Challenges of using Artificial Intelligence and Big Data in Public Policymaking

التحديات المرتبطة باستخدام الذكاء الاصطناعي والبيانات الضخمة في صنع السياسات العامة

Les défis de l'utilisation de l'intelligence artificielle et des mégadonnées dans l'élaboration des politiques publiques

Adel Inezarene- UNIVERSITY OF MOSTAGANEM

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Introduction

Research in big data and artificial intelligence is increasingly important, both in academic circles and among policymakers. This is because artificial intelligence and big data technologies are having a major impact on all aspects of economic, social, and political life, and are raising a host of challenges across multiple disciplines. Consequently, this topic has become central in recent studies, which aim to determine its importance, areas of influence, and challenges at various levels.

This study aims to explore one of these areas related to political science: public policy-making. Political decision-makers recognize that the technological revolution brought about by information and communication technologies significantly impacts the policy-making process and the effectiveness of its outcomes on society in general. This has led to the emergence of new mechanisms and systems that have transformed the field of decision-making due to the rapid developments brought about by artificial intelligence technologies. Extensive research across various sectors supports the effectiveness of artificial intelligence in the decision-making process, which suggests its extensive use in public policy governance.

Based on this, this study seeks to address the following question:

- How does the use of artificial intelligence and big data technologies affect the process of formulating public policies?

To answer this question, we start with the following hypothesis:

- The use of artificial intelligence and big data in the formulation of public policies enhances the technical and technological aspects of public policy decisions, thereby improving their effectiveness and quality in implementation.

To analyze the problem and hypothesis, we adopted an inductive approach by collecting data on the impact of big data technologies and artificial

intelligence on various steps of public policy-making and their reflection on the policy-making process. This approach enhances effectiveness and performance while addressing real models and practices to maximize their benefits in the analysis.

1. Conceptual Framework

1.1. Definition of Public Policy

While there is no single agreed-upon definition of public policy, B. Guy Peters defines it as a set of activities carried out by the government, either directly or through its agents, that affect the lives of citizens. Charles L. Cochran and Eloise define public policy as political decisions made to implement programs that achieve societal goals (Birkland, 2015, p. 8).

According to Birkland, public policy is a way to address a "real, potential, or perceived social problem" (Pencheva, 2018, p. 29).

Therefore, public policy can be defined as the collection of decisions made by the government in response to public problems, which require developing solutions and alternatives.

Policymaking is driven by the need to solve societal problems and should result in interventions to address these issues. Social problems include unemployment, pollution, water quality, safety, crime, well-being, health, and immigration. Policymaking is an ongoing process in which issues are recognized as problems, alternative courses of action are formulated, and policies are drafted, implemented, executed, and evaluated. This process is complex due to the many interactions involved, including with various stakeholders. The involvement of numerous stakeholders adds to the complexity of policymaking (Marijn Janssen, 2015, p. 3).

1.2 Definition of Artificial Intelligence

The term "artificial intelligence" is widely used to describe technologies that use data, algorithms, and devices to identify relationships, make predictions, or accomplish semi-complex tasks. Artificial intelligence aims to develop machines and software capable of performing functions similar to humans, such as learning, reasoning, and creativity (David Valle-Cruz, 2020, p. 2).

According to Legg and Hutter, intelligence is the ability to interact, learn, and rely on information derived from experiences, in addition to adapting to uncertainty. Conversely, "artificial" refers to a version created by humans, so artificial intelligence is the ability of a computer system to exhibit intelligent

behavior similar to humans. This includes basic skills such as perception, understanding, action, and learning (Bernd W. Wirtz, 2019, p. 600). Professor John McCarthy of Dartmouth College in New Hampshire, United States, is considered the founder of the term "artificial intelligence," defining it as "the science and engineering of making intelligent machines" (Santosh K. Misra, 2020, p. 103).

Artificial intelligence has been defined in various ways. Here are some examples:

- Encyclopedia Britannica defines artificial intelligence as the ability of digital computers or robots controlled by them to solve problems that are usually associated with high human cognitive processing capabilities (Ertel, 2017, p. 2).

- It refers to artificial intelligence applications associated with digital computers that either (1) possess or demonstrate human-like intelligence or (2) are capable of solving problems rationally to achieve specific goals. This definition is more accurate and technical in nature (Matthew M. Young, 2019, p. 2).

- Artificial intelligence is the machine's ability to perform functions requiring cognitive skills similar to those of humans, such as perception, reasoning, learning, interaction with the environment, problem-solving, and creativity. An expert system is an artificial intelligence system that uses mathematical models to mimic the logic of experts in a specific field. This system benefits from knowledge and reasoning based on information provided by experts to make the best possible decisions (Juan M. Sánchez, 2020, p. 7).

- The definitions of artificial intelligence provided give a broad view of the concept and include various aspects and technologies used in its development. This highlights the difficulty in determining a precise and comprehensive definition due to the complexity and diversity of models, applications, and methodologies involved. Therefore, the appropriate definition depends on the study's purpose or use.

In the field of public policy, artificial intelligence can be defined as a set of technologies, tools, and applications used to enhance human cognitive abilities and improve them in various ways. This includes computing, machine learning, neural networks, robots, intelligent systems, e-learning, and other technologies. Artificial intelligence is used to analyze and understand political, governmental, and economic data and information, improve political

decision-making, develop government services, and increase efficiency and effectiveness in managing public affairs. It is employed to find solutions to significant political and governmental challenges, analyze large and complex data, and provide results and recommendations for making better and more effective decisions.

Artificial intelligence can be categorized into the following levels (Saveliev, 2021, p. 660):

- Artificial Narrow Intelligence (ANI): Available for decades and still widely used, ANI systems perform specific "smart" tasks such as object or person recognition from images, language translation, or gameplay. They can perform complex calculations but are limited by their task boundaries, operating environment, and specific programming.

- Autonomous Artificial Intelligence: Provides the ability for the system to operate independently for extended periods without operator participation.

- Artificial Adaptive Intelligence: Refers to a system's ability to adapt to new conditions and acquire knowledge not embedded in its initial creation.

- Artificial General Intelligence (AGI): Characterized by such high adaptability that the system can be used in various activities with appropriate training, whether independent or guided (with the help of a trainer).

- Artificial Super Intelligence (ASI): Surpasses human intelligence in all fields. This type of artificial intelligence has not yet been achieved but may occur autonomously in the future, raising concerns about humanity's fate and ethics if control over machines is lost. Therefore, the government must play a regulatory role in technology and benefit from specific artificial intelligence applications (Bernd W. Wirtz, 2019, p. 600).

1.3. Definition of Big Data

Several definitions have been provided for the concept of big data. By examining existing definitions and the main research topics associated with it, we can affirm that the core of the concept of big data can be expressed by the following elements (Andrea De Mauro, 2015, p. 103):

- Volume, Velocity, and Variety: These terms describe the characteristics of the information involved.
- Technology and Analytical Methods: These clarify the specific requirements needed to handle such information.
- Transformation into Insights and the Creation of Economic Value: This represents the principal way big data impacts companies and society.

Therefore, big data can be defined as information assets characterized by high volume, velocity, and variety, which require specific technology and analytical methods to be transformed into value.

Big data is often defined by its three Vs: volume, velocity, and variety. This definition emphasizes that big data involves not just large datasets or many datasets (volume) but also rapidly changing, real-time data (velocity) and significant heterogeneity (variety). Generally, it refers to the vast increase in data sources from space, social media, the public and private sectors, and the ability to integrate this data to generate new insights, typically for commercial purposes. Some definitions add other Vs, such as veracity, value, and visualization, from a technical perspective. Other authors take a more social and political perspective, focusing on big data and "ratification" as transforming our everyday lives into quantifiable, measurable, and controllable data, which could lead to forms of surveillance capitalism (Massimo Craglia, 2020, pp. 98-99).

Thus, big data is a broad term for the volume and complexity of available data. While there is no widely accepted definition, the most basic description is that big data refers to datasets that are too large for traditional processing systems and require new technologies (Gies, 2017, p. 367).

Based on these definitions, the characteristics of big data can be summarized as follows (Johann Höchtl, 2016, p. 151):

- Speed (Velocity): The rate at which big data arrives can vary widely, from kilobytes per second to terabytes per second, depending on the data type (textual, audio, or video). Even with modern hardware, traditional algorithms may struggle to keep up with this pace.
- Volume: As data arrives at high speeds and transitions from macro-level data to personalized data, the volume of data that accumulates over time increases exponentially. This is particularly noticeable when analyzing data over time, which requires random access to

large amounts of data. Declining storage costs and modern storage algorithms enable organizations to store and access big data efficiently.

- Diversity (Variety): Big data is heterogeneous, with various origins (internal legacy systems, external data sources) and different types of data (audio, video, text) resulting in various shapes and formats. This requires algorithms from AI or the semantic realm that can handle heterogeneous datasets, sometimes at the expense of precision.

In addition to these three characteristics, some authors also include:

- Value: Refers to data's potential to become economically valuable when transformed into useful information. While big data may have limited immediate value in its raw form, combining and analyzing large volumes of data can yield significant value.

- Veracity: Refers to the accuracy and reliability of the data. Although big data is often characterized as objective, this is not always the case. Data interpretation, crucial for transforming data into information, can introduce subjectivity and potential misleading conclusions. The context in which data is collected or how it is combined with other data can affect the accuracy of the extracted information. Thus, it is not the data itself that is subjective but the interpretation of the data (Bekkers, 2023, p. 43).

2. The Effectiveness of Employing Artificial Intelligence and Big Data Techniques in Public Policy

2.1. Why Artificial Intelligence and Big Data in Public Policy?

Despite general agreement that information and communication technology presents fundamental challenges to governance, there remains a research gap concerning how these developments impact the formation and implementation of public policies. This raises questions about the feasibility of employing modern technologies, especially artificial intelligence, in public policy.

One prominent reason is the rapid digital transformation towards a data- and AI-driven society. Digitization has significantly increased both the quantity and accuracy of available administrative information, as well as the speed at which it can be processed. Additionally, communication technologies have facilitated easy data integration and sharing through complex algorithms and methodologies such as machine learning or AI-networked data sets (Johann Höchtl, 2016, p. 151).

On the other hand, public policy-making encounters numerous problems due to its inherent complexity and impact on a changing environment, particularly if it prioritizes short-term gains over long-term goals. Policymakers thus require new methodologies in policy-making. Key problems include:

- The difficulty of reaching consensus among policy formulation participants, which can be addressed using simulation scenarios to find common solutions.
- Policymakers' overconfidence in their judgments compared to expert systems that offer recommendations.
- Policymakers attributing failures to external factors rather than taking responsibility.

These issues pertain to the human and self-aspects of policymakers but can be mitigated by utilizing artificial intelligence tools in policy formulation (Juan M. Sánchez, 2020, p. 15).

Additional major problems in decision-making for public policy include:

- Prediction difficulties in some policy areas.
- Inconsistent and inaccurate implementation of policies.
- Bias in decision-making, such as in law enforcement arrest rates.
- Corruption in policy-making, such as using illegal methods to implement policies.

Artificial intelligence offers opportunities to improve all these aspects by providing greater accuracy, consistency, and reduced bias, as well as being less susceptible to corruption due to stronger data-to-decision relationships and more cost-effectiveness through reduced labor costs for routine tasks (Matthew M. Young, 2019, p. 3). AI applications can adapt the policy environment to a rapidly changing world. When designed responsibly and transparently, they can update the policy cycle by allocating, evaluating, and adapting interventions, and can consider the needs of marginalized individuals and groups through a social contract that enables government and citizen participation and data usage (Massimo Craglia, 2020, p. 98).

2.2. The Importance of Using Big Data and Artificial Intelligence in Public Policy

2.2.1 Big Data as a Tool to Update Government Decisions

Big data has provided significant benefits across various sectors, including public sector organizations. These organizations can leverage big data

information to enhance public service satisfaction. According to Chrisvania, organizations that implement big data can benefit from social data analysis, historical data analysis, and predictive analysis. Data analytics, a crucial aspect of data governance, can be improved through a more comprehensive ICT governance framework. Big data-based analysis, conducted through various digital means, allows for a broader range of data and more objective assessments, benefiting decision-making accuracy and policy planning improvements. Big data technology is extensively used in the public sector to gather feedback from government service information systems and social media, which informs policy formulation and public service enhancement. Integrated services with specific criteria enabled by big data lead to more effective and efficient services and aid in problem-solving (Fajar Rahmanto, 2021, p. 3).

When integrated into government systems, big data facilitates the development of faster, more accurate, and cost-effective policies across various government organizations. By employing an analytical approach, big data organizes information, leading to more structured outputs. Big data's role in government and public services is crucial as it converts external data into useful information for policy formulation and enhances government performance. Big data technologies enable several objectives, including:

- Improving government performance through increased efficiency and reduced traditional workload.
- Addressing financial challenges by streamlining the funding process and positively impacting the country's survival and citizens.
- Generating additional revenue for the state by reducing infrastructure strain and benefiting sectors such as export-import, agriculture, trade, and tourism.
- Enhancing data transparency and promoting the concept of Open Government, which increases public trust in the government (Supriyanto, 2022, p. 59).

The advent of big data, supported by artificial intelligence, has proven beneficial in gathering information for policy decision-making and future system enhancements. AI has widespread applications in various sectors of public life, enhancing productivity. For instance, in health, AI has been used for preliminary diagnoses that serve as references for the public.

However, potential downsides of big data and artificial intelligence include diminishing humanism, marginalizing the weak and powerless, creating

disparities between netizens and citizens, establishing new hegemonies in virtual spaces, and reducing roles in public services. These issues must be addressed as these technologies become more integrated into society (Fajar Rahmanto, 2021, p. 4).

2.2.2 Artificial Intelligence and the Reengineering of Public Policy-Making Processes

We are developing policymaking strategies on the potential impacts of big data and artificial intelligence in public policy by building on data and information-based foundations and systems. This approach aims to make policymaking more reliant on "facts," thus facilitating better and more accurate decisions. Vydra and Klievink argue that the use of artificial intelligence enhances the effectiveness, efficiency, and legitimacy of policymaking processes (Misuraca 2022:2), leading to data-driven policies and improved decision-making capacity. In this regard, we will review the role of artificial intelligence in the various stages of public policy-making.

2.2.2.1. Setting the Agenda and Formulating Policy

This stage is aimed at identifying general problems that necessitate governmental intervention and including them in the political agenda. Consequently, these problems become subjects requiring solutions in the form of alternative measures.

Artificial intelligence can aid in setting the agenda and formulating public policies by drawing the attention of both the public and decision-makers to issues needing governmental focus. AI systems have emerged as crucial sources of information and play a significant role in agenda-setting. Pencheva contends that by employing artificial intelligence algorithms, governments can monitor emerging topics on social media, thereby improving the agenda's accuracy, efficiency, and speed (David Valle-Cruz 2020: 4).

AI technologies enable faster and more accurate detection of citizen problems and preferences. Governments can leverage vast amounts of unstructured data to analyze citizen preferences and identify the most suitable alternatives. AI technologies offer multiple sources for research and analysis, enhancing understanding of the political landscape and allowing for more precise and detailed solution formulation (Pencheva 2018: 29). Sensory inputs from AI applications and the inclusion of diverse data sources via the Internet contribute to gaining insights from new sources in the policy-making process. Additionally, it may be possible to predict social problems by integrating data (Misuraca 2022: 3) using software like natural language processing and topic

classification, which facilitates the extraction of significant information from large data sets efficiently.

AI technologies also significantly impact the study of policy alternatives by allowing for the presentation and evaluation of different options before implementation. They facilitate analysis of stakeholder opinions and public sentiment or encourage their participation in developing solutions. These tools can be summarized as follows (Misuraca: 3):

- Data Mining Technologies: AI relies on data mining technologies that utilize large data sets, potentially revealing new trends about public issues or solutions.
- Algorithmic Models*: These models predict policy outcomes, such as costs, benefits, and influencing factors. Their use can enhance political awareness and shape consensus among all parties, offering objective results and reducing the gap between intended goals and unintended effects. For example, the Alan Turing Institute in the UK has a dedicated data science program for public policy aimed at identifying individual needs and targeting political interventions accordingly, while protecting privacy through anonymous operations and governance protocols.
- Complex Modeling: AI contributes to creating future scenarios that aid in selecting the best alternative. AI tools have been used to predict various economic indicators, improving economic policy quality. For instance, artificial neural networks have been applied to predict financial data effectively compared to traditional methods. Machine learning models have also been used to forecast future trade patterns for different countries (Henman 2020: 213), helping to extract variables affecting trade and formulate better policies.
- Social Media Analysis: AI is used to understand citizen concerns and interact with them. Automatic and extensive news analysis has revealed critical events, as seen in countries like China and Singapore, which monitor and measure public opinion trends on social media to gather information about citizens' preferences and use this data as early warning systems for potential political disturbances (Johann Höchtl 2016: 158-159).

2.2.2.2. Public Policy Implementation

This stage involves providing the necessary resources to achieve policy objectives. Incorporating AI into policy execution can enhance efficiency through various factors:

- Speed of Data Processing: AI improves the speed of data availability, policy implementation, and feedback collection. Most routines are automated through expert systems, robots, and Extended Reality, which helps in simulating reality for policy implementation and assists decision-makers in refining data and evaluating decisions before implementation. For instance, an algorithm in San Mateo County, California, assesses building materials and seismic data to predict how buildings interact with earthquakes (David Valle-Cruz 2020: 6-7). AI predictions aid in policy implementation and foster innovation and efficiency.

- Monitoring and Adjusting Policies: AI helps monitor implemented policies and make adjustments as needed. For example, a new tax system can be tested to determine its effectiveness in wealth distribution.

- Updating Information : AI can be used to update information used in policy implementation, such as population size and economic status, without waiting for annual data updates (Johann Höchtl: 162). This enhances the accuracy and efficiency of policy implementation.

- Strategic Goals: AI aids governments in achieving political goals by improving risk management and enabling joint decisions with citizens. Techniques such as resource allocation modeling and real-time process improvement help detect policy implementation issues, such as repetitive activities or inefficient resource use (Pencheva 2018: 32-33).

The practical impact of AI in public administration, as the dominant actor in the implementation process, can enhance and modernize operations, improving performance and service quality. For instance, AI can be utilized to manage financial and human resources more efficiently.

2.2.3. Thirdly: Public Policy Evaluation

Evaluation is one of the areas where the impact of artificial intelligence (AI) is most evident through data analysis, pattern detection, and real-time alerts. This stage assesses both the intended and unintended outcomes and measures them against the set goals. Some researchers argue that AI will fundamentally transform evaluation practices, integrating them into all stages of policymaking. This leads to continuous evaluation, where reports are generated in real-time throughout the policymaking period. The impact of AI technologies on evaluating public policies can be summarized as follows (Pencheva 2018 : 33-34):

- Detail and Monitoring: AI provides a higher level of detail, allowing for simultaneous monitoring of variables at individual or group levels (e.g., by region, city, local authority, or country).
- Time-Series Data Handling: AI supports the handling of time-series data from various sources, facilitating comprehensive measurement of policy outcomes.
- Exploration of New Models: AI enables the exploration of new organizational models and techniques. Arinder suggests that AI can transform public sector institutions to become more predictive and transparent through evaluative frameworks that emphasize evidence-based decision-making and long-term cost-benefit analysis at critical policy points. This facilitates significant feedback on employee performance and the exploration of new business models to improve operational performance.
- Continuous Evaluation: Although evaluation is typically the final stage, AI integrates into each stage of the process, enhanced by big data that enables continuous re-evaluation through what is known as the e-policy cycle. According to Hochtl et al., big data allows for rapid and ongoing evaluation, eliminating the need to wait until the end of the policy cycle to assess success or failure. New policies immediately generate new data, which can then be used to evaluate effectiveness and enhance future implementation. For instance, the US Army's Continuous Automatic Assessment System uses extensive data analysis to detect patterns related to army candidates, revealing issues like financial problems, family violence, or drug addiction in 21.7% of cases not reported by the candidates (Johann Höchtl 2020: 163).

In conclusion, AI technologies enhance the dynamics of public policy, making it more responsive to complex environments and enabling decision-makers to leverage information more effectively.

2.3 The Role of Artificial Intelligence and Big Data in Rationalizing Public Policy

2.3.1 The Role of Big Data and Artificial Intelligence in Supporting Public Policy Participation

Researchers are divided on the impact of AI on democratic practices. Pandora argues that AI negatively affects democracy by centralizing and controlling information and communications, and it can be used unethically,

such as for creating fake political support on social media or manipulating citizens during election campaigns (Paulo Savaget 2019: 370).

Conversely, Jeffersonian views AI positively, believing it allows marginalized groups to engage in the democratic process, educates voters about major political issues, increases participation rates, reduces vote manipulation, and enhances transparency. Modern technologies, particularly those powered by AI, have facilitated communication, data sharing, and the development of algorithms that process big data quickly and efficiently (Paulo Savaget 2019: 370).

AI systems are crucial for managing information overload and improving the extraction of useful data for policymakers. For example, digital medical records and AI can monitor patient health, improve medical care, and allow citizens to access their health information through digital assistants (Corvalán 2018: 77), thereby involving them in health policy decisions.

AI technologies are essential for strengthening democratic practices and addressing democratic deficits by bringing citizens closer to public administration (Paulo Savaget 2019: 370). Political literature supports that citizen participation improves democracy quality, highlighting the need to expand participation beyond elected representatives.

AI provides new ways to engage citizens and capture marginalized opinions that traditional methods might overlook. Social media data analysis reflects citizen preferences, helps include them in policy formulation, and enables policymakers to extract insights from vast amounts of online contributions (Misuraca 2022: 2-3). AI can assist multilingual countries like India by overcoming language barriers during elections, allowing voters to access more information about political issues. Additionally, AI technologies can extract data from blogs, forums, and the press, helping policymakers understand public opinion and controversial issues, which affects policy planning and implementation (Paulo Savaget 2019: 371). AI and machine learning facilitate the collection of large data sets, improving citizen engagement with administration.

Practically, AI provides collaborative platforms, such as "The CitizenLab platform," which enables citizens to interact with authorities, express opinions, and receive feedback. The "Tvarkau Vilnių" app in Vilnius, Lithuania, allows citizens to report concerns and uses AI to improve the quality and accuracy of citizen-provided information, enhancing policy-making (Misuraca 2022: 6).

Big data and AI technologies also enhance participation by identifying citizen needs. Algorithms help discover common needs and interests, informing policies that address geographic areas most in need. Notable opportunities   include:

- Online Surveys: Repeated and targeted online surveys based on data profiling make questions more relevant and engaging. They aim to identify not only needs but also perceptions of those needs.

- Intelligent Participation Platforms: Platforms that encourage profile creation and interaction, providing incentives for participation, and addressing non-participating categories to better understand and reduce the "silent and marginalized groups" problem. These mechanisms facilitate tailored public policy inputs, solid feedback for planning and implementation, improved communication between citizens and government, and increased accountability and active citizenship (Massimo Craglia 2020: 102-103).

2.3.2. The Role of Big Data and Artificial Intelligence in Enhancing Transparency and Accountability

Artificial intelligence (AI) offers new ways to enhance public governance by improving transparency and accountability in public policies. Despite the challenges, accountability can be achieved through AI by testing government algorithms for accuracy. This involves sending various variables to government algorithms to determine their decision-making processes, allowing for the evaluation of potential biases affecting protected social groups and improving government responses to the public (Henman 2020: 123). Transparency and accountability are closely linked to the free flow of information and access to it, as indicated by the "interactive disclosure principle," which stipulates that information must be publicly accessible to ensure transparency in government. This principle guarantees that information seekers receive it promptly, enabling direct interaction between citizens and administration, and enshrining accountability (Jing 2016: 139). The relationship between transparency and accountability is relational; thus, accountability cannot exist without transparency.

The significance of AI systems in enhancing transparency and accountability can be summarized as follows (Pencheva 2018: 30-31):

- Improved Monitoring: AI enhances monitoring of implementation processes by detecting regularities. Automated algorithms can

support human decision-making, significantly reducing fraud and errors in service processing.

- Increased Legitimacy: AI improves the legitimacy of agenda setting and policy formulation by involving citizens and governments in its design. AI technologies foster government accountability and transform it into a more open and interactive entity. Some researchers believe that AI creates a new model of data-driven governance, as Pisano describes, which enables institutions to understand external forces and adapt their actions to preserve the public interest.

- Combating Corruption: AI aids in combating corruption. For instance, tax authorities use AI to create incentives for increased taxpayer compliance and monitor crimes and patterns of incidents. Data analysis also enhances tax compliance and prevents social welfare fraud, improving the financial situation of public entities and allowing more funds to be used for solving problems rather than maintaining administrative status quos. This shift towards more efficient public administration ultimately benefits citizens.

- Resource Utilization: AI systems improve the use of material and human resources in public policy-making by consolidating efficiency and transparency. AI enhances decisions regarding the allocation of human and financial resources for new policies and ensures transparency in their identification and implementation.

A practical example illustrating AI's impact on enhancing transparency and accountability is its effect on the budget-setting process. Data collected through AI can uncover new patterns and design more efficient and transparent budgeting methods. Additionally, AI can test new financing approaches neutrally. Empirical evidence shows that using big data in public budget planning reduces costs, increases efficiency and effectiveness, and facilitates the transition to "results-oriented budgets." This creates evaluation frameworks that direct resources to their appropriate destinations. By determining funding needs based on estimated impacts, AI evaluates previous policies, generates feedback, and reallocates resources to successful policies (Johann Höchtl 2020: 161). This enhances transparency in state budget preparation.

3. Evaluation and Discussion

Despite the significant opportunities AI technologies offer in public policymaking, several problems and risks may arise from their use.

Governments must be cautious when implementing AI technologies, as there is a false assumption that automated decisions are always superior to human ones, especially if data quality is compromised. Many researchers highlight that data is not neutral but reflects biases from the culture in which it was created, collected, and analyzed. Additionally, some populations do not participate in official activities and data production, resulting in less data and negatively impacting policymaking. This is particularly relevant to social media data (Massimo Craglia 2020: 3). Social media may not accurately reflect public opinion as its users do not represent all citizens, and some groups may impose their orientations. Furthermore, social media often focuses on social issues rather than providing a comprehensive view.

On the other hand, governments might use social media for control or suppression. Algorithms can undermine the fairness and quality of political discourse, as evidenced by the use of bots and programmed accounts to create false public support and manipulate political mobilization in countries like the United States, France, and Brazil (Paulo Savaget 2019: 370). Using social media data in policymaking can negatively affect how citizens express their opinions. Although AI technologies may enhance decision-making, they do not necessarily increase public acceptance of these decisions (Jonathan Bright 2016: 222-223) as citizens might feel disconnected from the policymaking process.

Several researchers point out that AI systems could lead governments to focus on immediate results and operational gains rather than strategic issues, altering the goals and priorities of public policies (Pencheva 2018: 32-33). Additionally, employees might follow machine instructions without fully understanding them, leading to a "rule by artificial intelligence" scenario instead of "rule using artificial intelligence," potentially weakening government effectiveness and legitimacy (Misuraca 2022: 3). For example, Singapore's extensive data monitoring program, initially designed for citizen protection, has impacted various fields, including economic policy, immigration policy, and the real estate market. Similarly, China's Baidu has involved the army in the China Mind project to use deep learning algorithms on search engine data for social control (Helbing 2018: 75).

AI technologies might also hinder public policy research and evaluation. Focusing solely on data-driven political interventions may neglect other frameworks, as White and Breckenridge warned. Big data is not a comprehensive solution to public administration problems and may address symptoms without tackling root causes. For instance, while New York's

Office of Policy and Strategic Planning used data analytics to address illegal building conversions, the underlying causes of poverty and marginalization remain unaddressed (Desouza and Jacob). Furthermore, poor-quality data can become useless and costly to analyze. The digital divide may also be exacerbated, as Boyd and Crawford argue, creating or widening gaps between rich and poor, and excluding countries without the necessary infrastructure (Pencheva 2018: 31).

These challenges underscore the need for careful consideration when introducing AI applications in public policymaking. Key challenges include:

1. Strategic Planning: Developing a strategic plan for AI implementation, ensuring its safety and financial feasibility (Bernd W. Wirtz 2019: 601).
2. Data Quality and Integration: Ensuring good data collection and management without bias, balancing community benefits with privacy protection, and adhering to privacy legislation (Johann Höchtl 2020: 155-156).
3. Legal and Regulatory Challenges: Establishing regulatory policies for AI, forming a global governance council, and clarifying AI's legal status to address transparency, accountability, and responsibility (A. Zuiderwijk 2021: 12-13).
4. Ethical Concerns: Developing and implementing ethical standards to address issues like privacy, fairness, and discrimination in AI (David Valle-Cruz 2020: 10).
5. Societal Impacts: Addressing the effects of AI on the labor market and societal acceptance, promoting dialogue, and ensuring human control over AI interactions (Bernd W. Wirtz 2019: 605-606).

In conclusion, AI and big data technologies present both opportunities and challenges. Adherence to basic principles can optimize their benefits:

- Distribute information system functions.
- Support information self-governance and participation.
- Improve transparency to build trust.
- Reduce information distortion.
- Enable user-controlled information filters.
- Support social and economic diversity.
- Enhance compatibility and cooperation.
- Create digital assistants and coordination tools.
- Foster collective intelligence.

- Promote responsible citizen behavior through digital culture and enlightenment (Helbing 2018: 81).

Conclusion

In conclusion, it is evident that the reliance on artificial intelligence (AI) and big data technologies is continuously increasing at both organizational and national levels. This trend is a natural outcome of global developments and changes, particularly in technology, making their use in public policymaking an imperative rather than an option.

Despite the challenges and problems associated with implementing AI technologies and big data analysis in public policy, these technologies offer significant opportunities for development. They can greatly enhance the quality of public policies, particularly from a technical and technological perspective, by improving decision-making systems and mechanisms, and optimizing their outcomes. Additionally, they can bolster participation, support transparency and accountability, and make public policies more dynamic, effective, and inclusive.

The key findings and recommendations of this study can be summarized as follows:

- Restructuring Decision-Making: The application of AI and big data can transform the decision-making process in public policy, making it more dynamic through the use of algorithms, speeding up decision-making, and improving the ability to evaluate results.
- Bridging Information Gaps: AI systems aim to bridge the information gap between the government and non-formal actors, enhancing access to information through emerging technologies. This fosters greater harmony between the government and society and facilitates civil society participation.
- Automating Evaluation: AI and big data can automate aspects of the decision-making process, such as evaluating policy options. This automation frees up policymakers to concentrate on more strategic tasks.
- Technological Revolution: AI represents a technological revolution that opens new possibilities for public policymaking. It can quickly and accurately extract information and trends from big data, perform routine tasks efficiently, and rationalize public policy decisions.
- Rational Use of Data: There is a need to rationally utilize administrative data in formulating public policies. This approach

generates feedback that allows for assessing the impact on target groups and re-engineering new policies using more adaptive and responsive organizational tools.

- Enhancing Administrative Capabilities: The introduction of AI and big data technologies enhances the capabilities of the administrative apparatus and other stakeholders involved in policy formulation, making them more adaptable and responsive to internal and external changes.
- Legal and Ethical Framework: It is essential to develop a legal and ethical framework to regulate AI use in public policy, balancing the use of smart technologies with human capabilities and political, social, and economic factors. Despite its capabilities, AI cannot measure all human and political factors influencing many public policies.

Bibliography

A. Zuiderwijk, J. H. de Vries, H. R. W. de Lange, & J. J. H. M. Boonstra. (2021). Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda. *Government Information Quarterly, 38*(3), 2-19.

Andrea De Mauro, & M. G. (2015). What is big data? A consensual definition and a review of key research topics. *AIP Conference Proceedings*, 97-104. Madrid.

Bekkers, R. M. (2023). *Big data and public policy*. Palgrave Macmillan.

Bernd W. Wirtz, J. C., & H. F. (2019). Artificial intelligence and the public sector: Applications and challenges. *International Journal of Public Administration, 42*(7), 596-615.

Birkland, A. T. (2015). *An introduction to the policy process: Theories, concepts, and models of public policy making* (T. ed.). Routledge.

Corvalán, J. G. (2018). Digital and intelligent public administration: Transformations in the era of artificial intelligence. *A&C – Revista de Direito Administrativo & Constitucional, 18*(71), 55-87.

David Valle-Cruz, J., & P. V. (2020). Assessing the public policy-cycle framework in the age of artificial intelligence: From agenda-setting to policy evaluation. *Government Information Quarterly, 37*(4).

Ertel, W. (2017). *Introduction to artificial intelligence* (s. ed.). Springer International Publishing.

Fajar Rahmanto, U. P., & T. R. (2021). Big data: What are the implications for public sector policy in Society 5.0 era? *Earth and Environmental Science, 717*(1).

Gies, S. (2017). Big data for policymaking: Fad or fast track? *Policy Sciences, 50*(3), 367–382.

Helbing, D., & K. L. (2018). Will democracy survive big data and artificial intelligence?

In D. H. Ed (Ed.), *Towards digital enlightenment: Essays on the dark and light sides of the digital revolution*. Springer International Publishing.

Henman, P. (2020). Improving public services using artificial intelligence: Possibilities, pitfalls, governance. *Asia Pacific Journal of Public Administration, 42*(4), 209-221.

Jing, Z., & L. Y. (2016). *Information, models, and sustainability policy informatics in the age of big data and open government*. Springer International Publishing.

Johann Höchtl, P. P., & B. H. (2016). Big data in the policy cycle: Policy decision making in the digital era. *Journal of Organizational Computing and Electronic Commerce, 26*(1-2), 147-169.

Jonathan Bright, H. M., & S. H. (2016). Big data and public policy: Can it succeed where e-participation has failed? *Policy & Internet, 8*(3), 218-224.

Juan M. Sánchez, J. P., & R. D. (2020). Review of artificial intelligence applied in decision-making processes in agricultural public policy. *Processes, 8*(11), 2-23.

Marijn Janssen, H., & M. E. (2015). *Policy practice and digital science*. Springer Cham Heidelberg.

Massimo Craglia, J. H., & A. S. (2020). The big data and artificial intelligence: Opportunities and challenges to modernize the policy cycle. *European Union: Elsevier Limited*.

Matthew M. Young, J., & K. E. (2019). Artificial discretion as a tool of governance: A framework for understanding the impact of artificial intelligence on public administration. *Perspectives on Public Management and Governance, 20*(20), 1-13.

Misuraca, C., & L. M. (2022). Artificial intelligence for the public sector: Results of landscaping the use of AI in government across the European Union. *Government Information Quarterly, 39*(3), 1-13.

Paulo Savaget, T. C., & S. S. (2019). Empowering political participation through artificial intelligence. *Science and Public Policy, 46*(3), 1-12.

Pencheva, N., & T. M. (2018). Big data and AI – A transformational shift for government: So, what next for research? *Public Policy and Administration, 35*(1), 24–44.

Santosh K. Misra, S. P., & A. R. (2020). Public policy and regulatory challenges of artificial intelligence (AI). In *International Working Conference on Transfer and Diffusion of IT (TDIT)* (pp. 100-111). Tiruchirappalli, India.

Saveliev, A. A., & V. K. (2021). Artificial intelligence and social responsibility: The case of artificial intelligence strategies in the United States, Russia, and China. *Kybernetes, 50*(30), 656-675.

Supriyanto, E., & R. T. (2022). Big data and artificial intelligence in policy making: A mini review approach. *International Journal of Advances in Social Sciences and Humanities, 1*(2), 58-65.

Abstract

This study explores the role of artificial intelligence (AI) and big data technologies in modern public policymaking. It highlights how these technologies

can activate the political process and contribute to the reengineering of decision-making systems and mechanisms. The study also aims to understand the opportunities and challenges associated with integrating these technologies into public policy decisions. It concludes that AI and big data can enhance the public policy framework if applied within a legal and ethical framework that promotes and protects economic and social goals within society.

keywords

Artificial intelligence, Big data, Public policy, Decision-making, Modern technologies

جاءت هذه الدراسة بهدف تسليط الضوء على موضوع صنع السياسة العامة في ظل عصر الذكاء الاصطناعي، من خلال تحليل أهمية استخدام التقنيات التكنولوجية للذكاء الاصطناعي والبيانات الضخمة لتفعيل العملية السياسية ومدى مساهمتها في إعادة هندسة نظم وآليات صنع القرار، كما تكمن أهمية الدراسة في محاولة فهم الفرص والتحديات الناجمة عن توظيف هذه الآليات في صنع قرارات السياسات العامة، ليتم التوصل إلى أن الذكاء الاصطناعي والبيانات الضخمة تسمح بتجويد وتحسين إطار صنع السياسة العامة إذا تم توظيفها في إطار قانوني وأخلاقي يراعي تعزيز وحماية الأهداف الاقتصادية والاجتماعية داخل المجتمع.

الذكاء الاصطناعي؛ البيانات الضخمة؛ السياسات العامة؛ صنع القرار؛ التكنولوجيات الحديثة

Résumé

Cette étude se penche sur l'élaboration des politiques publiques à l'ère de l'intelligence artificielle en examinant l'importance de l'utilisation des technologies de l'intelligence artificielle et des mégadonnées pour dynamiser le processus politique et contribuer à la refonte des systèmes et des mécanismes de décision. L'étude vise également à comprendre les opportunités et les défis associés à l'intégration de ces technologies dans la prise de décisions en matière de politiques publiques. Il en ressort que l'intelligence artificielle et les mégadonnées peuvent améliorer le cadre de l'élaboration des politiques publiques, à condition qu'elles soient appliquées dans un cadre juridique et éthique qui favorise et protège les objectifs économiques et sociaux au sein de la société.

Mots-clés

Intelligence artificielle, mégadonnées, politique publique, prise de décision, technologies modernes