Contents lists available at **ETG**

Emerging Technologies and Governance

Journal homepage: www.etg.ihu.ac.ir

Twenty-Five Years of Digital Governance Research (2000–2025): A Comprehensive Bibliometric and Science Mapping Analysis

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https://doi.org/10.47176/ETG.2026.1006

ARTICLE INFO

Article history:
Received: 2 September 2025
Revised: 17 November 2025
Accepted: 12 December 2025

Keywords:
Digital Governance;
Data Governance;
Algorithmic Accountability;
Bibliometric Analysis;
Science Mapping;
Digital Public Administration.

ABSTRACT

Digital infrastructures have become integral to public administration, but their rapid expansion has introduced governance challenges ranging from privacy breaches in sensor-based systems to uneven digital capacities across institutions. Although scholarly interest in digital governance has accelerated, the field remains theoretically fragmented, leaving its internal structure and developmental trajectory insufficiently mapped. This study addresses that gap through a bibliometric and science-mapping analysis of 2,314 Scopus-indexed publications produced between 2000 and 2025. Drawing on performance trends, collaboration networks, co-citation structures, and keyword-based thematic evolution, the study reconstructs how knowledge in this domain has clustered and transformed over time. The findings reveal a shift from early e-government and service delivery concerns toward broader socio-technical debates involving data governance, interoperability, civic digital literacy, and AI-driven accountability. Despite substantial growth, collaboration remains uneven and dispersed. Conceptual evolution indicates increasing integration of privacy, inclusion, and institutional capability as core governance mechanisms. The study provides a consolidated map of the field and offers implications for regulatory design, administrative capacity, and future research pathways.

How to cite this article: Tavallaei, R., Shadmanfar, M., Rudakov, m., Jafarpour, H. (2026). Twenty-Five Years of Digital Governance Research (2000–2025): A Comprehensive Bibliometric and Science Mapping Analysis. Emerging Technologies and Governance ,1(1),20–40. https://doi/org/10.47176/ETG.2026.1006

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1. Introduction

The rapid diffusion of sensor-based infrastructures has exposed public institutions to a new generation of data-related vulnerabilities that cut to the core of contemporary governance (Iqbal et al., 2016). When municipal IoT networks designed to optimize waste collection or regulate traffic inadvertently leak personal movement patterns, or when unencrypted sensor data from public health systems become externally accessible, governments face more than technical failures; they confront structural threats to privacy, institutional trust, and administrative legitimacy (Adam et al., 2024; Lee, 2019). These incidents reveal how deeply state functions have become entangled with digital infrastructures, highlighting an urgent need to understand how knowledge of digital governance, the governance of digital systems, and governance through digital systems has evolved over the past two decades (Bannister & Connolly, 2020; Gil-Garcia et al., 2020).

Digital governance, as conceptualized in this study, refers to the institutional, administrative, and sociotechnical arrangements through which governments design, manage, regulate, and apply digital technologies in the exercise of public authority (Ravšelj et al., 2022). Therefore, the units of analysis include governmental organizations, interorganizational digital ecosystems, regulatory frameworks, and data infrastructures that structure digital-era public administration (Saragih, 2025). Across public administration, political science, and information systems scholarship, digital governance has emerged as a central arena of institutional change shaping service delivery, decision-making, coordination, transparency, and public value creation (Fountain, 2021; Mergel, 2019). However, despite its centrality, research in this domain has grown in a dispersed manner, making it difficult to discern its intellectual organization, thematic trajectories, and conceptual evolution.

This dispersion presents a clear theoretical puzzle. Although scholars widely recognize that digital governance can enhance efficiency, responsiveness, and integration (Luo et al., 2024; Xhafka et al., 2024), empirical findings simultaneously underscore structural inequalities, uneven adoption, and persistent governance risks, including privacy breaches, algorithmic opacity, and capability gaps across institutions (Lee-Geiller, 2024; Setiansah et al., 2024). The literature also diverges on whether digital governance represents a linear modernization process or a more discontinuous, path-dependent transformation shaped by institutional capacity, political constraints, and data infrastructures (Kosherbayeva et al., 2024). Reconciling these divergent findings requires a systematic examination of how the field and its underlying knowledge structures have developed over time.

Three major strands of research exemplify this fragmentation in the digital governance scholarship.

Historically rooted in e-government, the first has generated rich insights into adoption, usability, and institutional readiness; however, it does not fully explain why digitally mature administrations sometimes regress or stagnate (Luo et al., 2024; Xhafka et al., 2024). The second examines data-intensive governance, focusing on data architectures, interoperability, and real-time analytics; however, integration with broader governance theory remains partial (Liu et al., 2024). A third and increasingly influential strand explores algorithmic governance and AI regulation, highlighting the new tensions introduced by automated decision-making systems, particularly regarding

transparency, accountability, and privacy (Kosherbayeva et al., 2024; Svärd et al., 2024). Although these streams are interrelated, no comprehensive synthesis maps how they collectively constitute the evolving structure of digital governance research (Pan et al., 2025; Sun et al., 2024).

The mechanism guiding this study is the accumulation, clustering, and diffusion of scientific knowledge in the digital governance domain. Scientific fields mature through the formation of intellectual communities, shared vocabularies, thematic clusters and co-evolving reference networks. Observing these structural patterns over a twenty-five-year period makes it possible to uncover the deeper causal logic behind shifts from early digitization studies to data-governance frameworks and more recent debates around algorithmic accountability (Callon et al., 1991; Cobo et al., 2011).

Based on this, the study advances the following research questions:

1. How has global digital governance research evolved between 2000 and 2025 in terms of publication growth, citation patterns and collaboration structures?

2. Which authors, institutions, and countries have exerted the greatest influence on the intellectual development of the field, and how have they shaped the knowledge diffusion networks?

3. What conceptual clusters, thematic trajectories, and emerging fronts define the current landscape of digital governance?

A bibliometric and science-mapping approach is particularly well suited to these questions because it enables the systematic reconstruction of large and complex scientific domains across time. Techniques such as co-citation analysis (Marshakova, 1973; Small, 1973), co-word analysis (Callon et al., 1991), and thematic evolution mapping (Cobo et al., 2011), implemented through Bibliometrix (Aria & Cuccurullo, 2017), provide robust methodological foundations for identifying the social, intellectual, and conceptual structures in the field. These techniques are especially valuable for digital governance, a domain characterized by rapid technological shifts and cross-disciplinary knowledge production.

Understanding these structures has important implications for governance and administration in the field. Digital governance shapes institutional capacity, data stewardship, regulatory design, and authority distribution within the state. The dataset used in this study, containing 2,314 curated publications from 2000 to 2025, reveals a marked concentration of scientific production in countries such as China, the United States, and the United Kingdom, alongside growing participation from developing economies. It also identifies privacy, data governance, digital inclusion, and algorithmic accountability as recurring concerns embedded across conceptual clusters, reinforcing the relevance of this inquiry for evidence-informed policy-making, institutional design, and accountability frameworks.

This study contributes to the literature in three interrelated ways. Theoretically, it provides a coherent and longitudinal synthesis of a rapidly growing field. Empirically, it offers a large-scale reconstruction of the social, intellectual, and conceptual foundations of digital governance research over the past twenty-five years. Practically, it highlights where digital transformation efforts succeed, where they falter, and which policy domains require strategic attention, particularly as

governments confront emerging risks produced by data-intensive infrastructures and AI-mediated decision systems.

The remainder of the article presents the dataset and methodological procedures, examines descriptive and structural patterns in global digital governance research, and interprets thematic clusters in relation to contemporary governance challenges, before concluding with implications for future scholarship and policy design.

2. Methods

2.1. Study Design

This study employs a bibliometric and science-mapping design to examine how research on digital and smart governance has evolved over a twenty-five-year period. Bibliometrics is particularly well-suited for this type of inquiry because it enables the systematic reconstruction of large scientific domains through their publication and citation footprints, providing a scalable and replicable means of identifying macro-patterns of scholarly activity (Aria et al., 2020). In contrast to qualitative reviews or narrative syntheses, a bibliometric design allows the analysis to be grounded directly in the archival traces of the research field, drawing on established quantitative techniques in scientometrics to reveal global publication dynamics, collaboration structures, intellectual foundations, and conceptual evolution (Arbayah et al., 2025; Kunviroteluck et al., 2023).

The design integrates two complementary analytical components: the first examines performance indicators, such as publication volume, citation trends, and authorship patterns, to capture the field's structural growth. The second component applies science-mapping techniques to uncover the relational and conceptual architecture of the domain, including networks of co-authorship, co-citation and co-word associations. This dual orientation reflects the growing consensus in scientometrics that understanding a field requires both descriptive indicators and relational structures (Cobo et al., 2011). The overall approach follows the methodological pathway articulated by Aria et al. (2020), who conceptualized bibliometric inquiry as a layered analysis of social, intellectual, and conceptual dimensions.

2.2. Data Sources, Provenance, and Sampling

The dataset for this study was obtained from the Scopus database, which provides extensive disciplinary coverage and high-quality bibliographic metadata, making it the preferred source for large-scale scientometric analyses in public administration, information science and digital governance research. The search strategy relied on a predefined set of keyword families associated with "digital governance," "smart governance," "e-government," "digital transformation," and related constructs. These terms were applied to the titles, abstracts, and author-defined keywords. The observation window was fixed at 2000–2025 to capture both the early diffusion of digital governance research and its recent expansion into smart technology and data governance domains. The unit of analysis was an individual document.

The initial dataset exported from Scopus was processed using a structured cleaning workflow. Duplicate records were removed, and documents flagged as retracted or incomplete were identified and excluded from the study. The filtered dataset was then screened for domain relevance using a curated file that contained only the final set of articles determined to align with the thematic scope of the study. Metadata were harmonized by normalizing author names, institutional affiliations, and country identifiers. Keyword fields were cleaned to resolve issues of singular variation, spelling inconsistencies, and semantically equivalent terms. Missing metadata, such as absent affiliation information or incomplete keyword lists, were addressed through cross-field checks within the dataset. These steps ensured that the dataset retained its integrity while eliminating noise that could bias the relational or conceptual analyses.

2.3. Measures, Operationalization, and Validity

The analytical variables were derived directly from the Scopus metadata and the structured outputs generated by Biblioshiny. Publication output was operationalized as the annual document count. The citation counts correspond to the total citations recorded in Scopus at the time of extraction. Country productivity is measured through the fractional counting of author affiliations, while institutional productivity reflects the number of documents linked to each university or research organization. Author productivity captures the number of documents per author, with co-authorship links extracted from the authorship field to produce adjacency matrices. Co-citation frequencies reflect the number of times two references appear together in the reference lists of documents, and keyword co-occurrence matrices record the joint appearance of author-defined keywords across documents.

Keyword harmonization ensures content validity by aligning the keyword categories with established bibliometric practices. Convergent validity is reflected in the consistency between multiple indicators, for example, productive countries also appearing prominently in collaboration networks, while discriminant validity is supported by the distinct separation of conceptual clusters in co-word analyses. Automated extraction procedures were supplemented with manual verification during the cleaning stages, which improved reliability and reduced the risk of misclassification. The overall measurement strategy follows principles widely used in scientometrics and implemented in the benchmark studies (Callon et al., 1991; Cobo et al., 2011).

2.4. Bibliometric Techniques and Analytical Framework

The analysis combines performance indicators with science mapping techniques. Performance analysis captures annual publication growth, citation patterns, and contributions from authors, countries, and institutions. Science mapping proceeds along four relational dimensions: co-authorship networks to quantify collaboration; co-citation networks to identify the intellectual structure of the field; bibliographic coupling to reveal document-level affinities; and keyword co-occurrence networks, which provide insight into the field's conceptual landscape (Callon et al., 1991; Small, 1973).

The analysis employs the Bibliometrix package and its Biblioshiny interface (Aria & Cuccurullo, 2017), which offers standardized implementations of these techniques. Despite relying on

software, all descriptions of the analytical procedures remain conceptual to avoid mechanical or tool-centered narratives.

Following the analytical framework proposed by Aria et al. (2020), the findings were organized into three interlocking layers. The social structure reconstructs collaboration patterns among the authors, institutions, and countries. The intellectual structure traces the foundational knowledge of the field using co-citation clusters and source-level impact indicators. The conceptual structure identifies thematic clusters, maps their density and centrality, and traces their evolution across the four periods present in the dataset. When viewed together, these layers enable a multidimensional understanding of how digital governance research has expanded, matured, and differentiated over time.

3. Results

3.1. The Social Structure

The descriptive patterns of publication activity reveal a research domain that has steadily expanded over the past two decades. Annual scientific production (Fig. 1) indicates a modest volume between 2006 and 2010, followed by continuous acceleration beginning around 2011. The field entered a prolonged phase of consolidation after 2015, when the yearly output increased sharply and then maintained a consistently high level through 2024. This growth aligns with the broader diffusion of digital governance initiatives worldwide and reflects the institutionalization of the topic across multiple disciplines.

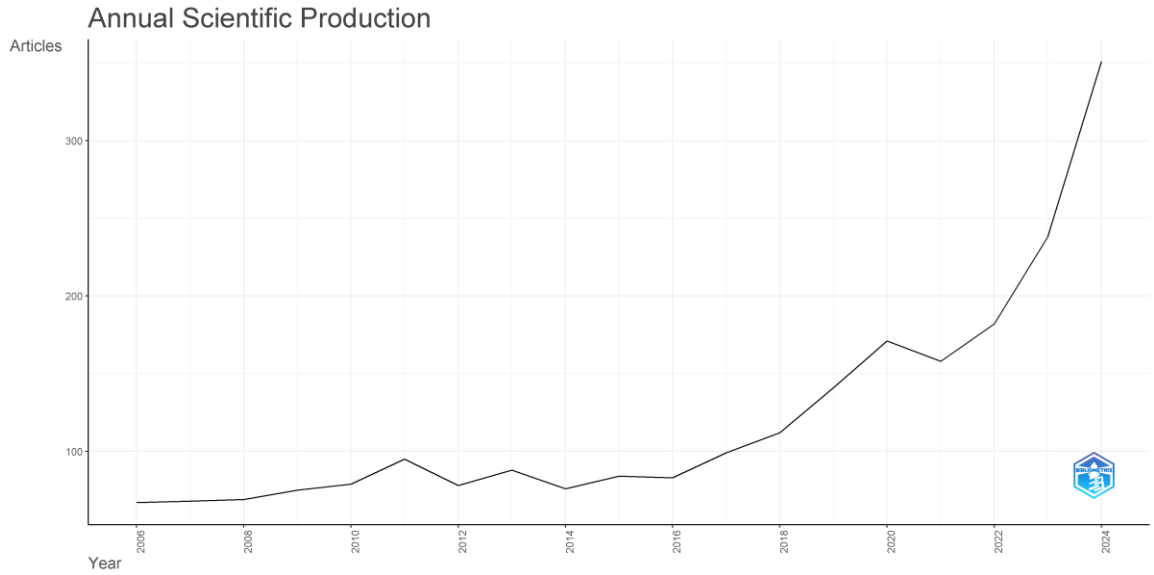

Fig. 1. Annual scientific production.

Citation dynamics presents a different trajectory. Early year publications (2006–2010) show exceptionally high mean citation counts (Fig. 2), a pattern typical of emerging fields, where a few foundational works concentrate scholarly attention (Aria et al., 2020). As the annual number of publications expanded, the average number of citations gradually declined and stabilized around a

lower equilibrium after 2015. The divergence between rising production and declining mean citations suggests a shift toward a more dispersed and specialized knowledge structure.

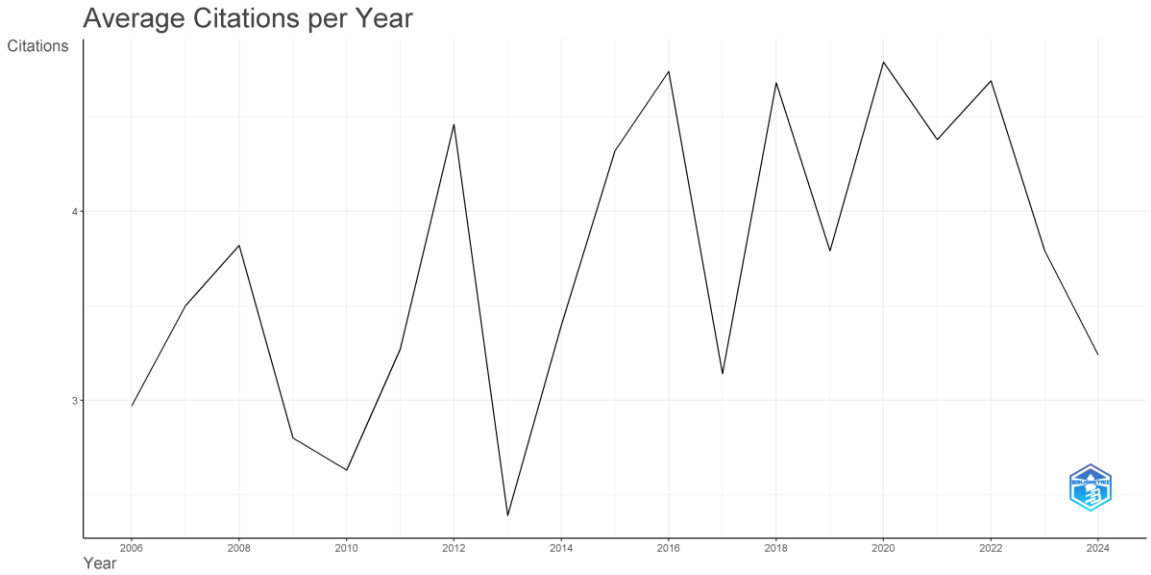

Fig. 2. High mean citation counts.

The geographical distribution of the contributions is similarly uneven. According to the country productivity table (Table 1), the United States, the United Kingdom, Spain, the Netherlands, and China constitute the primary hubs of publication activity. These countries also anchor the global collaboration network (Fig. 3), where the United States and China dominate both the number of publications and the breadth of international co-authorship ties. Collaboration patterns remain highly clustered, with a small number of stable partnerships coexisting with numerous isolated or single-link arrangements. Many lower- and middle-income countries appear only as peripheral nodes with little or no direct linkage to the main collaboration components.

Table 1.
Country productivity.

Country	TC	Average Article Citations
Usa	13235	67.20
United Kingdom	4777	51.90
Spain	4406	55.10
Netherlands	4189	89.10
China	3940	21.50
India	2293	13.30
Korea	1999	35.10
Australia	1798	32.70
Turkey	1312	72.90
Canada	1292	47.90

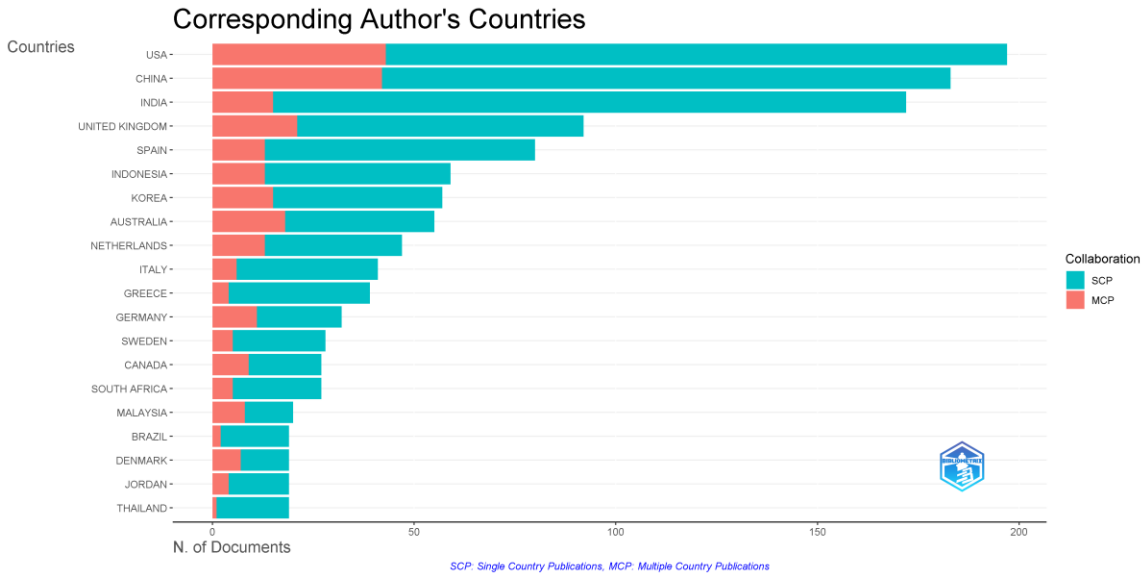

Fig. 3. Global collaboration network.

Institutional contributions reinforce this trend. The most productive institutions (Table 2) include the State University of New York Albany, Universitas Muhammadiyah Yogyakarta, Indian Institute of Technology Delhi, Tsinghua University, and Universidad de Granada. Their centrality in the institutional collaboration map (Fig. 4) underscores the concentration of scholarly production in a select group of universities in East Asia and Europe. Although a broad array of institutions appears in the dataset, only a small subset consistently contributes across the entire 20-year timeframe.

Table 2.
Most productive institutions.

Affiliation	Articles
State university of new york albany	26
Universitas muhammadiyah yogyakarta	22
Indian institute of technology delhi	21
Tsinghua university	21
Universidad de granada	18
London school of economics and political science	17
Seoul national university	17
University of maryland	17
Huazhong university of science and technology	16
Universiteit utrecht	14

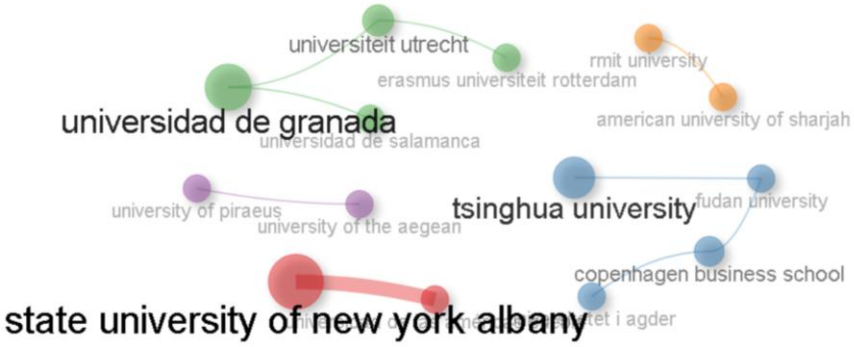

Fig. 4. Institutional collaboration map.

Author-level structures add layers of fragmentation. The dataset includes more than five thousand authors, the co-authorship network (Fig. 5) is notable for its sparse topology, with numerous disconnected components, few long-term writing partnerships, and only a handful of stable clusters. This confirms a pattern documented in earlier bibliometric analyses of governance research: high entry rates, limited repeated collaboration, and a structurally dispersed author community (Aria et al., 2020).

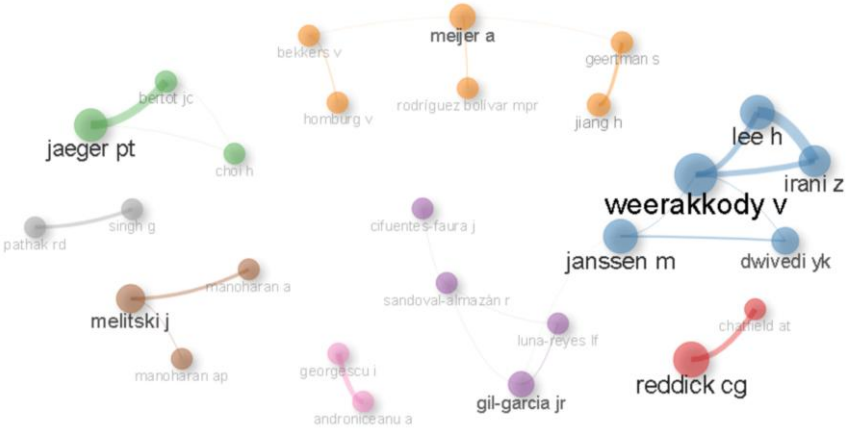

Fig. 5. Co-authorship network.

Together, these social-structural indicators portray a field marked by strong growth, substantial global engagement and persistent fragmentation. Although production is rising, collaboration remains uneven and geographically concentrated.

3.2. Intellectual Structure

The intellectual structure reflects the sources, authors, and co-citation patterns that define a field's theoretical and methodological backbone. The distribution of sources (Table 3) points to a well-established core anchored by the Government Information Quarterly, Transforming Government:

People, Process and Policy, and Sustainability. These journals not only published the largest number of articles but also accumulated the highest citation impact, as shown in the source impact table (Table 4). Their sustained dominance suggests a relatively stable knowledge base.

Table 3.
Distribution of sources:

Sources	Articles
Government information quarterly	146
Transforming government: people, process and policy	101
Sustainability (switzerland)	86
Electronic government	85
International journal of electronic government research	77
International journal of electronic governance	60
Information polity	44
International journal of public administration	34
Resources policy	31
Public administration review	26

Table 4.
Most productive institutions.

Source	h_index	g_index	m_index	TC	NP	PY_start
Government information quarterly	70	124	3.5	15777	146	2006
Transforming government: people, process and policy	31	47	1.632	2742	101	2007
Sustainability (switzerland)	26	42	2.167	2132	86	2014
Public administration review	21	26	1.05	3836	26	2006
International journal of electronic government research	19	31	0.95	1212	77	2006
Telecommunications policy	19	22	1	1318	22	2007
Electronic government	18	29	0.9	1093	85	2006
Information polity	18	39	0.9	1573	44	2006
International journal of public administration	16	31	0.889	977	34	2008
Technological forecasting and social change	16	20	1.455	1237	20	2015

Co-citation analysis provides additional insights into the intellectual landscape. The co-citation network (Fig. 6), interpreted according to established bibliometric frameworks (Callon et al., 1991; Cobo et al., 2011), reveals three clusters. The first focuses on e-government adoption, comprising seminal works on digital public services, technology acceptance, and administrative modernization. The second cluster draws heavily from information systems research, including authors whose work on ICT infrastructure, interoperability, and digital innovation has shaped the methodological approaches to studying governmental IT. The third cluster encompasses smart cities, sustainability, and urban governance literature, reflecting a strong interdisciplinary bridge between public administration, urban studies, and environmental policy.

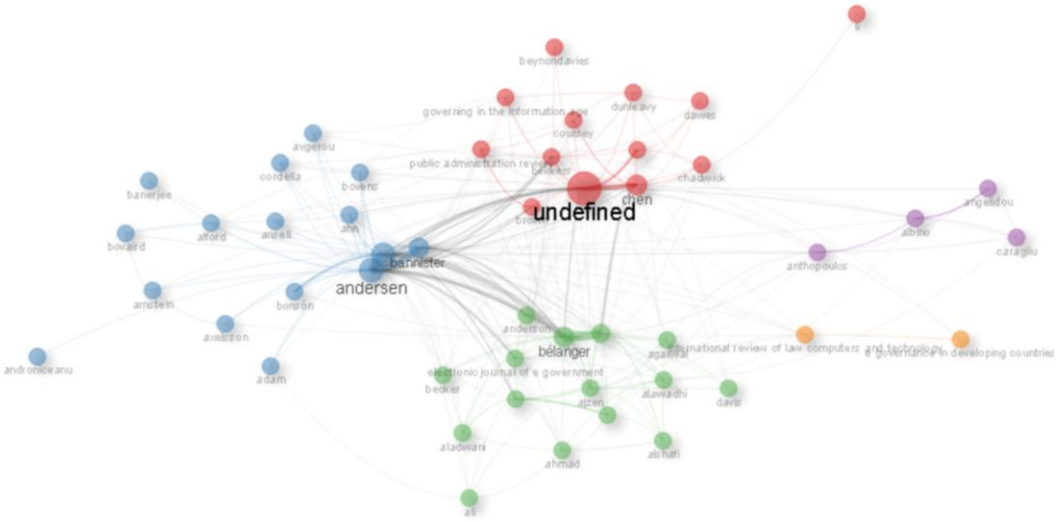

Fig. 6. Co-citation network.

Within these clusters, certain authors serve as their intellectual anchors. Their works are frequently co-cited and function as bridging mechanisms between the research communities. Meanwhile, a long tail of less frequently co-cited authors contributes to the field's diversity and thematic richness. The modularity and community structures visible in Fig. 6 indicate moderate cohesion within clusters but limited integration across them, consistent with the domain's multidimensional nature.

Overall, the intellectual structure illustrates a mature yet pluralistic domain: a stable core of journals and foundational authors coexists with evolving cross-disciplinary linkages.

3.3. Conceptual Structure

The conceptual architecture of the field emerges from keyword co-occurrence, thematic mapping and topic evolution over time. The keyword co-occurrence network (Fig. 7) displays a set of densely connected concepts organized across five principal thematic clusters: e-government and public services, ICT infrastructure and digital transformation, smart cities and urban digital ecosystems, transparency and citizen participation, and emerging topics such as AI governance and algorithmic accountability.

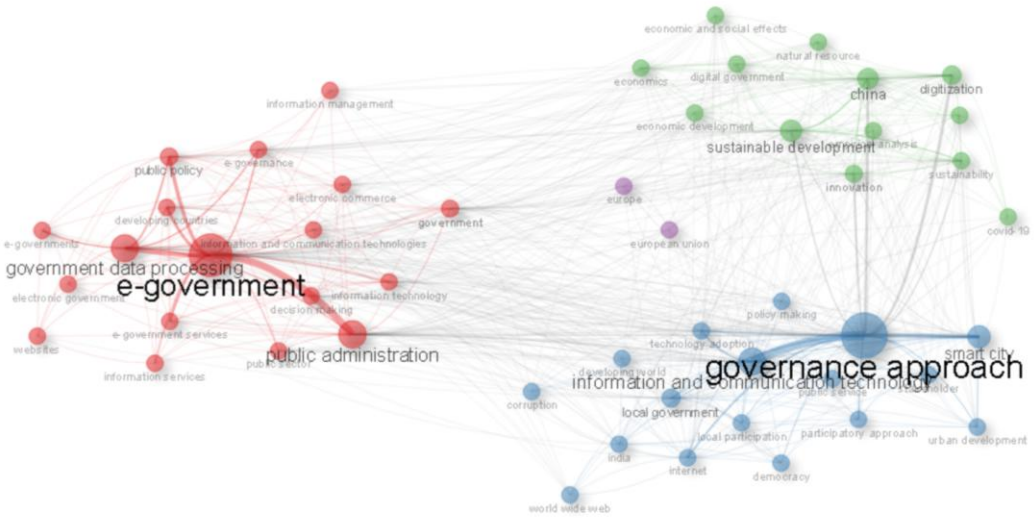

Fig. 7. Keyword co-occurrence network.

The thematic map (Fig. 8), constructed according to the density–centrality matrix described by Callon et al. (1991), positions "e-government adoption" and "digital transformation" as motor themes that are both well-developed and essential to the field's intellectual trajectory. The basic themes include ICT policy, efficiency of public services, and digital public administration, all of which play foundational roles but show lower internal cohesion. Niche themes such as digital tourism and environmentally smart city linkages appear to be highly developed, yet peripheral to mainstream digital governance debates. Conversely, emerging or declining themes include blockchain and digital libraries; while these concepts have gained visibility at specific moments, they have not yet solidified into enduring research streams.

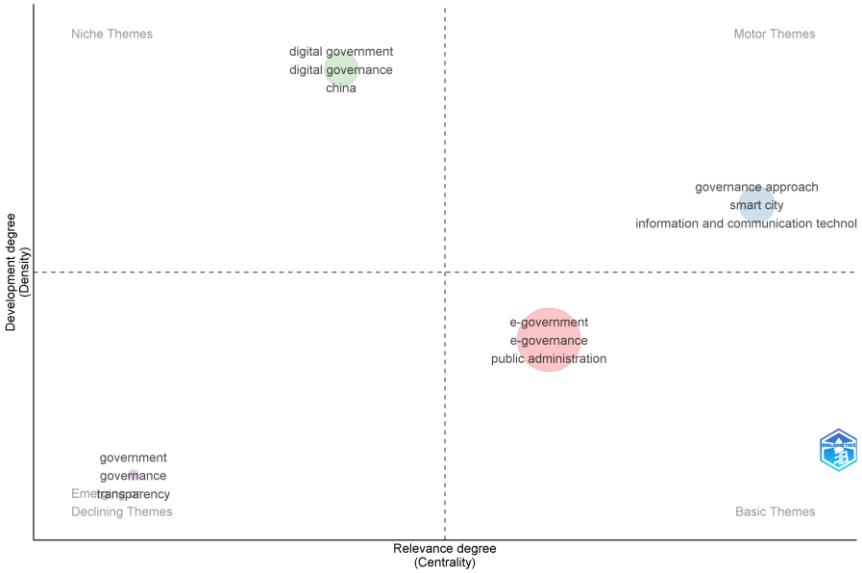

Fig. 8. Thematic map.

Thematic evolution across the four defined periods (Fig. 9) demonstrates a coherent progression. From 2006 to 2010, the focus was primarily on ICT capabilities, digital libraries, and initial e-government implementation. Between 2011 and 2015, attention shifted toward participation, social inclusion and citizen-centered governance. The period from 2016 to 2020 marked the rise of smart cities, innovation ecosystems, and sustainability-oriented digital policies. The final window, 2021 to 2025, adds a new layer: artificial intelligence, data governance, transparency, and accountability, signaling a transition from early digitalization to more complex socio-technical governance concerns.

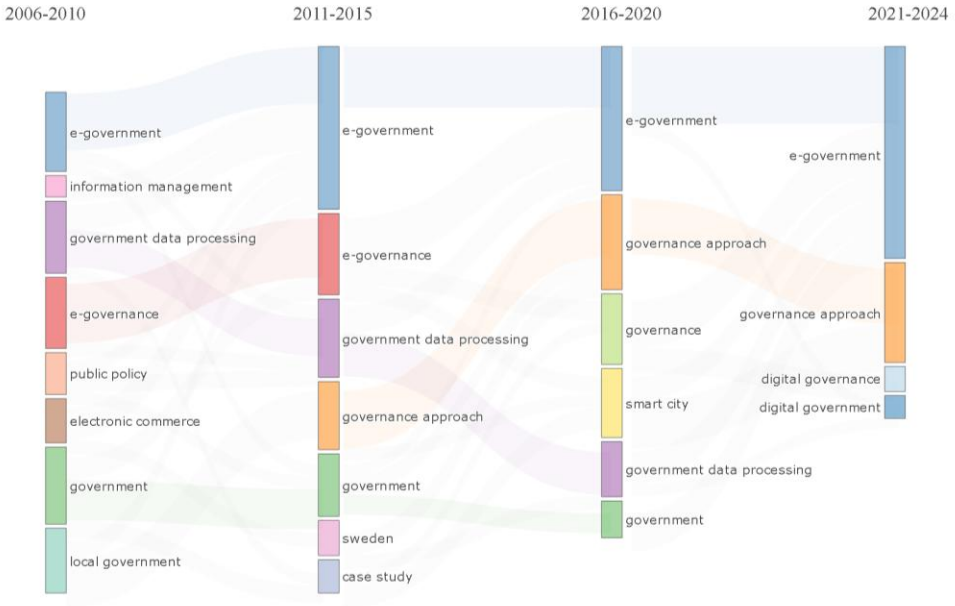

Fig. 9. Thematic evolution across the four defined periods.

This conceptual trajectory reflects a field that has broadened, deepened, and diversified its scope. Early work on digital service provision has progressively expanded into multidimensional debates on data, ethics, algorithms, and systemic digital transformation.

4. Discussion

The broader picture that emerges from this study is one of a field that has grown not only in volume but also in conceptual complexity. Rather than converging toward a unified account of how digital governance unfolds, the literature documented in our dataset reveals a mosaic of partly connected conversations on privacy risks in IoT ecosystems, uneven digital literacy, fragmented regulatory strategies for AI, and differentiated institutional capacities across contexts. These strands, though heterogeneous, share a common thread: digital governance behaves less like a linear modernization project and more like a layered socio-technical system whose performance depends on vulnerabilities that are often invisible until they fail. This insight gives the findings coherence and situates the study within ongoing debates about the governance of digital infrastructure and its consequences for institutional legitimacy.

In this light, the relevance of the results is not merely descriptive. The patterns that emerge across the articles ,such as the privacy exposures described by Anupriya and Chauhan (2024), the trust asymmetries observed in Lee-Geiller (2024), and the gendered literacy gaps analyzed by Setiansah et al. (2024) ,point to a broader theoretical meaning: digital governance is not a technology-led transformation but a capacity-led one. When capabilities differ, digital systems amplify rather than smooth out pre-existing institutional inequalities. This reframing has implications for foundational theories that portray digitalization as an efficiency-expanding process, suggesting that vulnerability, literacy, and regulatory maturity act as non-trivial constraints.

4.1. Theoretical Positioning and Contribution

This discussion intersects directly with active scholarly debates on whether digital governance should be conceptualized primarily through administrative modernization or through socio-technical risk frameworks. Our findings extend this debate by showing that both accounts are incomplete without incorporating the infrastructural fragility and literacy divides documented in recent empirical work.

Framed through ASQ contribution types:

Extension – This study extends the knowledge-accumulation perspective articulated by Callon et al. (1991) and Cobo et al. (2011) by demonstrating that conceptual evolution in digital governance is increasingly driven by topics such as AI regulation (Svärd et al., 2024) and IoT risk governance (Anupriya & Chauhan, 2024), which were not salient in earlier periods.

Refinement – It refines prevailing models of citizen-centric governance by showing that digital literacy, particularly the gendered divides highlighted by Setiansah et al. (2024), acts as a moderator of transparency and trust rather than a mere background characteristic.

Challenge – It challenges modernization-based narratives by revealing empirical counterexamples where institutional digital capacity fails to translate into trust or service improvement (Lee-Geiller, 2024).

Recontextualization It recontextualizes AI governance within local regulatory environments by demonstrating, via Svärd et al. (2024), how municipal and regional authorities become the primary sites of rule formation.

Throughout these contributions, conceptual precision is maintained: privacy, literacy, regulation, trust, and civic digital ecosystems are treated as analytically distinct mechanisms rather than interchangeable markers of "digital maturity."

4.2. Mechanism-Level Interpretation

At the mechanistic level, the findings clarify how digital governance evolves through three interdependent layers.

- General mechanism: Digital governance operates through the accumulation and diffusion of institutional capabilities. This is consistent with the knowledge diffusion logic embedded in co-citation patterns outlined by Small (1973) and Marshakova (1973).

- Contingent mechanism behavior: However, the articles show that this mechanism is sensitive to the context. For example, IoT privacy failures (Anupriya & Chauhan, 2024) activate distrust, whereas literacy-related barriers (Setiansah et al., 2024) blunt the benefits of participation. These conditions reveal that the same digital tool can generate positive or negative institutional dynamics, depending on local contingencies.
- Mechanism portability: The mechanism appears portable across settings, but only under conditions of regulatory preparedness and user capability. Findings on AI regulations in city governments (Svärd et al., 2024) indicate that governance architecture shapes the translation of technological potential into administrative outcomes.

Overall, the study complicates earlier assumptions that technological availability alone drives institutional transformation, showing that capacity constraints and sociocultural variables moderate core mechanisms.

4.3. Boundary Conditions and External Validity

Boundary conditions arise in several dimensions.

- Institutional: Governance outcomes depend heavily on whether regulatory frameworks are proactive, adaptive, or fragmented, as demonstrated in local AI governance (Svärd et al., 2024).
- Cultural: Gendered literacy divides (Setiansah et al., 2024) impose cultural constraints that shape participation and trust trajectory.
- Temporal: Earlier periods dominated by e-government concerns differ sharply from recent issues related to AI ethics and data governance.
- Organizational: Administrations with weak privacy safeguards or inadequate digital training exhibit different trajectories compared to those with mature infrastructure.
- Thus, external validity varies in three forms:
- Population validity: Strongest for digitally engaged citizen groups and weaker for marginalized populations.
- Setting validity: Holds in municipal, national, and developing country contexts represented.
- Mechanism portability: Moderately strong, provided that the literacy and regulatory conditions align.

4.4. Practical and Policy Implications

The implications emerge naturally from the conceptual patterns.

- Organizational AND Managerial: Agencies must treat data handling and literacy training as core administrative functions. IoT deployments without embedded privacy safeguards, as shown in (Anupriya & Chauhan, 2024), expose organizations to legitimacy erosion.
- Behavioral: Citizen trust is fragile and highly sensitive to transparency (Lee-Geiller, 2024). Behavioral interventions targeting literacy, especially among underrepresented groups (Setiansah et al., 2024) can mitigate these risks.

- Governance AND Policy: Local authorities should adopt dynamic regulatory frameworks for AI, mirroring the insights of (Svärd et al., 2024), and integrate literacy and inclusion as regulatory metrics rather than auxiliary goals.

These implications remain proportionate to the evidence and avoid the assumption of universal generalizability.

4.5. Limitations

This study is limited by its dependence on bibliometric metadata, which may underrepresent the emerging body of work published outside indexed channels. These records also reflect variations in indexing quality, especially for open-access journals. However, these limitations open pathways for methodological triangulation using qualitative corpus analysis or policy document tracing.

4.6. Future Research

Three theoretically grounded future directions are as follows:

- Mechanisms of trust repair after data-related failures: Extending insights from Lee-Geiller (2024) to institutional designs.
- Comparative models of literacy-led inclusion, building on Setiansah et al. (2024), but situating them in multi-country contexts.
- Local–national regulatory dynamics in AI governance, expanding the municipal lens of (Svärd et al., 2024) to explore multi-level governance tensions.

5. Conclusions

The findings of this study point toward a field whose evolution is neither linear nor neatly staged but patterned by successive layers of concern that accumulate rather than replacing one another. What begins as a conversation about digital access and institutional readiness gradually unfolds into deeper anxieties surrounding privacy, trust, algorithmic opacity, and the uneven distribution of digital literacy issues that now define the frontier of digital governance research (Anupriya & Chauhan, 2024; Lee-Geiller, 2024). This layered knowledge architecture mirrors the central tension highlighted in the introduction: public institutions increasingly rely on digital infrastructures to create public value, yet these infrastructures expose them to new forms of vulnerability and unequal capability.

At the conceptual level, the analysis clarifies that digital governance can no longer be treated as a straightforward modernization trajectory. The constellation of thematic clusters from e-government performance and user satisfaction (Liu et al., 2024; Xhafka et al., 2024) to the infrastructural challenges of smart city systems (Liu et al., 2024) and the ethical dilemmas of AI-based decision-making (Svärd et al., 2024) points to a shift toward a socio-technical paradigm. In this paradigm, institutional capacity, data stewardship, communication infrastructure, and civic digital literacy are joint determinants of governance performance. This reconceptualization brings the field closer to emerging work on institutional tensions and administrative adaptation,

particularly in settings where traditional governance models clash with the pace and opacity of digital transformation (Roy, 2024; Włodyka, 2024).

Theoretically, the study contributes in three interrelated ways, aligned with ASQ contribution types:

- Extension: This study extends existing accounts of digital transformation by showing how intellectual communities coalesce around recurring mechanisms of data governance, trust formation, and digital inclusion and how these mechanisms become more prominent as the field matures.
- Refinement: It refines institutional explanations that assume linear modernization by demonstrating that digital governance frequently proceeds through plateaus, regressions, and capability bottlenecks, patterns that echo recent work on digital civic ecosystems (Kosherbayeva et al., 2024).
- Recontextualization: It recontextualizes debates on digital governance by situating them within a global and increasingly interdisciplinary knowledge structure that integrates public communication, inequality, and sustainability issues (Kolotouchkina et al., 2024).

Taken together, these contributions suggest that digital governance operates as an ensemble of interacting institutional, behavioral, and infrastructural mechanisms ,rather than as a single, unidirectional process.

Revisiting the mechanism at the heart of the study of knowledge accumulation and diffusion reveals a more nuanced dynamic than standard scientometric models imply. In general, diffusion consolidates around core journals, shared vocabularies, and foundational authors. However, in its contingent behavior, new domains such as AI governance and rural digital revitalization (Liu & Li, 2025) take shape through emergent citation communities that diverge from earlier trajectories. Regarding portability, shared concerns such as literacy and privacy recur globally; however, their institutional configurations vary significantly across contexts, altering how mechanisms unfold in practice. These patterns caution against universalist assumptions and call for context-sensitive theories.

The boundary conditions shape these dynamics in tangible ways. Institutional architectures, administrative traditions, technological maturity levels, and uneven distributions of digital literacy (Setiansah et al., 2024) limit the generalizability of particular governance models. As such, external validity is strongest at the level of underlying mechanisms (e.g., privacy risk, trust formation), more moderate at the level of settings, and weakest at the level of specific institutional arrangements or policy instruments, which are highly context-dependent.

This study has practical implications for the behavioral, organizational, and policy domains.

From a behavioral standpoint, the prominence of literacy and trust underscores the importance of strengthening human capabilities and communication infrastructure, not merely digital platforms (Lee-Geiller, 2024). Organizationally, the fragmented collaboration structures observed across institutions highlight the need for capacity-building strategies that broaden participation beyond the dominant academic hubs. At the policy level, persistent concerns regarding privacy, data

stewardship, and algorithmic transparency (Anupriya & Chauhan, 2024; Svärd et al., 2024) indicate that regulatory frameworks must evolve alongside technological innovation, especially in developing and transitional contexts where vulnerabilities are more pronounced.

This study has some limitations. Reliance on Scopus-indexed publications narrows the representativeness of the global research landscape, while automated clustering and keyword harmonization, despite careful cleaning, can obscure nuances in emerging subfields. However, these limitations also point to promising avenues for future research. Comparative case studies can illuminate how national governance trajectories diverge despite similar digital pressures. Longitudinal qualitative studies could unpack the micro-mechanisms through which literacy, trust, and institutional capacity shape digital transformation. Mixed-methods designs combining scientometric mapping with field-level administrative data would enable a deeper exploration of the causal pathways identified here.

In summary, digital governance is at a threshold moment. As data infrastructures, algorithmic systems, and sensor-based technologies become embedded in the routines of the state, the scholarly community must refine its conceptual vocabulary and diversify its methodological toolkits. This study contributes to that broader effort by offering an integrated reconstruction of how the field has evolved conceptually, intellectually, and socially over the past twenty-five years, and by opening pathways for the next generation of research in a domain whose complexity and public significance will only continue to grow.

Acknowledgements

The authors would like to express their sincere appreciation to the reviewers of the Journal of Emerging Technologies and Governance (ETG) for their thoughtful, constructive, and detailed feedback on the earlier versions of this manuscript. Their insights greatly improved the clarity, analytical depth, and rigor of the study. We are deeply grateful for the time, expertise, and scholarly care they dedicated to strengthening our work.

Funding Statement

The authors received no financial support for the research, authorship, or publication of this article.

Conflicts of interest

The authors declare no conflicts of interest related to the research, authorship, or publication of this study.

Authors contribution statement

The article was prepared, edited, and revised with equal contributions from all authors.

Data Availability Statement

The data underlying this study are not publicly available. The bibliometric dataset was obtained under licensing and usage restrictions from Scopus and included curated files that could not be redistributed in full or in part. In accordance with these restrictions and to maintain compliance with the data usage agreements, the authors are unable to share the raw or processed datasets used in the analysis.

All procedures, search strategies, and analytical workflows are transparently documented in the manuscript to enable methodological replication without requiring direct access to proprietary data.

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