

The Application of Artificial Intelligence in Policy Formulation (Intelligent Policy Formulation)

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ABSTRACT

Since previous policies have failed to adequately address existing public issues in society and have often created new problems themselves, it is necessary to move towards utilizing new tools, such as artificial intelligence (AI), to enhance policymaking. This article aims to review the characteristics of artificial intelligence to answer the question of why its utilization is necessary in the policy formulation process. To achieve this objective, among 100 articles retrieved from Google Scholar, 30 articles were selected, and subsequently, 10 articles were analyzed using note-taking to identify AI characteristics applicable to policy formulation. Artificial intelligence possesses capabilities such as analytical power, recognition, learning, prediction, foresight, the creation of large databases, and neural networks. By leveraging these features, in addition to existing capabilities, it is possible to achieve more precise and higher-quality policies, thereby enabling intelligent policy formulation.

Keywords: policy formulation, artificial intelligence, characteristics of artificial intelligence

1. Introduction

Numerous failures of public policies have been reported since the advent of modern democracies, with ongoing debates regarding their trends and impacts. However, the reasons for these failures remain unclear. Explanations have ranged from a structured relationship of corruption to human operational errors, yet the problem persists—rendering these policies inadequate and inefficient (Verheij, 2020). Time and again, the process of public policy is questioned in terms of the type of influence policies exert and the extent to which their objectives are achieved. There is widespread awareness that many social

policies, particularly in developing countries, may fail due to prevailing and specific conditions. The partial or complete failure of policies cannot be solely attributed to a binary (dualistic) understanding inherent in their formulation and implementation. Rather, a complex interplay of corruption, lack of proper oversight, and inadequate evaluation underlies these failures, ultimately endangering social advancement and improved living standards. This is because stakeholders themselves are responsible for approving, implementing, monitoring, and evaluating these policies. For a long time, this combination of corruption and human error has influenced governance. When the interpretation of public problems becomes an

impediment, efforts are made to resolve these obstacles on a temporary basis. Consequently, at different times, policies are established that create artificial problems for the future. For example, when there is no appropriate policy regarding housing and construction, various issues may arise during construction, resulting in low-quality buildings being provided to the public—so that even a minor earthquake could trigger a major disaster. In modern public administration, the hasty policy decisions concerning the outsourcing of state-owned enterprises and privatization have transformed the longstanding issue of unemployment into a major crisis for the country. Alternatively, when the population issue was addressed by formulating and implementing policies without future-oriented planning, low fertility gradually became an accepted and prevailing cultural norm, leading to the projection that within a few years Iran will be among the oldest countries in the world (Peykani, 2016). Recently, a law establishing veteran benefits related to voluntary frontline service has been extended to conscripts in accordance with the directives of the Armed Forces' General Staff. The important point is that, 40 years after the war, these benefits and regulations—which were originally granted to veterans 30 years ago—have now been extended to some individuals who served on the frontline (the target population). Imagine that many of these laws and regulations are no longer needed by these individuals, or that they are unable to make use of them, or that they have lost their appeal and legitimacy. These are examples of policies that have been adopted over the years in the country, and it is evident that successful policies have not been implemented—or, in other words, that smart policy formulation has not taken place.

One of the active characteristics of policy formulation is that an established policy directly or indirectly affects people's lives (Alvani & Sharifzadeh, 2013; Pikani, 2016). It appears that if a policy is not formulated correctly, an individual might need an entire lifetime to compensate for the damages caused by an incomplete or erroneous policy. In other words, if policies are not formulated intelligently, they can steer people's lives in an adverse direction—as is evident in many current policies. Conversely, when a policy is formulated intelligently, it not only addresses the real issues of the target community but also has fewer adverse effects on other segments of society. Therefore, the new decision-making system must be sufficiently sensitive and intelligent to identify problems promptly and take

appropriate measures to resolve them (Alvani & Sharifzadeh, 2013; Shekhawat, 2020).

With the emergence of the digital age, technological advances, and the adoption of artificial intelligence, it is assumed that by eliminating human interference—and, consequently, corruption—and by simultaneously enabling faster access through data-driven policymaking processes, the challenges inherent in the policy cycle can be addressed (Hosseini & Yazdani, 2024).

Artificial intelligence (AI) is an interdisciplinary research field that has recently gained significant importance in society, the economy, and the public sector. Advances in AI have attracted the attention of researchers and experts and have provided a wide range of beneficial opportunities for using AI in the public sector (Xudaybergenov, 2023). AI systems are typically designed to simulate or mimic human behavior with the goal of maximizing effectiveness and efficiency while minimizing errors to achieve correct and appropriate decision-making. Accordingly, AI systems are geared toward logical thinking and action, replicating the natural decision-making process of humans (Suryana, 2024). Although artificial intelligence has been explored as a concept in recent years, no comprehensive and universally accepted definition exists (Qian et al., 2024; Ramadhan et al., 2024). Minsky (1985) generally defined intelligence as the ability to solve complex problems (Minsky, 1985). Rosa (2020) defines intelligence as a tool for problem-solving that seeks solutions for issues in dynamic, complex, and uncertain environments (Rosa et al., 2016). Initially, intelligence was conceived as a human attribute—especially as a mental or cognitive capability—so it has been historically human-centered. However, it has been argued that a definition of intelligence cannot be overly human-centric to the point of rendering a non-human definition impossible; thus, an intelligent being need not resemble a human in every aspect (Ghasempour & Safaei, 2024; Hakim & Ebrahimi, 2024). Artificial intelligence is conceived as computer systems that, in specific ways, resemble the human mind, even though computers and the human mind cannot be identical in every respect. From a theoretical perspective, AI should not be equated solely with computer science (Wang, 2023; Xudaybergenov, 2023). Wang (2019) describes AI as a fully controlled agent with an information processing system that operates with insufficient knowledge and resources in order to adapt to its environment (Wang, 2019). Monett et al. (2020) favor Wang's definition over others, suggesting that intelligence is the capacity of an

information processing system to adapt to its environment despite insufficient knowledge and resources (Monett et al., 2020). Wirtz et al. (2018) point out that in AI—given characteristics such as mimicking thought and learning—efforts are made to achieve solutions that offer greater capability and efficiency for problem-solving to enhance performance. They also propose an integrated definition of AI whereby an AI program is seen as a fusion of AI technology within a computer program that involves human-computer and data interactions to exhibit intelligent behavior similar to human attributes such as perception, action, and learning (Wirtz et al., 2018). Rosa et al. (2016) introduce AI as a program capable of learning, adapting, being creative, and solving problems (Rosa et al., 2016). AI can learn and replicate a wide range of human cognitive functions, or it can act as a form of labor that performs related activities at greater scale and speed; it is also capable of executing high-level operations—even surpassing human abilities in some tasks (Verheij, 2020; Zheng et al., 2018). Thierer et al. (2017) describe AI as systems created by humans that can be delegated some of the authorities normally reserved for humans—and which may, in the future, be entrusted with even more authority (Thierer et al., 2017). Ultimately, Wang (2019) notes that there is no complete practical definition of AI, and consensus is not expected to be reached soon. The choice of the term “artificial intelligence” remains at the discretion of each researcher, although it should be clarified when discussing outcomes and implications (Wang, 2019). Intelligence is the ability to cope with complexity by constructing models tasked with controlling that complexity (Bach, 2020). Technology expands opportunities, and policymakers must keep in mind the diverse and rich possibilities provided by AI. The boundaries of AI are continually shifting and evolving (Thierer et al., 2017). Adopting AI-based policy—by establishing appropriate mechanisms and facilitating exchanges among various actors—assists the government (Verheij, 2020). Governments and companies must make countless decisions in the pursuit of their missions and objectives. The characteristics of AI enable them to integrate and analyze vast amounts of data to improve their decision-making (Bullock, 2020). Given that our country has limited and fragmented information databases, there is a clear need for a comprehensive and intelligent database for decision-making—especially for formulating smart policies and addressing public problems (e.g., data regarding the target community). This need can be fulfilled

through AI’s capabilities to create such databases as well as to process, analyze, and interpret the information within them.

Artificial intelligence can reduce the burden of searching through vast data sets. In many cases, data analysis—due to its volume or complexity—exceeds the capacity of individual humans. In fact, AI is not a substitute for human intelligence; it is an entirely different approach to drawing conclusions. AI can complement or even surpass our capabilities. It can work alongside us and even teach us; perhaps the true benefit of AI lies in its ability to demonstrate new methods of thinking (Walport & Sedwill, 2016). Given that our country has limited and fragmented information databases, there is a clear need for a comprehensive and intelligent database for decision-making—particularly for formulating smart policies and addressing public problems (e.g., data regarding the target community). This need can be met through AI’s capacity to create, process, analyze, and interpret such data.

Governments, by adopting AI-based policies (or AI-enabled e-government), can design precise, efficient policies and make rapid decisions. Moreover, this type of policymaking improves communication and interaction with the public, as well as the provision of public services that are more effective, reliable, high-quality, and cost-efficient (Berg, 2018; Berryhill et al., 2019; Verheij, 2020). AI supports e-government and its tools, helping to reduce processing time, minimize workload, and improve workflow—thereby enhancing government service delivery (Chun, 2008; Zheng et al., 2018). With the increasing digitization of services and the adoption of AI-based e-government, benefits for the target community are delivered more broadly and comprehensively through an integrated service system (Verheij, 2020). Digitization, considering the role of AI, significantly transforms the work environment; as AI advances and is deployed, job activities are increasingly exposed to automation, and in smart automation AI can complement the existing workforce’s skills (Castro & New, 2016; Mehr, 2017; Thierer et al., 2017).

Technological capabilities continue to increase. The discretionary power that is entrusted to AI can logically replace bureaucratic discretion (Grace et al., 2018). It appears that bureaucracy within e-government can be supported by AI; consequently, an AI-based—or smart—bureaucracy can be established, one that possesses more features and capabilities than traditional bureaucracy. In such a system, many repetitive tasks that AI can easily

learn may be delegated to it, thereby resolving the “iron cage” problem described by Marx and Weber. In smart policy formulation, there should be a clear link between the formulated policy, policymakers, the target community, implementers, and the problem itself, so that the outcomes of the policy formulation and problem resolution are reflected promptly and can be evaluated. One of the infrastructures that appears particularly important in smart policy formulation is smart bureaucracy, which can establish this connection. Hence, AI can play a significant role in smart bureaucracy—an element that is especially critical in decision-making. AI-based evaluation creates conditions for timely updates and assessments, enabling policymakers to obtain prompt evaluations of implemented policies and to take swift action on urgent issues (Verheij, 2020).

One of the characteristics of AI is its ability to refine and adjust its algorithms until the desired outcome is achieved (Thierer et al., 2017). Specifically, algorithms serve as the foundation for recent innovations in AI (Holdren & Smith, 2016).

In the context of using AI programs, the quality and integration of system data are of paramount importance, because an AI system is only as intelligent as the data provided for its learning—and data are considered the fundamental driving force behind current AI systems (Thierer et al., 2017). Conversely, incorrect or poor-quality data may lead to failure. Another characteristic of AI systems is that they learn while operating (based on reinforcement learning) and act independently (Johnson, 2015).

The cognitive level in AI varies and is programmed according to need. High-performing systems—which include knowledge representation—are capable of learning and responding (Wirtz et al., 2018). Neural networks, a class of machine learning systems inspired by the functioning of the nervous system in biology, consist of a large number of neurons (Thierer et al., 2017). Among the features of AI are its computational capacity, processing power, high recognition capability, and deep learning; efforts are made to have neural networks function similarly to the human brain (Grace et al., 2018). The use of neural networks enables the analysis, distribution, and sharing of knowledge with others (Lin et al., 2018).

One of the features of AI technology is its use as a predictive model—for example, to minimize the damages and casualties resulting from natural disasters (Tang & Wen, 2009). It appears that this technology can assist

policymakers in forecasting future needs, such as the precise requirements for housing, education, employment, healthcare, and other public issues. Thus, it becomes clear that employing AI features as a predictive model addresses the current needs in smart policy formulation. With access to historical databases documenting past developments and projected future trends—coupled with AI capabilities—the likelihood of policy failure can be substantially reduced (Berryhill et al., 2019).

In Spain, Belgium, and Finland, researchers have developed AI-based programs to increase public access as well as to design welfare and health initiatives. By leveraging the features of AI and networking, the will and opinions of the public can be analyzed and understood (Berryhill et al., 2019; Thierer et al., 2017; Verheij, 2020). Greater trust can be built through a common human–AI framework. With such a network for setting the agenda, new policies—owing to reduced human interference that diminishes corruption and overly bureaucratic processes—will be more accountable to the public and will garner greater trust from the masses. Verheij (2020) notes that implementing AI-based policy can encourage the target population to adopt the specific behaviors necessary for the success of the policy. By reducing ambiguity in interactions, social will, and political culture, such an approach contributes to bolstering political legitimacy and establishing better structures to ensure the achievement of policy objectives (Verheij, 2020). Therefore, with the use of AI, public opinion and the will of the people become readily accessible—and as is well known, access to public opinion (and consequently, to the people’s needs and awareness of their public problems) is the prerequisite for formulation. This is a critically important component in the policymaking chain, because when policies are formulated based on the needs and desires of the people, it leads to public support in implementation, monitoring, and evaluation, thereby fostering trust in the policymaking system—a significant asset for governance.

Analyses indicate that governmental organizations are experimenting with practical AI programs and have initiated various projects for the implementation and use of AI in the public sector. However, there remains limited knowledge about the types and overall potential of AI applications for governments. Some countries—particularly the United States and China, and subsequently Europe—have placed high value on AI for public use, have formally recognized its potential, and have undertaken various costly AI initiatives that demonstrate its broad range of potential

applications (Mehr, 2017; Thierer et al., 2017; Wirtz et al., 2018). It seems that if we do not quickly update our utilization of these scientific advancements and elevate our level of knowledge, not only will we be unable to resolve current policy issues, but in the future, AI may provide the basis for the dominance of countries that have invested in this field over others.

Given that research on AI in the public sector is still in its early stages—and that a review of the literature and identified classifications shows that previous studies have only sparsely and narrowly addressed AI applications in the public sector and public policies, with many programs being implemented as innovative pilot projects—the public sector represents a relatively new domain for AI application. This is a young research field with various research opportunities, and scholars should pay attention to these opportunities to expand both theoretical and empirical knowledge in this area (Herman, 2017; Verheij, 2020; Wirtz et al., 2018).

It is evident that previous research has not sufficiently focused on AI-based policy formulation, which is observed as a research gap. Therefore, the aim of this study is to review the characteristics of AI and the necessity of its utilization in policy formulation.

2. Methods and Materials

Initially, searching for the term "artificial intelligence" in the Google Scholar database yielded a vast number of indexed and accessible articles discussing the applications of AI in industry, agriculture, healthcare, and policies related to AI implementation, among other topics. Subsequently, by refining the search criteria (limiting the time frame to 2017–2020) and focusing on phrases such as "AI characteristics," "AI-based policymaking," "intelligent policy formulation," and "AI and public administration," 100 articles were identified. After reviewing the titles, abstracts, and conclusions, 30 articles relevant to the research topic were selected. Furthermore, to identify and extract AI characteristics applicable to policy formulation, 10 articles were examined in greater depth. Findings from these selected articles were systematically recorded to collect relevant data. The reported findings pertain to the capabilities of artificial intelligence and their potential applications in policy formulation.

3. Findings and Results

A review of previous studies reveals that limited research has been conducted on artificial intelligence within the public sector, with most studies focusing on the practical applications of AI across various domains. Tirer et al. (2017) examined AI and public policies, while Wartz et al. (2018) explored AI in the public sector—its applications and challenges—highlighting various fields such as AI applications in healthcare, autonomous vehicles, and unmanned aerial vehicles. Zheng et al. (2018) investigated government-provided AI services, emphasizing the reciprocal relationship between the needs of the public sector and AI-driven solutions. Vardan (2020), in an article titled "Governance Through AI-Based Policymaking Processes," provided a broad overview of the policy formulation cycle. Similarly, Thierer et al. (2017), in their article "Artificial Intelligence and Public Policies," analyzed AI applications across different sectors and discussed investments made by certain countries in this technology. They explored AI and the future of public administration, aiming to depict the prospects of AI-based policymaking (Thierer et al., 2017). Sharma et al. (2019) noted that AI has evolved through three waves of research, highlighting features such as cognitive abilities (Sharma et al., 2019). Mahanty and Mahanti (2016) also discussed AI applications for big data analysis (Mahanty & Mahanti, 2016). Bullock (2020) described AI as a double-edged sword (Bullock, 2020). Wang (2019) and Monett et al. (2020) contributed to the definition of artificial intelligence (Monett et al., 2020; Wang, 2019).

4. Discussion and Conclusion

Legislation and policymaking must adapt to the new transformations and evolving conditions brought about by artificial intelligence. Implementing AI in the public sector requires a strategic and prudent approach to ensure that the vast potential benefits of AI are realized and ultimately generate value. AI possesses capabilities that can be leveraged in policy formulation, as outlined in this study. Therefore, these identified capabilities should be utilized as tools for achieving more precise and higher-quality policies—namely, intelligent policy formulation—which not only retains previous strengths but also integrates the new capacity provided by AI. It appears that the integration of artificial intelligence into policy formulation and policymaking is fostering a new paradigm. If we do not promptly update our expertise and enhance our knowledge in utilizing this scientific advancement, not only will we

fail to resolve current policy challenges, but AI—due to its transformative capabilities for users—could also enable dominance by countries that have invested in this field over those that lag behind.

Authors' Contributions

M. A. conceptualized the study and led the literature review process. A. R. contributed to the development of the research framework and was responsible for gathering the articles. A. E. analyzed the articles and provided insights into AI characteristics applicable to policy formulation. F. Z. assisted in the manuscript writing, reviewed the analysis, and provided critical revisions. All authors contributed to the interpretation of the findings and approved the final manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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