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ORIGINAL ARTICLE

Utilizing Artificial Intelligence in Policymaking Process: Big Data Analysis and Smart Decision-Making

Pantea Ghaffari^{1*}, Seyed Mehdi Alvani², Amirhesam Arabi³

1. Assistant Professor,
Department of Public
Administration and Public Policy,
Central Tehran Branch, Islamic
Azad University, Tehran, Iran.

2. Professor, Department of
Public Administration, Faculty of
Management and Accounting,
Allameh Tabataba'i University,
Tehran, Iran.

3. Ph.D. Candidate, Department
of Futures Studies, University of
Tehran, Tehran, Iran.

*Correspondence

Pantea Ghaffari

E-mail: pantea.ghaffari@ut.ac.ir

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EXTENDED ABSTRACT

Introduction

The digital age has brought significant complexity to social, economic, and environmental spheres, driving a profound change in public policymaking. With the surge in digital data and rapid advancements in artificial intelligence (AI), traditional policy models based on qualitative methods and personal judgment are being replaced by adaptive, evidence-based, and data-driven approaches. AI and data science now play a pivotal role, expanding possibilities in knowledge production, supporting political decision-making, and improving government responsiveness. AI excels at analyzing vast amounts of both structured and unstructured data, uncovering patterns, forecasting scenarios, and offering actionable policy insights—making it an important aid to human policymakers. This change is also propelled by increasing demands to manage complex issues like environmental threats, demographic changes, and security risks.

In countries such as Canada, Estonia, and Singapore, incorporating AI into policymaking has led to more transparency, better efficiency, and reduced corruption. Importantly, AI serves as a decision-support tool—enhancing multi-dimensional analysis for evidence-based and timely policy choices, rather than replacing human decision-makers. This has encouraged a move away from intuition-led governance toward predictive modeling and scenario-based planning. Recent research also highlights the value of developing locally relevant AI models for public policy, stressing that universal solutions risk ignoring each society's unique cultural, social, and structural features, thereby reducing effectiveness and potentially increasing inequality. Integrating indigenous knowledge with advanced AI creates new opportunities for participatory governance that is sensitive to national context.

Methodology

This study employs a rigorous systematic review methodology, strictly adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards. The analysis draws upon both qualitative content and comparative thematic analysis to synthesize insights from leading international examples and local requirements. The research design involved extensive searches of reputable scientific databases, including Web of Science, Scopus, IEEE Xplore, ScienceDirect, and SpringerLink. The search spanned from 2010 through 2024, capturing literature that reflects the evolution and contemporary challenges of AI in policy environments.

A total of 632 articles were identified in the initial search. After applying predefined inclusion and exclusion criteria, 28 scholarly articles were selected for in-depth analysis. The inclusion criteria prioritized empirical studies, systematic reviews, and conceptual papers that directly addressed AI's role at various stages of the public policy cycle. Exclusion criteria eliminated commentaries, opinion pieces, and studies lacking robust methodological foundations. The data extraction process emphasized key thematic areas such as algorithmic bias, model transparency, privacy implications, efficiency gains, and ethical frameworks.

Subsequent qualitative content analysis identified recurrent themes, theoretical models, and cross-

national comparative insights. The analysis also featured benchmarking against real-world case studies from Canada, Estonia, and Singapore to contextualize global best practices and challenges. Special attention was paid to frameworks integrating local knowledge, participatory governance models, and multi-level governance protocols, which were deemed critical for tailoring AI systems to Iran's unique societal landscape. Additionally, the research incorporated expert interviews and policy analysis reports relevant to the Iranian context as supplementary sources, ensuring a comprehensive and multi-dimensional perspective.

Findings

The systematic review and qualitative analysis of the selected articles revealed several overarching patterns in the application of AI across the five key stages of the public policy cycle: problem identification, policy analysis, solution design, effective implementation, and continuous evaluation. In leading countries, AI contributes to more incisive issue detection and refined analysis by leveraging big data, machine learning algorithms, and advanced social network analytics. These technologies not only facilitate the identification of emergent societal trends and nuanced policy challenges but also enable anticipation of complex feedback loops resulting from policy actions.

Effective deployment of AI supports evidence-based solution design by integrating predictive analytics and simulation models. For instance, in healthcare policymaking, AI-driven epidemic modeling enables early detection of outbreaks and optimizes resource allocation. In environmental governance, AI-enhanced monitoring systems contribute to more accurate assessments of ecosystem dynamics and support adaptive regulatory responses. In economic policy, AI enables sophisticated scenario forecasting, guiding macroeconomic stabilization and investment strategies.

Implementation stages benefit from AI through real-time monitoring of policy outcomes, automated reporting systems, and decision support platforms. Machine learning models assist in tracking program performance, detecting anomalies, and generating alerts for corrective action. Beyond operational efficiencies, AI facilitates increased transparency by making policy processes and outcomes more accessible and auditable to citizens and oversight institutions. In Singapore, for example, AI-powered smart platforms have redefined public service delivery, while in Estonia, decentralized digital governance protocols have streamlined administrative procedures and reduced governmental friction.

Evaluation and continuous improvement are bolstered by AI's capacity to analyze large-scale feedback, perform sentiment analysis on citizen inputs, and identify persistent gaps in policy effectiveness. Social network analysis further elucidates community-level reactions and supports participatory assessment models, strengthening the feedback loop between policy designers and stakeholders.

Despite these benefits, persistent challenges remain. Algorithmic bias, data silos, lack of model explainability, and privacy threats are cited as major risks in the reviewed literature. The risk of perpetuating inequities through unexamined algorithms is particularly acute in heterogeneous societies. Moreover, the opacity of AI models can undermine trust, especially when policy decisions have significant social impact. Privacy concerns are magnified with the expansion of surveillance capacities and the aggregation of sensitive personal data.

The analysis of Iranian policy literature and expert interviews underscores that, while technical infrastructure and expertise are growing, systemic hurdles persist. Data fragmentation, lack of unified governance protocols, and insufficient legal frameworks hamper comprehensive AI adoption. Furthermore, the absence of robust digital literacy programs among civil servants and the public inhibits meaningful participation in AI-driven governance processes. The persistence of legacy administrative systems and cultural resistance to technological change are additional factors constraining the transformative potential of AI in Iran's public sector.

Discussion and Conclusion

The findings highlight both remarkable opportunities and critical gaps in AI implementation within Iranian public policymaking. While several operational advances have been achieved, the current landscape remains primarily concentrated on efficiency-driven applications, with less emphasis on transformative restructuring of policymaking processes. Most Iranian initiatives focus on automating administrative tasks, optimizing workflow management, and improving service delivery. However, the integration of AI into strategic policy design, legitimization, and evaluation is nascent.

A major limitation identified in the literature is the insufficient localization of AI models. International examples demonstrate that successful AI-driven governance depends not only on technological sophistication but also on contextual adaptability. Standardized solutions, when imported without nuanced customization, risk incompatibility and even adverse societal consequences. In countries with complex socio-cultural fabrics such as Iran, effective AI adoption

requires multidimensional customization, balancing technological advancement with cultural sensitivities, governance traditions, and legal norms.

The absence of comprehensive ethical and regulatory frameworks in Iran poses additional barriers. International best practices advocate for the implementation of algorithmic transparency protocols, independent ethics councils, and regulatory sandboxes for testing novel policy models. However, Iran's current legal and institutional arrangements do not adequately address challenges related to data ownership, privacy protection, and algorithmic accountability. This gap not only undermines public trust but also exposes the policy ecosystem to risks of misuse, bias propagation, and social disenfranchisement.

The reviewed literature indicates that fostering a culture of digital literacy and inclusivity is vital for successful AI-driven governance. Participatory governance models, as adopted in Estonia and Singapore, underscore the importance of stakeholder engagement and cross-sectoral collaboration. In Iran, the segmentation of policymaking institutions and the predominance of hierarchical structures limit opportunities for dynamic interaction between technologists, policymakers, and civil society. Bridging this gap requires strategic investment in capacity-building initiatives, curriculum reform, and the promotion of cross-functional policy innovation teams.

A three-layered conceptual framework is proposed to address these challenges and optimize AI integration in Iranian policymaking:

- Layer 1 – Technological Integrity: Establish robust national standards for data quality, security, and interoperability across government databases. Centralize critical data infrastructure and introduce mandatory bias and explainability testing for all public sector algorithmic models.
- Layer 2 – Institutional and Legal Governance: Develop a unified and adaptive national AI policy, including legal mandates for algorithmic transparency and the creation of an independent ethics and auditing council. Pilot regulatory sandboxes to enable careful experimentation with innovative policy mechanisms while upholding minimum standards for transparency and accountability.
- Layer 3 – Socio-Cultural and Strategic Capacity: Launch comprehensive public and civil servant digital literacy programs and promote strategic workforce planning to cultivate indigenous AI expertise. Encourage public discourse on data ethics, privacy, and algorithmic fairness to strengthen collective trust in AI-enabled governance.

This research systematically maps the current state and future prospects of AI utilization in Iranian public policymaking, drawing upon in-depth analysis of 28 scholarly articles, global case studies, and local context assessments. The findings confirm that, while progress is being made in operational efficiency and administrative modernization, the full transformative potential of AI in Iranian policy remains largely untapped. Persistent technical, institutional, and cultural barriers must be addressed to enable a successful shift toward intelligent, data-driven governance.

The proposed three-layered indigenous framework offers a comprehensive roadmap for aligning technological innovation with ethical imperatives and robust institutional structures. By addressing data integrity, regulatory oversight, and strategic capacity development in tandem, Iran can maximize the benefits of AI integration while mitigating associated risks.

Looking forward, future research should prioritize quantitative impact assessment, pilot program evaluations, and longitudinal studies tracking the evolution of AI models within Iranian governance. Policymakers are encouraged to embrace collaborative and cross-sectoral approaches, harnessing both local expertise and international best practices. Ultimately, Iran's journey toward intelligent governance will depend not only on acquiring advanced algorithms but also on embedding them within transparent, participatory, and ethically governed policy systems. Only through this holistic strategy can Iran unlock AI's full potential to advance social welfare, economic resilience, and sustainable development.

KEYWORDS

Artificial Intelligence, Public Policymaking, Big Data, Smart Decision Making, Data-driven Governance.

