-making process is carried out in the public domain with an inter-institutional perspective in policy design and implementation. This approach calls for coordination and collaboration between the public and private sectors and has opened up public administration to new, effective ways of meeting public needs (Vignieri, 2020).

In the digital era, with a large variety of information that is growing rapidly in society, both personally and through social media and the internet, it presents new challenges for the government in responding to issues in society. In this industrial era 4.0, almost all sectors, including the energy, traffic, education, health services, environment, fraud and corruption sectors, both public and private sector organizations, produce very large amounts of data (Charles et al., 2022). This very large amount of data, or BD, can be used as material for the government to make policies. The use of BD not only improves the results of the decision-making process, but also increases public values such as security, safety, accountability and transparency (Charles et al., 2022).

Research Methods
The method used in this research is qualitative method. A qualitative approach was used to gain an in-depth understanding of the integration of Artificial Intelligence (AI) in decision-making in the public sector. Qualitative methods allow researchers to explore various aspects related to the use of AI in decision-making contexts, including challenges, benefits, and impacts. A qualitative approach also allows researchers to understand the views and experiences of stakeholders related to the integration of AIs in decision-making in the public sector. Thus, qualitative methods are the right approach to answer research questions related to AI integration in the context of decision-making in the public sector.

Results and Discussion
GPT Basic Capabilities
ChatGPT, which is a breakthrough in generative AI, was created based on GPT-3. Brown et al. (2020) explain that GPT-3 is an autoregressive language transformation model trained using 175 billion parameters. The model was trained to have the following capabilities:
1) *Language modeling and task completion:* the ability to understand language modeling, predict the focus word, complete sentences or paragraphs, or choose among possibilities to complete a text.
2) *Answering questions:* the ability to answer questions without additional information for conditioning.
3) *Translation:* the model's ability to perform language translation from English to several other languages it was trained on previously.
4) *Winograd-Style tasks:* the ability to determine which word a pronoun refers to, when the pronoun is ambiguous in the sentence but not semantically ambiguous to humans.
5) *Common sense reasoning:* the ability to perform reasoning physically or scientifically.
6) *Reading comprehension:* the ability to understand reading material.
7) SuperGLUE: ability in feature detection and matching.
8) NLI *(Natural Language Inference):* the ability to understand the relationship between two sentences.
9) *Qualitative and synthetic tasks:* the ability to perform dynamic calculations, understand new patterns that may not have existed in the training data, or quickly adapt to an unusual task. This includes arithmetic calculations, word scrambling and manipulation, grammar correction, and writing creation.
These capabilities of AI in general can provide three advantages in tasking capability; task scalability, which means that AI is able to process vast quantities of data, task cost where under certain conditions, AI processes are more cost-effective than humans, and task quality where AI in some cases surpassed human in the task quality (Young et al., 2019).

Integration of AI Technology in the Policy Process
Young et al. (2019) describe five problems in the current administrative decision-making; 1) innacurate predictions, 2) inconsistent quality of discretion, 3) bias in discretion, 4) corruption, and 5) high labor costs on the semi-routine bureaucratic tasks. Indonesia is the largest archipelagic country in the world, with more than 300 ethnic groups or ethnic groups (Administrator, 2017). The vastness of the region, cultural

richness, and community character lead to high socio-economic dynamics. To deal with this, with increasing societal interconnection and the rapid flow of information, bureaucracy can become an obstacle in policy making. In this era of Industry 4.0, various areas of national life produce enormous amounts of data, but only a few government agencies can process the potential of such large amounts of data to improve the quality of decision-making and carry out orders to handle public issues and problems (Charles et al., 2022).

AI has the ability to analyze and process very large and complex data. The government's use of applications to receive information and store data from the public gives the government the authority to manage public BD for the public interest. Seeing examples of the use of AI in processing data and information during the pandemic, the government can utilize AI technology in formulating policies and making decisions relating to the public. This is in line with the National Strategy for Artificial Intelligence formulated by the government in collaboration with various stakeholders in 2020, that intelligence technology will be an important component in providing solutions to city governance challenges. Where city problems can be immediately identified in real-time through IoT and understood through machine learning, AI, and others to be able to support taking actions or decisions according to the most optimal solution (BPPT, 2020).

The study regarding the integration of AI in the formulation of public policy is related to the nine basic AI abilities that have been described previously, namely: the ability to understand language modeling, the ability to answer questions, the ability to carry out language translations if necessary, the ability to understand pronouns, the ability o do good reasoning. physically and scientifically, the ability to understand reading, the ability to match features, the ability to understand the relationship between two sentences, and the ability to perform dynamic calculations and create new patterns. In the policy formulation stage, which has also been described in the framework of thought, and based on a general description of the AI learning process (OpenAI, 2023), in simple terms, AI technology at each stage of the policy cycle can be integrated as follows:

1) Agenda Setting

   The purpose of agenda setting is to identify problems and the level of urgency of developing issues. The possibilities for AI integration in this stage are in the steps of:
   a) Data collection and data analysis: AI's ability to collect and process robust data from various sources, with additional options in real-time can help identify major emerging topics and issues.
   b) Problem analysis: formulating what problems and issues need attention.
   c) Carry out predictive analysis modeling: make predictions about possible challenges that may arise.

2) Policy Formulation

   The policy formulation stage is the stage for finding solutions to problems and alternatives. At this stage AI integration can help with:
   a) Analysis of study results and references: AI's ability to understand reading can be used to analyze various research results and large amounts of documents related to problems and provide a summary of potential solutions that can be implemented to deal with these problems.
   b) Create policy simulations: with several alternative solutions that have been selected, AI can help to run simulations regarding the implications of the policy, so that

policy makers, in this case the government, can analyze each of the policy alternatives further.

c) Calculations and pattern making: AI's ability to carry out calculations and understand patterns from existing data, can help the government to identify the most effective combination of policies that can be made.

3) Decision-making

From several alternative policies that have been created, the government must be able to choose a policy that will ultimately be implemented. In the decision-making process, the government must be able to choose based on data and evidence (data-driven policy).

a) Helps in decision making: AI can help policy makers in evaluating existing policy alternatives. With its analytical capabilities, with sufficient data AI can provide input regarding the analysis of the costs and benefits of each policy alternative.

b) Stakeholder analysis: carry out an analysis of the possibility and involvement of stakeholders regarding a policy.

c) Risk analysis: make predictions about possible risks that could occur related to each policy alternative,

4) Policy Implementation

The government is the party that will determine the implementation of a policy that has been decided and taken. AI integration at this stage can be used to help:

a) Monitoring system: AI technology can be used to monitor the policy implementation process in real time. Information from this monitoring can also help policy makers to know the extent to which policy implementation has been carried out and to assess its suitability so that adjustments can be made to implementation if necessary.

b) Resource allocation: assist in optimizing the allocation of existing resources in policy implementation.

5) Policy Evaluation

The policy evaluation stage is a stage to see whether the policies taken and implemented have succeeded in providing solutions to problems. AI technology can be used in:

a) Data analysis: AI can collect data when the policy has been implemented to help policy makers see and know the extent to which the policy is effective in solving problems.

b) Impact prediction: with the data from the implementation results at hand, long-term impacts can be calculated, and help anticipate future challenges and adjustments that must be made if necessary.

An example of the use of AI technology in this case is to increase the efficiency and effectiveness of the realization of a smart city, where the concept of a smart city has begun to be developed in various cities since 2017. The National Policy Strategy for Artificial Intelligence defines a smart city as a city that can manage various city resources effectively. efficiently and effectively using smart solutions, which can be interpreted as a constellation of technology, governance, people and smart data (BPPT, 2020).

Challenges on the AI Integration

Currently AI technology is still being developed and cannot be completely reliable. There are concerns about the integrity of the results from using trains without human supervision. So that in its implementation, human intervention cannot be eliminated. Based on the AI technology processing flow, there are at least three fundamental challenges:

1) Integrity of input data (input):
   a) AI technology relies on input data as the basis for analysis, making the integrity of the data used very important. Readiness in BD infrastructure, data structure, and data quality really need to be considered for integrating AI technology in the public sector. This is especially true if the AI is intended to help formulate policies and make decisions, because if the input data used is wrong, the resulting policies and decisions can also be wrong.
   b) The issue of data confidentiality and security when using AI technology is still a topic of concern. Especially for its use in the public sector where the data used involves personal and sensitive information, there must be a guarantee of confidentiality and security of the data. Data storage infrastructure must be well prepared and planned.

2) Data analysis process: As an algorithm with reasoning capabilities, AI is able to process and carry out analysis according to data rationality and conditioning. However, from a social and ethical perspective, AI as machine learning does not yet have this capacity, so it is necessary to involve humans, in this case, the government and other stakeholders, to ensure that there are elements of justice and ethics that can be accounted for in the resulting policies and decisions.

3) Ethics regarding the results of the AI process: There is a need for clarity regarding the authorized parties who are responsible for the process and results of AI technology analysis, so that the integrity of the entire process has a basis for accountability.

Discussion

In general, the integration of AI in decision-making can have an impact on the effectiveness and efficiency of analysis and decision-making regarding public policy. Not only in city problems and smart city development or public service applications but in various areas of national life. The integration of AI in the policy cycle has enormous potential to assist the government in making data and evidence-based policies, in the public interest. The use of AI technology can also make it easier for the government to carry out analyses and predictions of the impacts and implications of each policy alternative so that it can help to make optimal and inclusive decisions for society. This is in line with Charles, et al.(2022) which states several advantages of using AIs in the public sector, including increasing the effectiveness of decision-making, increasing efficiency and productivity, improving the quality of public services, and can help the government in making better government strategies based on existing data. The integration of AI technology to help the government speed up the decision-making process in dynamic situations in the future is also in line with Indonesia's National Strategy for Artificial Intelligence 2020-2045 which has projected smart cities to realize transparent, accountable, and integrated urban governance (BPPT, 2020). Charles et al.(2022) write down several challenges faced in using AI in the public sector, including the quality and integrity of the data used, data security and confidentiality, data storage infrastructure,

social ethics, and fairness in data processing carried out by AI, limited research and empirical studies, and the possibility of public distrust of the use of AI in formulating policies and making decisions.

Studies show that AI development is still increasing exponentially and shows no slowdown. The increase in AI capacity causes further disruption of industry 4.0 which causes a shift towards industry 5.0. Currently, trains have entered various areas of people's lives, which shows that trains will become increasingly integrated with society and become part of everyday life, not only in Indonesia but also in the world. The government needs to consider utilizing the potential of AIs in the public sector, especially in policy formulation and decision-making, but challenges related to AI technology need to be anticipated first. Alavi et al. (2022) stated that public sector organizations must be careful to consider their readiness to adopt AI and develop a strategy to integrate AI technology capabilities into their organization. There is a need for further studies regarding the readiness of public sector infrastructure and organizations to face the challenges of integrating AIs in the public sector so that the government can utilize the potential of AI technology in policy formulation and decision-making.

Conclusion

In conclusion, the integration of AI technology in decision-making regarding public policy holds great promise for enhancing effectiveness and efficiency across various sectors of national life. This integration can facilitate data-driven policymaking, leading to more informed and inclusive decisions that serve the public interest. However, challenges such as data quality, security, ethical considerations, and public trust must be addressed to fully realize the potential benefits of AI in the public sector. Despite these challenges, the exponential growth of AI development underscores the importance of harnessing AI technology in public policy formulation and decision-making. Public sector organizations must carefully assess their readiness to adopt AI and develop strategies to integrate AI capabilities effectively. Further research is needed to explore the readiness of public sector infrastructure and organizations to overcome challenges and fully utilize the potential of AI technology in policymaking.

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