



A Bibliometric Mapping of Artificial Intelligence Research in Digital Public Service (2020–2025)

Inkreswari Retno Hardini¹, Susetyo Bagas Bhaskoro², Tivani Shakilla Ervi³, Meta Bara Berutu¹

¹Faculty of Economics and Business, Universitas Negeri Jakarta, Indonesia

²Department of Cyber Physical System, Politeknik Manufaktur Bandung, Indonesia

³Department of Technology Management Economy Policy, Seoul National University, South Korea

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*Corresponding Author:

inkreswari.retno@unj.ac.id

ABSTRACT

AI ceases to be a matter of discussion as a technological innovation, but also of how governments redesign the provision of public services, deal with information, and react to the more intricate needs of society. Research in the field of AI and digital public service has been accelerating rapidly over the past few years, particularly amid the accelerated pace of digital transformation during the COVID-19 period and beyond. However, the discourse is still dispersed across different fields and research issues, and thus, it is difficult to follow the development of the field as a system. The aim of this paper is therefore to conduct a review of the development and research frontier of AI in Digital Public Service during the period between 2020 and 2025 through a bibliometric approach. The study used bibliographic data acquired via the Scopus database. Data were collected using a structured search strategy that combines Boolean operators and keywords related to artificial intelligence and digital public service. A total of 662 publications were retrieved and visualized using VOSviewer. After the use of a minimum occurrence of five, 216 keywords were chosen and grouped into six thematic clusters. The results show a definite upward trend in the number of publications after 2022, indicating greater academic interest in AI-based governance and digital transformation in the state sector. Several prevailing themes emerged, including machine learning, digital government, public administration, natural language processing, information management, and AI governance. Overall, the findings suggest that the study of AI in digital public service has moved beyond the argument about fundamental digitalization to address significant questions about governance, public value, and the responsible use of AI.

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■ INTRODUCTION

Artificial Intelligence (AI) has become a significant component of digital transformation policies within the state sphere. Governments in developed and developing countries are embracing AI-based systems in administration, citizen decision-making, and service delivery to the populace. Various technologies are currently deployed in various areas of government, such as machine learning, natural language processing, robotic process automation, predictive analytics, and intelligent decision-support systems in taxation, healthcare management, transportation, immigration, licensing, and social welfare management. Their usage is increasing, which points to an even broader tendency for

governments to streamline bureaucracies and keep up with the growing demands of more efficient, responsive, and data-driven services (Sun & Medaglia, 2019; Wirtz et al., 2019).

This transformation has been increased by the expansion of digital ecosystems of public services. Digital public service is often viewed as the provision of public services through integrated digital architectures such as government portals, interoperable databases, cloud computing applications, and mobile applications. Within these environments, AI can assist governments in automating operations, handling vast amounts of citizen data, personalizing services, and becoming more responsive to citizens. As a result, AI is no longer perceived as a technical tool of

operational efficiency, but rather as an institutional mechanism that modifies governance practices and state-citizen interaction (Mergel et al., 2019; Zuiderwijk et al., 2021).

The necessity of AI adoption was more evident during the COVID-19 pandemic and afterward. The immobility demanded institutional stability in the management of public institutions and, concurrently, more remote public services. This scenario in numerous countries stimulated digital government projects and stimulated the exploration of AI-driven systems in automated communication, case management, and the release of public information. The recent quick growth of generative AI and large language models, which started in 2022, has added to the policy and academic focus on AI deployment in government settings. AI-based multilingual communication, AI-based smart document processing, AI-assisted citizens, and data-driven policy support systems are becoming of interest to governments.

Nevertheless, the increasing use of AI in online government has also presented significant governance issues. Unlike AI implementation in the private sector, the use of algorithms in government directly affects citizens' rights, their access to welfare and taxation, immigration, and even law enforcement outcomes. This has made concerns about transparency, explainability, fairness, accountability, privacy, and the bias that exists in algorithms the main discussion points in recent literature (Busuioc, 2021; Grimmelikhuisen & Meijer, 2022). The new controversy surrounding Explainable Artificial Intelligence (XAI) in the governmental context illustrates the increasing uneasiness with the lack of transparency in automated decision-making procedures and the legitimacy of algorithmic governance.

At the institutional level, AI implementation also exposes structural weaknesses in government. Multiple public entities still experience disjointed legacy infrastructures, a lack of interoperability, inadequate digital capabilities, bureaucratic imperatives, and poor cross-agency coordination. Several high-profile failures of automated public systems have demonstrated that the less-controlled use of AI may reinforce social inequality, have discriminatory impacts, and lessen trust in the system. In this case, the introduction of AI should not be understood as technological implementation but as a socio-technical change, which involves the ability to govern, the willingness of institutions, changes in regulations, and changes in organizations

(Mergel et al., 2019; Valle-Cruz et al., 2020).

These developments have underpinned the rapid growth of scholarly attention to AI in the public-sector environment. AI and digital government research has grown in a wide range of disciplines, such as public administration, information systems, governance studies, computer science, public policy, and data science. The literature covers multiple subjects, such as AI-enabled services provided by governments, AI accountability, algorithmic governance, trust among citizens, the adoption of chatbots, and the ethical regulation of AI. However, even with the ever-increasing number of publications, the literature is still disjointed and scattered.

The main issue is that most works focus on specific technologies or individual institutional cases. Some researchers view AI chatbots as general communication, and others as predictive analytics, intelligent governance, and regulatory models. Although these studies can provide useful information, they are more often in a narrow disciplinary mode and hardly provide a general picture of how the discipline has evolved into a consistent body of knowledge. Consequently, the academic paradigm, theme development, and novel research directions of AI in digital public services have not been thoroughly synthesized so far.

Past review research has tried to conceptualize the adoption of AI in government. In their turn, Wirtz et al. (2019) classified AI applications into service delivery to the population, policy analysis, and administrative support. Valle-Cruz et al. (2020) also asserted that AI technologies influence all stages of the public policy cycle, including agenda setting and evaluation. The implications of AI on governance have been studied by other researchers, especially in the context of accountability, transparency, and citizens' trust (Busuioc, 2021; Wang et al., 2024). The necessity of human-centered AI governance and ethically grounded regulatory frameworks in the public sector has also been discussed recently.

Despite these contributions, the literature on bibliometric studies on specific aspects of AI in digital public service is limited. The existing bibliometric literature is more likely to discuss AI in government generally, and does not find digital public service as a particular area of analysis. Furthermore, little emphasis has been placed on the post-pandemic acceleration stage that took place in 2020-2025, when governments grew significantly more active in their digitalization strategy and their AI-implementation strategies. This era is

especially significant since it signifies a shift from experimental AI to more institutionalized and operational AI use in public administration.

Another constraint in the literature currently available is thematic integration. Arguments related to technological innovation, governance change, citizen confidence, responsibility, institutional preparedness, and operational effectiveness are rarely brought together on a single platform of analysis in past literature. Consequently, the area is yet to gain a holistic understanding of the interactions among these dimensions and how they influence the development of AI-enabled public services worldwide.

Bibliometric analysis in this respect offers a methodological approach to tracing the intellectual development of a field of research. Bibliometric techniques allow researchers to determine the trends of publications, collaboration, theme clusters, citation networks, and new streams of research by quantitatively assessing scholarly metadata (Aria & Cuccurullo, 2017; Donthu et al., 2021). Besides quantifying the growth of publications, bibliometric mapping can also be used to uncover conceptual fragmentation, interdisciplinary convergence, and research gaps, which might not be apparent using traditional narrative reviews.

Therefore, the research project will consist of a bibliometric mapping of the global research on Artificial Intelligence in Digital Public Service in the 2020–2025. This paper concentrates on digital public service as the object of analysis, unlike the former studies, which present the topic of AI in a governmental context vaguely. Furthermore, the two methods used in this study include bibliometric mapping and thematic synthesis in order to provide a more comprehensive picture of the intellectual framework and evolution of research in the area.

This study aims to examine the trends in AI publication growth within digital public service, identify key thematic clusters and co-occurrence patterns in the texts, synthesize main research streams from the literature, and highlight future research opportunities along with ongoing gaps.

Based on these objectives, the study addresses the following research questions:

1. How has global research on Artificial Intelligence in Digital Public Service evolved during the 2020–2025 period?
2. What thematic clusters and dominant research streams characterize the literature on AI in digital public service?
3. What major research gaps and future research opportunities emerge from the

existing body of literature?

The contribution that the work brings to the theoretical discussion is that the intellectual context of AI research in digital public service is made transparent and that the fields of governance, information systems, and AI research are also linked interdisciplinarily. In practice, the results should inform policymakers, researchers, and practitioners in the public sector by helping them understand current research trends and strategic issues in AI-enabled public services.

■ LITERATURE REVIEW

Conceptual Foundation of Artificial Intelligence in Digital Public Service

The concept is also known as artificial intelligence (AI) and normally suggests a computerized capability to perform tasks associated with human thought, including learning, prediction, reasoning, perception, and language processing. Though the early discourses of AI were mostly related to automation of industries and applications within companies, in the recent past, there have arisen developments that show that AI is being integrated more into administrative and government service structures by governments. AI is no longer an experimental technology in government. Instead, it is gradually becoming a part of bigger digital transformation agendas to improve institutional efficiency, policy responsiveness, and service delivery to citizens (Valle-Cruz et al., 2020; Wirtz et al., 2019).

AI technologies are utilized in digital service ecosystems to support operational and strategic processes in government. Virtual assistants and chatbots are used more and more to promote communication with citizens and offer 24/7 access to governmental information. Predictive analytics supports traffic management, fraud detection, and resource allocation, and machine-learning systems help governments process vast amounts of administrative data. In practice, AI is not just deployed in front-office interactions, but is also used in internal bureaucratic processes such as document classification, case handling, and policy analysis (Androutsopoulou et al., 2019; Dwivedi et al., 2021).

However, discussions of AI in the context of public administration cannot be separated from governance concerns. Unlike AI systems in the private sector, AI systems in the public realm are shaped by institutional contexts directly connected to legal jurisdiction, social responsibility, and citizen rights. Consequently, explanatory, transparency, fairness, and accountability of the algorithm have become central to the recent literature. There is a

growing doubt among scholars about the possibility of automated decision-making systems being compatible with the principles of democratic governance, especially at a time when algorithmic processes are not easily audited or explained to the citizens subject to them (Busuioc, 2021; Grimmelikhuijsen & Meijer, 2022).

It is even more severe when AI is applied to make high-stakes governmental decisions (welfare distribution, immigration procedures, taxation, policing, and people monitoring). According to some researchers, the introduction of AI to the government can, therefore, be regarded as a socio-technical change and not a technological one. Institutional readiness, regulatory capacity, organizational culture, data governance maturity, and public trust may also mediate the power of algorithms to a large extent (Mergel et al., 2019; Zuiderwijk et al., 2021). This viewpoint has been used to understand the prevalence of AI implementation outcomes across various governmental settings despite similar technological environments.

Theoretical Perspectives on AI and Digital Governance

Investigations into AI in digital public service have been informed by several theoretical frames grounded in the literature of public administration, information systems, and the governance sciences. One of the most popular theories is Digital Government Theory, which explains how the system of service delivery, the structure of the public sector, and the interaction of the state and citizens are changing due to the impact of digital technologies. In this context, AI is considered a continuation of the development of digital government, where governments can leave non-adaptive administrative systems in the past and move to more adaptive and data-driven governance forms.

Another important one is the Public Value Theory. According to researchers in this school of thought, efficiency or cost-cutting cannot be regarded as the only criterion by which the implementation of AI can be evaluated in government. Other social values that are likely to be developed by technologies in the public sector include fairness, accessibility, legitimacy, transparency and citizen trust. Thus, AI systems that improve operational efficiency, at the expense of accountability or procedural justice, may be considered problematic in the public-value lens.

The Social-Technical Systems Theory can also serve as a valuable perspective on AI adoption in state agencies. It is an opinion that

points to the reality that technological systems cannot be segregated from organizational structures, human competency, institutional culture, and regulatory environments. Bureaucratic inertia, discontinuous legacy systems, and institutional inertia may be likely to occur in the governmental context of implementing AI. Thus, the level of technological sophistication itself cannot guarantee a successful implementation outcome most of the time (Mergel et al., 2019).

The more recent aspect of the literature on public administration is algorithms in governance (as opposed to governance by algorithms). It is a term applied to governance systems in which algorithmic systems are employed to influence or partially automate people's decision-making. Current literature indicates that algorithmic governance introduces conflicts between efficiency and democratic accountability since the power to make decisions is in part entrenched within the obscure computational systems (Busuioc, 2021; Dwivedi et al., 2021). These debates have expanded with the emergence of generative AI and large language models, which contribute to the issues of explainability and institutional responsibility.

Previous Studies on AI in Government and Public Administration

The rapid progress in the use of AI in the public sector has been followed by growing scholarly interest. The available literature tends to concentrate on several key topics, such as AI-based service provisions, predictive governance, chatbot adoption, citizen trust, ethical AI, and regulatory policies.

An example is the study of AI chatbots that has demonstrated their potential to improve accessibility and efficiency in governmental communication; according to the articles by Androutsopoulou et al. (2019) and Larsen & Følstad (2024), conversational AI systems have the potential to decrease administrative workload but, at the same time, increase citizens' access to government services. However, recent studies also show that unresolved problems of service accuracy, multilingual inclusiveness, protection of privacy, and accessibility for vulnerable population groups remain.

An additional major line of writing looks at predictive analytics and data-driven governance. Governments increasingly use machine-learning systems to predict service demand, allocate resources efficiently, detect fraud, and support policy review. On the one hand, some individuals think that predictive governance can improve administrative

responsiveness and the use of evidence in policy-making. However, some people believe that data-driven systems may introduce bias and reduce human responsibility in key decisions that affect people (Charles et al., 2022; Sousa et al., 2019).

Accountability and explainability issues have become the leading points in recent articles, as well. Busuioc (2021) concludes that AI systems disrupt conventional bureaucratic accountability structures because accountability is decentralized among software developers, public managers, vendors, and frontline agencies. On the same note, Grimmelikhuijsen & Meijer (2022) point out that perceptions of transparency, fairness, and procedural legitimacy significantly determine citizens' satisfaction with AI-enabled government services.

Another critical issue within the literature has come out as citizen trust. According to some studies, the social acceptability of AI systems depends not only on technological efficiency but also on institutional confidence, a sense of justice, and citizens' ability to understand or challenge automated decisions (Geske & Leyer, 2022; Wang et al., 2024). The case of high-profile failures of automated systems in governments, e.g., the Robodebt case in Australia and the SyRI case in the Netherlands, is frequently cited as a signifier of how poorly controlled AI systems can destroy social trust and the legitimacy of the government (Bekker, 2020; Clarke et al., 2024; Meuwese, 2020).

The literature on AI governance is increasingly abundant among regulators, as there is an emerging trend to discuss the need to establish AI governance frameworks that would strike a balance between innovation and democratic protection. The growing interest in developing risk-based governance mechanisms for AI implementation in the public sector can be seen in international efforts such as the OECD AI Principles and the European Union AI Act. Nevertheless, scholars are also concerned about the feasibility of implementing regulatory approaches tailored to high-capacity institutions in developing nations with alternative administrative frameworks and digital infrastructure (Wirtz et al., 2022; Zaidan & Ibrahim, 2024).

Systematic Reviews and Domain-Specific Studies

Besides bibliometric research, review studies are also devoted to the application of AI to government in a functional and governance manner. Wirtz et al. (2019) divided AI applications into service delivery and policy

analysis, and administrative support, highlighting implementation barriers, including legal ambiguity, organizational resistance, and data limitations. The same authors discussed the use of AI in the sphere of public policy. Valle-Cruz et al. (2020) have shown that it is possible to apply AI to the agenda-setting process, policy design, implementation, and evaluation.

To address the accountability dilemmas presented by algorithmic systems, Busuioc (2021) asserts that conventional bureaucratic accountability is insufficient in the case of opaque AI models. The latter also pointed out that AI can contribute to enhancing service responsiveness, while increasing the risk of exclusion, surveillance, or procedural unfairness in scenarios where governance safeguards are lax. Chatbot research has remained niche, especially in specific areas. AI chatbots can differ significantly in the efficiency of communication between citizens and governments, as demonstrated in (Androutsopoulou et al., 2019). Cortés-Cediel et al. (2023) also surveyed e-government chatbots and attributed their genesis to open government data, accessibility, and citizen involvement agendas.

The question of citizen trust has also become one of the main areas of focus, as well. The relevance of transparency in algorithms also emerged as influencing the likelihood of citizen behavior regarding automated decisions affecting the population (Grimmelikhuijsen & Meijer, 2022). However, a study conducted by Madan and Ashok (2023) revealed that perceived fairness, explainability, and reliability of services have a significant correlation with trust in AI-based public services.

Research Gap and Positioning of the Present Study

The body of literature on AI in government has expanded, and conceptually, it remains highly fragmented. The current literature is typically split along disciplinary lines, e.g., in the areas of public administration, information systems, governance studies, and computer science. There is much literature on specific applications of technology or specific national case studies, but there is relatively a lack of generalised research on intellectual development in the field.

Current bibliometric sources tend to discuss AI in government broadly, without identifying digital public service as a particular point of analytical attention. As a result, little emphasis has been placed on the interplay of themes such as governance transformation,

citizen trust, responsibility, operational efficiency, and technological infrastructure as a subset of the broader development of AI-enabled public services.

Another important constraint is the 2020-2025 period after the pandemic. The period was marked by governments accelerating the pace of digital transformation and more heavily leveraging AI tools in their operations owing to administrative disruption and the demand for digital services by the population. Although this transformation has strategic importance, bibliometric mapping in the context of AI in digital public service in the post-pandemic period is not well covered.

In this connection, this research paper identifies its purpose as a specialized bibliometric study of international scholarship on Artificial Intelligence in Digital Public Service over the last 5 years (2020-2025). This paper aims to elucidate the intellectual framework, most used research areas, and emerging research gaps influencing the discipline by merging bibliometric mapping and thematic synthesis.

■ **METHOD**

Research Design

This study employed a bibliometric research design to map the intellectual structure and thematic development of Artificial Intelligence research in Digital Public Service during the 2020–2025 period. Bibliometric analysis was selected because it enables the identification of publication trends, conceptual relationships, and thematic patterns within a rapidly expanding interdisciplinary field. The choice of bibliometric analysis was based on the fact that it allows exploring publication trends, the development of themes, and citation patterns, as well as the relationships between concepts in a fast-growing interdisciplinary field of research (Aria & Cuccurullo, 2017; Donthu et al., 2021). Unlike traditional narrative reviews, bibliometric methods utilize structured scholarly metadata, including titles, abstracts, author keywords, affiliations, citation counts, and place of publication. In this way, researchers can determine prevailing research themes, new knowledge clusters, and intellectual links in large volumes of scientific publications in a more transparent and reproducible way.

To facilitate the interpretation of bibliometric findings, the keyword clusters generated by VOSviewer were examined descriptively based on their dominant terms, co-occurrence relationships, and conceptual relevance to the literature on artificial intelligence and digital public service. This

interpretive procedure was intended to explain the characteristics of each bibliometric cluster and identify major research streams emerging from the dataset. The study did not employ formal qualitative thematic synthesis involving coding procedures or theme generation from full-text documents. The analysis was conducted on the post-pandemic time span of 2020-2025, when governments increased their pace of adopting AI-enabled digital public services across the globe. The study did not employ formal qualitative thematic analysis procedures involving textual coding or theme generation from full-text documents. Instead, the interpretive component of the study focused on describing and contextualizing the bibliometric clusters identified through VOSviewer.

Search Strategy

The first quarter of 2026 saw the retrieval of the bibliographic dataset from the Scopus database. Scopus provides broad interdisciplinary coverage and higher indexing and peer-reviewing standards than open-source academic search engines (such as Google Scholar). Scopus also enhances data consistency, metadata standardization, and replicability in bibliometric research.

To ensure comprehensive retrieval of relevant publications, the search strategy employed a combination of Boolean operators (“AND” and “OR”) and synonyms to expand the scope of the search, as it was necessary to obtain as many relevant publications as possible. The search strategy was guided to accommodate differences in terms used with respect to Artificial Intelligence and the digital public service in the literature on the topic of public administration, information systems, and governance.

The search query was conducted using the TITLE-ABS-KEY field in Scopus as follows:

```
TITLE-ABS-KEY (  
  (  
    "artificial intelligence"  
    OR "AI"  
    OR "machine learning"  
    OR "intelligent system*"  
    OR "generative AI"  
    OR "natural language processing"  
  )  
  AND  
  (  
    "digital public service"  
    OR "digital government"  
    OR "e-government"  
    OR "electronic government"  
    OR "public service"  
    OR "government service delivery"
```

```

OR "smart governance"
)
)
AND PUBYEAR > 2019
AND PUBYEAR < 2026

```

The search process was limited to journal articles and conference proceedings, English-language publications, final published documents, and subject areas relevant to social sciences, computer science, business, decision sciences, and public administration. The search retrieval yielded a broad set of data, which was filtered and narrowed through several steps according to the PRISMA 2020 principles.

Inclusion and Exclusion Criteria

The study selection process was reported using the PRISMA 2020 framework to enhance transparency in the identification and inclusion

of publications for bibliometric analysis. Eligibility criteria were operationalized through the Scopus search strategy and predefined database filters.

The inclusion criteria were defined as follows: (1) publications discussing Artificial Intelligence within digital public service, digital government, e-government, or public-sector governance contexts; (2) studies published between 2020 and 2025; (3) journal articles and conference proceedings indexed in Scopus; (4) English-language publications; (5) final published documents with complete bibliographic metadata, including title, abstract, author information, publication source, and keywords.

The eligibility criteria were implemented directly through the Scopus search query and database filtering options. Publications were limited to English-language journal articles and

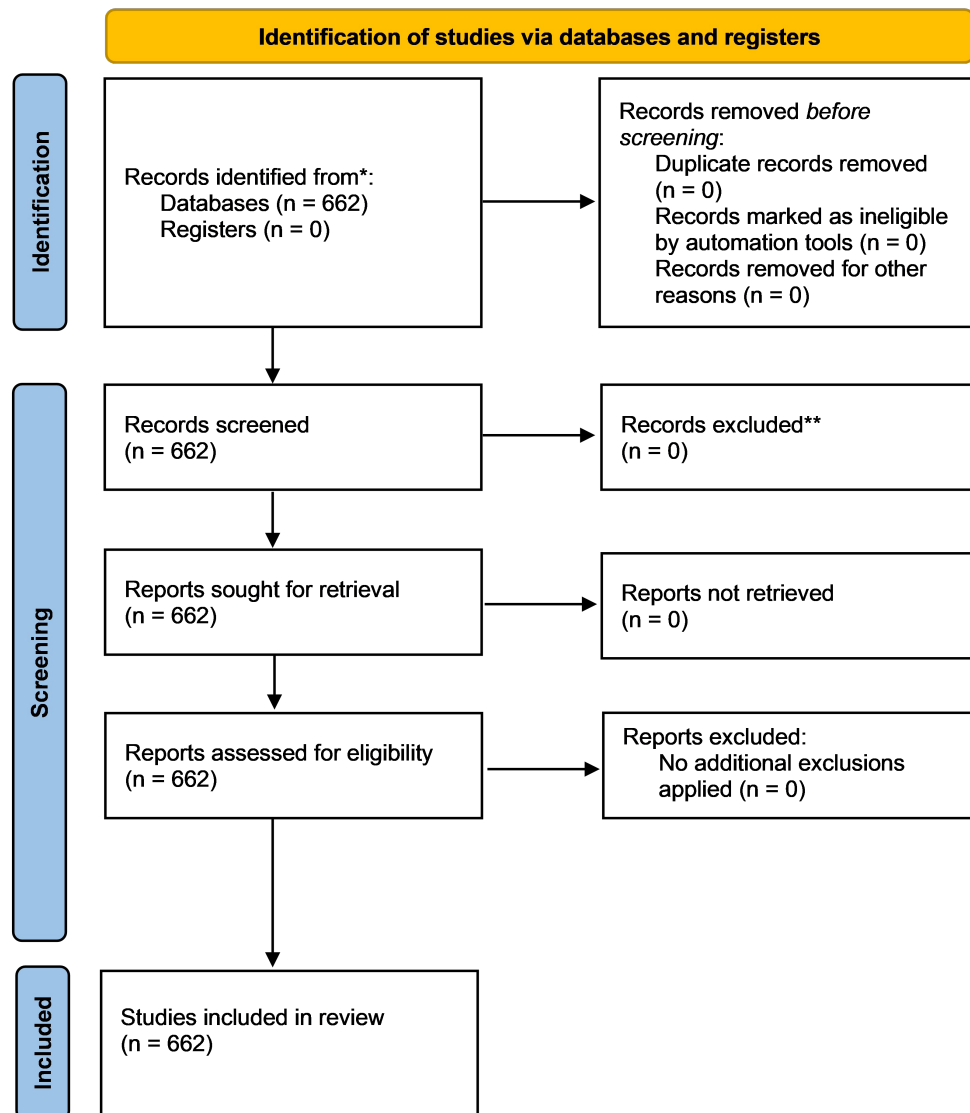


Figure 1. Prisma 2020 flow diagram of the identification and inclusion process for bibliometric analysis

conference proceedings published between 2020 and 2025, with final publication status and subject areas relevant to social sciences, computer science, business, decision sciences, and public administration. As the Boolean search strategy had been specifically designed to retrieve studies addressing artificial intelligence within digital public service contexts, all retrieved records satisfied the predefined eligibility requirements. Consequently, no additional manual exclusions were applied after data retrieval.

Following data retrieval, the bibliographic records were reviewed to verify metadata completeness prior to bibliometric processing. No additional title screening, abstract screening, or full-text eligibility assessment was conducted because the predefined search strategy and database filters had already aligned the retrieved publications with the scope and objectives of the study.

The use of Scopus was intended to improve dataset quality and reduce the likelihood of non-peer-reviewed and potentially predatory articles. In contrast to Google Scholar, which records a wide collection of scholarly and non-academic literature, Scopus is more stringent with its source-indexing and journal-evaluation criteria. This increases metadata consistency and reduces the possibility of adding poor or missing scholarly documents in bibliometric analysis.

In addition, several quality-control processes were implemented during screening. Sources to avoid included discontinued sources, sources not checked manually, and dubious sources. The conceptual material was assessed in relation to the research topic of digital public service and AI governance by inspecting titles and abstracts to ensure it was relevant to the research topic.

The identification and inclusion process adopted in this bibliometric study is presented using the PRISMA 2020 flow diagram (Figure 1). As the predefined search strategy and database filters were specifically developed to align with the study objectives and eligibility criteria, all retrieved records were retained for bibliometric analysis.

Data Cleaning and Preparation

Bibliometric mapping was enhanced through preprocessing and data cleaning to improve metadata consistency, reduce term fragmentation, and increase mapping reliability. The original Scopus data export included terminology variability, redundancy, author label inconsistency, and variations in keyword representation that might affect network visualization and theme clustering. An

automated and manual cleaning process was run to preprocess the dataset. The initial preprocessing stage involved verification of bibliographic metadata exported from Scopus to ensure record completeness and consistency prior to normalization. Because the dataset was retrieved from a single database source and no duplicate records were identified, all retrieved publications were retained for subsequent bibliometric analysis. The bibliographic metadata were then standardized to ensure uniformity across publication records.

Further processing of the dataset was done with OpenRefine to normalize metadata and clean keywords to enhance harmonization of terms. Inconsistent spelling, plural-singular, and abbreviation inconsistencies, and synonymous terms frequently used in titles, abstracts, and keywords by authors were identified using OpenRefine. This operation minimized conceptual fragmentation in the construction of co-occurrence networks.

Several normalization procedures were subsequently applied to improve metadata consistency and reduce conceptual fragmentation within the dataset. These procedures included synonym unification, abbreviation expansion, singular-plural harmonization, spelling correction, and terminology standardization. For example, abbreviated expressions such as “AI” and “ML” were standardized as “Artificial Intelligence” and “Machine Learning,” respectively. Similar normalization rules were applied to other synonymous and variant expressions identified throughout the bibliographic records to ensure that conceptually equivalent terms were represented consistently during co-occurrence analysis.

Moreover, author-name disambiguation was also verified manually to curb discrepancies in indexed publications caused by inconsistencies in initials, punctuation, or even variations in names. The metadata normalization was then followed by the creation of a thesaurus file that was imported into VOSviewer to standardize key terms and merge terms when analyzing the co-occurrence of texts. The thesaurus had an organized list of consolidated terms, abbreviations, terms that were not included in the mapping process and were excluded as generic words, and terms that were normalized and used in the mapping. In contrast to the simplified examples used in the preliminary dataset, the final thesaurus was based on a much larger list of harmonized terms to enhance analysis transparency and reproducibility.

Generic and low-information terms that did not contribute to conceptual interpretation,

such as “study,” “article,” “analysis,” and “research,” were excluded from the visualization process to improve thematic clarity and enhance the interpretability of the network maps. Following metadata normalization and thesaurus development, the cleaned dataset was exported to VOSviewer version 1.6.20 for bibliometric mapping and network visualization.

Data Analysis

The metadata retrieved in Scopus was processed in VOSviewer version 1.6.20 to explore the research structure and theme development of the study of Artificial Intelligence in Digital Public Service. The analysis primarily concentrated on the co-occurrence patterns of the keywords, since this method enables clearer identification of relationships between research themes and conceptual trends. The pre-visualization dataset has undergone several pre-processing steps. Checks and improvements were done in OpenRefine and through manual verification to fix duplications, inconsistencies, abbreviations, and redundancies. A thesaurus file was then created to standardize terms that described similar concepts. For example, terms such as “AI” were merged into “Artificial Intelligence,” while “ML” was standardized into “Machine Learning.”

To perform the bibliometric mapping, it was necessary to use the Full Counting method of the All Keywords option in VOSviewer. The frequency cut-off point was set to 5 to remove unnecessary noise due to the low frequency of word use. After the cleaning and normalization process was completed, 216 keywords that met the threshold requirement were included in the final analysis.

Three types of visualization were generated in this study. Network visualization was used to show thematic relationships and cluster structures between keywords. Visualizing the evolution of research topics over time, aided by overlay visualization, showed a shift to more recent discussions about natural language processing, language models, and generative AI. Meanwhile, the density visualization helped identify the areas of highest concentration in the study and determine the topic of greatest scholarly research.

The clustering process was performed automatically by VOSviewer based on keyword co-occurrence strength. The resulting clusters were subsequently described and labeled by the researchers through an examination of the dominant keywords within each cluster and their correspondence with concepts discussed in the existing literature. These labels served as descriptive representations of bibliometric groupings rather than themes derived from a formal qualitative synthesis process.

Overall, the combination of the two bibliometric visualizations and qualitative interpretation enabled examination not only of the existing research topic, but also of novel directions and unexplored fields of AI-driven digital public service research in the upcoming period 2020-2025.

■ RESULTS AND DISCUSSION

Publication Growth Trends (2020–2025)

Figure 2 includes the annual publication trends in relation to Artificial Intelligence in Digital Public Service in the period 2020-2025. The results indicate that publication activity slowly rises during the first years, then increases more rapidly after 2022. This increase

Table 1. Examples of thesaurus normalization used in vosviewer

Original Term	Standardized Term
AI	Artificial Intelligence
ML	Machine Learning
NLP	Natural Language Processing
chatbot	chatbots
machine-learning	machine learning
cyber security	cybersecurity
artificial intelligence (ai)	artificial intelligence
digital literacies	digital literacy
internet of things (iot)	internet of things
large language models	large language model
knowledge graphs	knowledge graph
natural language processing sy	natural language processing
block-chain	blockchain
cloud-computing	cloud computing

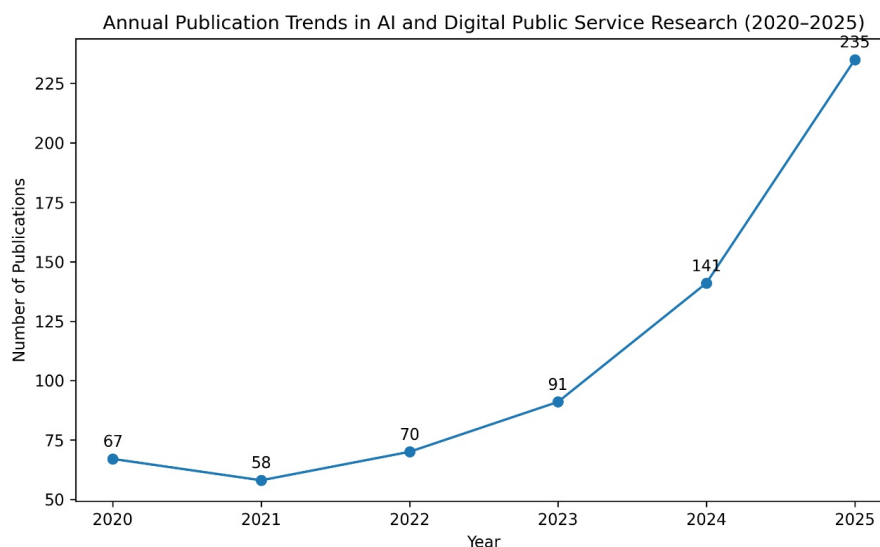


Figure 2. Annual publication trends in ai and digital public service research (2020–2025)

appears to accompany the accelerated digitalization of general institutions during the COVID-19 period and in the post-COVID-19 period. In most countries, government organizations began to embrace AI-based systems with greater vigor to aid the delivery of digital services, service automation, data analysis, and communication with citizens. As a result, the population of scientists interested in AI-mediated governance and smart services also grew exponentially.

This spike in new publications could likewise be associated with the increased rate of creating AI technologies and large language models since 2022. It shifted to a more specialized literature discourse, which included topics on more advanced AI, such as natural language processing, conversational AI, AI governance, intelligent decision support, and systems of citizen-centered digital interactions. The other trend is the increasing interdisciplinary character of the discipline. Older literature was more likely to focus on the introduction of e-government and the uptake of the technical system. In contrast, recent publications are defined by the increasing involvement of perspectives from public administration, governance, cybersecurity, ethics, information management, and digital policy.

Network Visualization and Cluster Structure

The Keywords co-occurrence network developed using VOSviewer, based on Scopus data, is presented in the following figure (Figure 3). With a minimum threshold of 5, 216 keywords were added to the visualization and automatically clustered into six thematic clusters based on co-occurrence relationships.

Artificial intelligence was assigned the middle spot in the visualization, as shown in the network map, indicating that it dominates the whole research environment. There are also a few highly interrelated terms, like machine learning, digital government, public administration, natural language processing, and information management, that emerge as highly interrelated nodes. The pattern is interdisciplinary, as research on AI in digital public service has become increasingly technologically developmental, overlapping with governance transformation and innovation in the public sector.

Another observable trend in the visualization is a close connection between computational technologies and concepts oriented toward governance. Discourse related to AI has moved beyond technical implementation issues and now more often encompasses social policy, digital transformation, service optimization, citizen interaction, cybersecurity, and institutional adaptation. Through this network form, a gradual shift from the digitalization of systems to broader debates on the ecosystem of AI-enabled governance is evident. Thematically concentrated levels within clusters are also denoted in the visualization. The other clusters are more technical in nature, such as those of machine learning, intelligent systems, and natural language processing. The other clusters emphasized governance, the transformation of digital government, information management, and service delivery to the public sector.

The six clusters consist of different thematic areas, but cluster connections are quite thick. This implies that Artificial Intelligence in Digital Public Service research is currently

Cluster 1. Machine learning and intelligent systems

environments. The strong presence of machine learning, deep learning, predictive analytics, automation, and decision-support technologies indicates that much of the research has focused on enhancing operational efficiency, analytical capability, and evidence-based decision-making within public-sector organizations. The prominence of sentiment analysis further suggests an increasing interest in utilizing digital citizen-generated data to support service evaluation and public engagement initiatives.

Cluster 2. Governance and public policy transformation

Restructuring of the public services through AI-enabled systems and data-driven decision-making processes is one of the discussions that continues to re-emerge in this cluster. Much research has examined how intelligent technologies may contribute to better administrative efficiency, faster service delivery, and evidence-based policymaking. Meanwhile, the literature also recognizes that organizational preparedness and regulatory support are necessary to undertake

Overall, this cluster highlights the growing importance of data-driven analytical techniques in digital public service



technological adoption.

Another important theme reflected in this cluster concerns the governance implications of AI adoption within public-sector organizations. The prominence of keywords such as governance, public policy, digital government, and citizen participation suggests increasing scholarly attention to institutional adaptation, policy development, and the management of technological transformation in public administration.

This cluster demonstrates that governance-related perspectives constitute an important stream within the broader literature on artificial intelligence in digital public services. The identified keywords indicate growing scholarly interest in how AI technologies interact with public institutions, policy processes, and citizen engagement. These findings suggest that governance considerations have become increasingly visible alongside technical discussions within the evolving research landscape.

Cluster 3. Digital government and smart public service transformation

The third group indicates the wider changing nature of public services through digital government initiatives and smart governance practices. The most common keywords related to this cluster are “digital transformation,” “smart city,” “public service delivery,” “innovation,” “digital inclusion,” and “smart governance.” The books in this discipline are more likely to focus on how new technologies are changing how the government relates to citizens.

Numerous studies emphasize the development of more connected and citizen-focused digital service environments supported by digital technologies and innovation initiatives. This change is commonly linked to attempts to enhance accessibility, responsiveness, efficiency, and service personalization via digital platforms and smart technologies. In several instances, smart city projects are being shown as viable illustrations of how AI and digital infrastructures are further integrated into city management and service administration.

Another vital observation of the cluster is that inclusivity is becoming increasingly important in digital transformation agendas. Although technological innovation is often considered a source of efficiency, many studies highlight issues concerning digital literacy, unequal access to technology, and the risk of excluding disadvantaged groups from digital access to public services. As a result, inclusive government and designing services around

citizens at the center appear more prevalent in recent literature.

This cluster highlights the growing prominence of digital transformation and smart governance within public-service research. Keywords such as smart city, digital transformation, innovation, digital inclusion, and public service delivery suggest increasing scholarly interest in how digital technologies support service modernization, citizen engagement, and institutional innovation. The findings indicate that digital transformation is being examined not only from a technological perspective but also in relation to broader public-service and governance objectives.

Cluster 4. AI governance, data security, and emerging technologies

The fourth cluster will deal with the governance and infrastructural issues of Artificial Intelligence implementation in digital public service. The keywords which are included in this cluster are: “AI governance,” “cybersecurity,” “blockchain,” “cloud computing,” “data privacy,” and “interoperability.” This cluster reveals greater emphasis on institutional control, technological governance, and digital risk management than the former cluster, which places more emphasis on service transformation and intelligent systems.

A significant portion of the literature addresses the growing reliance of public institutions on intricate digital infrastructures and interlinked information networks. As AI technologies become increasingly integrated into public-sector operations, the challenges of information security, data protection, and regulatory accountability grow in importance. Several studies identify cybersecurity threats, algorithm vulnerabilities, and privacy concerns in large-scale digital service platforms.

Another notable theme within this cluster concerns the development of governance and regulatory frameworks for implementing AI in public-sector environments. The prominence of keywords such as AI governance, data privacy, cybersecurity, and interoperability suggests growing scholarly attention to institutional oversight, regulatory coordination, and risk management mechanisms required to support the responsible deployment of AI technologies.

Keywords such as blockchain, cloud computing, and interoperability highlight the importance of digital infrastructure in supporting AI-enabled public services. These technologies are frequently discussed as enabling components that facilitate data exchange, system integration, service reliability, and secure information management

within public-sector organizations.

Cluster 5. Information management and intelligent public-service systems

The fifth group deals with the role of information management and intelligent digital infrastructure in supporting public-service work and administrative coordination. The keywords to this cluster include “information management,” “information systems,” “data analytics,” “decision support,” “interoperability,” and “knowledge management.” Most of the literature in the field is about how governments use, assimilate, and utilize digital information to improve the performance and delivery of services by institutions.

Numerous works speak about the growing role of data-driven management in modern public administration. Artificial intelligence-based information systems are widely used to support administrative coordination, automate routine operations, and accelerate and improve the accuracy of decision-making. Digital platforms are also employed to enable cross-departmental communication and enhance interoperability between government institutions in several cases.

Another issue replicated in this cluster is the management of large and fragmented public-sector datasets. As government agencies continue to become more digitalized, the ability to plan, combine, and process information becomes increasingly important in the provision of effective services and policy execution. Knowledge sharing, data governance, and intelligent information infrastructures are, in turn, the subject of many new studies.

The cluster highlights the increasing importance of advanced information management capabilities within digital public-service environments. The prominence of information systems, data analytics, decision support, interoperability, and knowledge management suggests that contemporary research is focused on improving the collection, integration, analysis, and utilization of information to support administrative coordination and evidence-based decision-making. These findings indicate a growing emphasis on information-driven public-service management supported by interconnected digital systems.

Cluster 6. Natural language processing and generative AI systems

The sixth cluster highlights the rapid development of natural language processing and generative AI technologies within digital

public service research. Keywords frequently associated with this cluster include “natural language processing,” “language model,” “chatbot,” “question answering,” “computational linguistics,” and “retrieval-augmented generation.” Compared with other clusters, this area reflects some of the most recent technological developments appearing in the literature.

A significant portion of works in this group is on conversational AI systems that enhance interaction between governments and citizens. Smart virtual assistants and chatbots are gaining traction to help them deliver information to the population, answer questions posed by citizens, and make services more accessible via digital government websites. These technologies are frequently mentioned as a way to increase service responsiveness and reduce administrative work.

Recent publications also reflect growing interest in large language models and the use of generative AI in the public world. Discussions of retrieval-augmented generation, semantic understanding, and intelligent question-answering systems indicate growing scholarly interest in adaptive and context-aware AI interaction models within digital public-service environments.

The increasing adoption of generative AI technologies in public-service contexts has also prompted discussion regarding their implementation and operational use within government environments. Existing studies frequently examine the opportunities offered by conversational AI and advanced language technologies while also acknowledging the need to ensure reliability, accuracy, and appropriate use in public-facing services.

The prominence of natural language processing, language models, chatbots, question-answering systems, and retrieval-augmented generation indicates that language-based AI technologies have become an increasingly visible area of research within digital public services. The findings suggest growing scholarly interest in how conversational and language-oriented AI applications can support information provision, citizen interaction, and service accessibility within public-sector environments.

Overlay Visualization and Emerging Research Trends

The overlay visualization will show the temporal development of research themes in Artificial Intelligence in Digital Public Service. By analyzing the average year of publication of individual keywords, the attention of research has been shown to change over time. In the

past, the research incorporated into the dataset was centered around e-government, digital transformation, the management of a specific country, and basic information systems. Such studies mostly focused on using digital technologies to increase administrative efficiency, provide online services, and modernize institutions in government environments.

More recent publications demonstrate a noticeable transition toward advanced AI-related topics. Keywords such as “natural language processing,” “language model,” “retrieval-augmented generation,” “chatbot,” and “generative AI” appear more prominently in the newer sections of the visualization. This trend indicates that contemporary studies are moving toward intelligent interaction systems, automated communication, and context-aware digital public services. Another trend is the growing body of discourse related to the governance of AI implementation. Themes such as AI governance, data privacy, ethical AI, transparency, and citizen trust are emerging as popular subjects of recent research. This implies that the literature is moving not only toward technological experimentation but also toward broader matters related to institutional readiness, regulatory frameworks, and the responsible use of AI in public-sector ecosystems.

The overlay visualization also shows that generative AI development as of 2022 has a rapid impact. The emergence of large-scale language models and conversational artificial intelligence applications appears to have made adaptive digital public-service systems, which can allow them to interact with citizens and search smart information in real-time, a more scholarly subject. Overall, the evolution of the field over time in the visualization suggests that the field is moving towards more integrated discourse, which entails technological capability, customization of governance, citizen-centered design, and ethical use of AI. New themes identified in this research could thus be new directions for future studies in digital public service and smart governance.

Density Visualization and Research Concentration

The density visualization shows the concentration and strength of the research theme in the Artificial Intelligence in Digital Public Service literature. The more concentrated the area in the visualization, the more academic interest there is in the subject and the more it is covered in publications. The most important concentration of the research is on such keywords as “artificial intelligence,”

“machine learning,” “digital government,” “public administration,” and “natural language processing.” The abundance of these words suggests that the current literature remains extremely biased toward AI-based digital transformation, smart information processing, and modernization of services provided to the population.

The visualization also shows how governance-related concepts become increasingly evident alongside technological ones. Debates about public policy, digital change, service innovation, and institutional change are also closely interrelated with AI-related issues, which means that technological implementation is often considered in the context of wider governance and the idea of public service. The majority of the more densely populated areas are also visible on the map, particularly those associated with generative AI, retrieval-augmented generation, AI governance, and conversational systems. Although these themes appear less dominant compared with traditional AI themes, their growing popularity signals the emergence of new research trends in digital public service studies.

The density pattern also indicates that the sphere of research is gradually shifting from initial discussions about the implementation of digital government to more advanced questions regarding intelligent governance systems, adaptive relations between citizens and governmental agencies, and responsible use of AI. Governments are seeking an increasing amount of AI application in the public-sector environment, and these emerging trends are capable of increasing in significance.

Research Implications

The results of the present study show that the scientific study of Artificial Intelligence in Digital Public Service has developed beyond the traditional discourses of e-government realization and the digitalization of administration. The bibliometric mapping demonstrates a gradual transition to more comprehensive systems of AI-enabled governance which incorporate intelligent technologies, institutional change, citizen engagement, and data-driven management of the public service.

Amongst the most visible shifts in the literature, one can single out the increased interconnection of computational technologies with the questions of governance. Previous research predominantly concentrated on digital infrastructure, online service frameworks, and administrative efficiency. Nevertheless, more recent publications start to prioritize issues

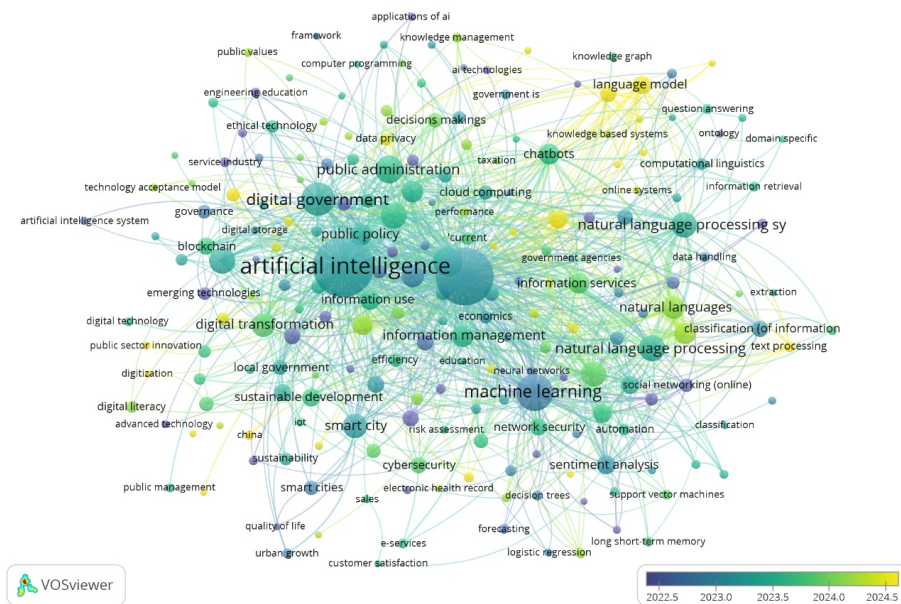


Figure 4. Overlay visualization

such as AI governance, public trust, ethical AI implementation, transparency, cybersecurity, and citizen-centered digital services. This change indicates that AI is no longer considered a technology tool, but an ability to govern strategically, which affects public-sector decisions and institutional adaptation.

The introduction of natural language processing, language models, conversational AI, and retrieval-augmented generation are also indicators that the field is at a new stage of development. Intelligent communication systems are gaining importance in public service, particularly in citizen interaction, automated information delivery, and active digital government. These topics have emerged in the foreground since 2022 and reflect the broader application of generative AI technologies to innovation in the public sector.

The interdisciplinary character of the research field is another crucial note. Increasingly, the perspectives of information systems, computer science, governance studies, cybersecurity, and digital policy are being brought into the literature. This interdisciplinary overlap means that the future realization of AI in connection with public services is not only a question of technical capacity, but also of institutional readiness, governance and ethical frameworks, regulatory changes, and the inclusion of digital service policies.

The results also indicate some of the research opportunities. Themes like AI governance, generative AI, conversational systems, explainable AI, data privacy, and

intelligent decision support are still relatively less focused, compared with more mature themes like machine learning and digital government. This means that many issues regarding responsible and adaptive AI implementation in the public sector remain under-studied and can be the focus of further research.

In practice, the study suggests that governments that accept the use of AI technologies must be more concerned with governance preparedness and institutional capability than with embracing technologies. The effectiveness of AI-based government services does not simply lie in computing power, but in transparency, accountability, interoperability, and the population's acceptance and trust in digital governance ecosystems.

CONCLUSION

Artificial Intelligence in Digital Public Service has been the subject of exponentially increasing research over recent years, particularly as governments have become more and more digital, with more advanced AI-powered solutions being tested by governments. The study employed bibliometric mapping of articles indexed in Scopus from 2020 to 2025 to identify six broad thematic clusters that provide insights into how the field has gradually evolved out of the traditional e-government discourses to broader AI-enabled governance ecosystems.

The findings suggest that current studies are no longer concerned with technical

implementation or administrative automation alone. Governance, communication with citizens, ethical AI application, openness, data management, and institutional readiness are now given more focus. Even more so in more recent directions of work in natural language processing, conversational artificial intelligence, large language models, and generative AI technologies, which have gained traction since 2022.

The new themes discovered during the study, notably those related to AI governance, explainable AI, conversational systems, and intelligent decision support, appear to be relatively untapped compared with more established areas such as machine learning and digital government. These areas can therefore be significant spheres of research in the future, especially as governments continue to transform generative AI technologies within the spectrum of administration of state services.

comparisons, or collaboration-network analysis to provide a more holistic view of the development of AI-driven digital governance. Overall, the paper demonstrates that Artificial Intelligence is not only becoming a technological instrument of the work of governments, but one of the elements of another large-scale transformation of how governments plan their services, communicate with citizens, and deliver digital governance in increasingly complex settings.

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