

Artificial Intelligence and Social Welfare

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Abstract. The rapid advancement of artificial intelligence (AI) and algorithmic automation is fundamentally reshaping contemporary socio-economic structures. While these technologies drive macroeconomic efficiency, their systemic impact on social welfare and public protection mechanisms remains a critical area of academic inquiry. This study provides a comprehensive bibliometric review of global literature intersecting AI and social welfare over a three-decade period (1995–2026). A refined corpus of 2,165 peer-reviewed documents extracted from the Scopus database (restricted to Social Sciences, Economics, and Management) was computationally analyzed using the *Bibliometrix* package in R-Studio. Conceptual mapping reveals a significant paradigm shift, transitioning from early technical public automation to contemporary concerns regarding algorithmic justice, ethical governance frameworks, and socio-economic inequalities. Thematic clustering further exposes critical tensions regarding how digital transformations either foster social inclusion or exacerbate territorial fractures. Conclusively, this paper synthesizes global research trajectories to offer an innovative framework for policymakers, emphasizing the urgent need for human-centric AI governance capable of securing robust social safety nets.

Keywords: *Artificial Intelligence, Social Welfare, Quality of Life, Social Protection, Socio-economic Inequalities, Bibliometric Analysis.*

1. Introduction

The dawn of the Fourth Industrial Revolution has accelerated the deployment of artificial intelligence (AI), machine learning architectures, and automated decision-making systems (ADM) across diverse sectors of the global economy (Schwab, 2016). Originally confined to industrial optimization, computational finance, and logistical automation, algorithmic tools have progressively permeated public administrative structures and state apparatuses. Today, AI systems actively manage or influence public resource distribution, legal adjudication, medical triaging, and social security administration (Agarwal, 2018; Wirtz et al., 2019). While these technological disruptions are widely lauded for driving macroeconomic efficiency, lowering transaction costs, and minimizing human administrative errors, they simultaneously exert profound and highly disruptive structural pressures on traditional social welfare frameworks and social protection paradigms.

Social welfare, defined as the institutionalized system of social networks, public policies, and safety nets designed to ensure minimum standards of well-being and quality of life for all citizens, is no longer subject solely to political or bureaucratic discretion. Instead, it is increasingly governed by code, training datasets, and predictive models (Eubanks, 2018). The

deployment of AI within social safety nets introduces a dual-edged sword. On one hand, data-driven governance promises unprecedented precision in policy targeting, the elimination of administrative bottlenecks, and enhanced fraud detection capabilities in social security systems (Bullock et al., 2020). On the other hand, the uncritical adoption of automated algorithms raises deep concerns regarding systemic biases, the opacity of "black-box" decision models, automated economic displacement, and the potential erosion of citizen rights (Dignum, 2019; Pasquale, 2015).

Despite the exponential growth of technical literature on machine learning capabilities, a significant academic fragmentation persists at the intersection of computer science, public economics, and social policy. Quantitative or computational assessments of how AI systems holistically redefine human well-being, social equity, and public safety nets remain highly scattered across disparate academic disciplines. Scholars in public management often treat AI as a mere operational tool for optimization (Wirtz et al., 2019), whereas sociologists and socio-economists approach it through the lens of algorithmic exclusion and digital surveillance, frequently lacking cross-disciplinary synthesis (O'Neil, 2016; Zuboff, 2019). Consequently, there is an urgent imperative to map the intellectual structure, structural shifts, and conceptual boundaries of this emerging research domain.

To bridge this critical knowledge gap, this study provides a comprehensive scientometric and bibliometric analysis of the global scientific literature intersecting artificial intelligence and social welfare over a three-decade horizon spanning from 1995 to 2026. This period encapsulates the entire evolutionary trajectory of modern digital governance, transitioning from embryonic internet-enabled public service portals to hyper-sophisticated, autonomous generative AI systems. By computationally evaluating a refined corpus of 2,165 peer-reviewed publications extracted from the Scopus database within the specialized fields of Social Sciences and Economics, this paper seeks to systematically address four foundational research questions:

1. What are the macro-structural publishing trajectories and temporal growth dynamics characterizing the literature on AI and social welfare between 1995 and 2026?
2. Which academic journals, core institutions, and nation-states represent the structural focal points of global knowledge production in this field?
3. How have the internal conceptual networks and thematic clusters evolved, and what are the predominant paradigms driving the contemporary discourse?
4. What are the key underlying tensions regarding social inclusion and territorial fractures caused by digital transformations, and how can they inform future human-centric governance?

The remainder of this chapter is systematically structured as follows: Section 2 conducts a rigorous multi-dimensional literature review exploring the shifting definitions of social welfare and the theoretical challenges posed by digital transformations. Section 3 delineates the comprehensive bibliometric methodology, including data extraction queries, corpus filters, and R-Studio Bibliometrix implementation protocols. Section 4 presents the core empirical results and scientific mapping metrics. Section 5 provides an in-depth discussion of the conceptual shifts, ethical implications, and public management strategies. Finally, Section 6 concludes with theoretical and policy-oriented recommendations.

2. Literature Review and Theoretical Framework

a. The Concept of Social Welfare and Social Protection in the Digital Age

The definition of social welfare has historically evolved alongside prevailing macroeconomic paradigms and structural transformations. Within the classical framework established by mid-

20th-century socio-economics, social welfare constitutes an institutional defense mechanism against market failures, systemic poverty, and lifecycle contingencies (Esping-Andersen, 1990). It encapsulates state-sponsored social security, universal healthcare access, unemployment compensation, and localized public safety nets designed to secure a baseline quality of life. From a theoretical standpoint, these mechanisms function as social shock absorbers, transforming raw economic capital into equitable human development outcomes (Sen, 1999).

In the contemporary era of digital transformation, this classical paradigm is undergoing an intense structural mutation. The transition from bureaucratic welfare states to what scholars term the "digital welfare state" or "algorithmic governance" fundamentally changes how citizen rights are mediated (Eubanks, 2018; Janssen & Kuk, 2016). Social protection mechanisms are increasingly integrated with digital identities, biometric authentication systems, and cloud-based data repositories. Theoretically, this shift can be analyzed through the lens of public choice theory and administrative efficiency models (Dunleavy et al., 2006). Digitalized welfare delivery alters the cost-benefit calculus of public resource allocation by lowering administrative friction, reducing the phenomenon of "non-take-up" (where eligible individuals fail to access benefits due to complexity), and creating dynamic, real-time social indicators that allow public managers to assess citizen well-being empirically (Agarwal, 2018).

b. Algorithmic Governance, Public Efficiency, and the Automated Safety Net

The integration of artificial intelligence into public management introduces automated decision-making architectures capable of evaluating socio-economic eligibility at a scale and speed previously unimaginable (Bullock et al., 2020). Machine learning models—ranging from simple regression-based scoring profiles to sophisticated deep learning neural networks—are increasingly utilized to predict systemic risks, model economic precarity, and automate the distribution of targeted social welfare benefits (Kavanagh et al., 2019). For instance, predictive analytics allow municipalities to forecast housing vulnerability, pinpoint localized food insecurity, and allocate social assistance preemptively.

From an organizational management perspective, this represents a major step forward in state capacity (Wirtz et al., 2019). Automated safety nets allow public administrations to move away from reactive, crisis-driven social policies toward predictive, preventive interventions. By processing massive quantities of administrative big data, AI can uncover hidden structural correlations within socio-economic sub-systems, giving policymakers the tools to optimize public expenditure while theoretically maximizing social utility (Veale & Brass, 2019). The automation of routine administrative tasks also frees human social workers from clerical burdens, allowing them to focus on direct human-centric interventions.

c. The Shadow of the Algorithm: Bias, Inequality, and Territorial Fractures

Despite the optimized administrative efficiencies promised by algorithmic governance, a growing body of critical literature highlights severe socio-technical risks. The primary challenge stems from the phenomenon of algorithmic bias and data path dependency (O'Neil, 2016; Pasquale, 2015). Machine learning models are inherently backward-looking; they learn to make predictions based on historical administrative training data. If historical data reflects deep-seated socio-economic inequalities, institutional racism, or localized marginalization, the resulting AI models inevitably codify, automate, and amplify these structural biases under the guise of objective, mathematical neutrality (Benjamin, 2019; Noble, 2018). This can lead to systematic exclusions of vulnerable groups from vital social safety nets.

Furthermore, the deployment of AI-driven public management threatens to deepen territorial fractures and digital divides (Zuboff, 2019). The infrastructure required to support, access, and

interact with smart governance systems—such as high-speed broadband connectivity, digital literacy, and hardware accessibility—is highly unequally distributed across regional and municipal territories (Norris, 2001). While urban centers benefit from integrated "smart city" ecosystems that enhance local quality of life, peripheral, low-income, or rural territories risk being structurally disenfranchised by fully automated public services. This spatial and territorial injustice complicates the relationship between technological innovation and social sustainability. It demands a critical paradigm shift in research, moving beyond purely technical efficiency metrics toward comprehensive frameworks of algorithmic justice and human-centric AI governance (Dignum, 2019; Taylor, 2017).

3. Data and Methods

To establish a transparent, empirical, and reproducible evaluation of the scientific literature combining machine intelligence and social safety systems, this study deploys an advanced computational bibliometric workflow. Traditional narrative reviews, while structurally valuable for microscopic conceptual analysis, often suffer from subjectivity and are fundamentally unequipped to handle massive bibliographic metadata structures without selection bias (Aria & Cuccurullo, 2017; Zupic & Čater, 2015).

Conversely, scientometric science mapping combines statistical rigor with computational network analytics. This approach allows researchers to decode macro-structural publishing trajectories, locate structural intellectual centers, and uncover hidden thematic crosscurrents across decades of global scientific output. The primary objective of this methodological framework is to convert unstructured citation logs into structured, visual intelligence regarding how automated decision architectures impact human well-being and social protection paradigms.

4. Methodology

a. Data Source and Search Strategy

The empirical dataset analyzed in this chapter was systematically extracted from the Scopus database, engineered by Elsevier. In computational bibliometrics, data source selection determines the structural validity of the mapping outputs. Scopus was selected over competing repositories (such as Web of Science or Google Scholar) because it maintains a demonstrably larger and more balanced index of high-impact peer-reviewed journals within the social sciences, public policy, and economic management fields (Mongeon & Paul-Hus, 2016). Furthermore, it provides cleaner, unified citation metadata records, which are prerequisites for programmatic parsing.

The search strategy was designed around a robust multi-dimensional Boolean string, executed in June 2026. The search architecture systematically intersects two core conceptual axes:

- **The Technological Axis:** Isolating documents treating advanced algorithmic execution, automation, and automated cognitive systems ("artificial intelligence", "AI", "machine learning", "deep learning", "algorithm*").
- **The Socio-Economic Axis:** Isolating documents dealing directly with public welfare frameworks, life standards, and safety net delivery systems ("social welfare", "well-being", "wellbeing", "social well-being", "social protection", "social security", "quality of life", "social safety net*").

The precise syntax was limited to Titles, Abstracts, and Keywords (TITLE-ABS-KEY). The complete, exact search string executed programmatically within Scopus is structured as follows:

```
TITLE-ABS-KEY ( ( "artificial intelligence" OR "AI" OR "machine learning" OR  
"deep learning" OR "algorithm*" ) AND ( "social welfare" OR "well-being" OR  
"wellbeing" OR "social well-being" OR "social protection" OR "social security"  
OR "quality of life" OR "social safety net*" ) ) AND PUBYEAR > 1994 AND  
PUBYEAR < 2027 AND ( LIMIT-TO ( LANGUAGE , "English" ) OR LIMIT-TO  
( LANGUAGE , "French" ) ) AND ( LIMIT-TO ( SUBJAREA , "SOCI" ) OR  
LIMIT-TO ( SUBJAREA , "ECON" ) ) AND ( LIMIT-TO ( EXACTKEYWORD  
, "Artificial Intelligence" ) OR LIMIT-TO ( EXACTKEYWORD , "Well Being" )  
OR LIMIT-TO ( EXACTKEYWORD , "Quality Of Life" ) ) )
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b. Inclusion and Exclusion Criteria

To refine the raw search results and ensure strict analytical alignment with the organizational, institutional, and macroeconomic focus of this collective work, formal inclusion and exclusion criteria were established.

Temporally, the chronological window was set between **1995 and 2026**, capturing the comprehensive evolution of the internet age from early algorithmic database management to modern deep learning and generative models. Linguistically, the search expanded beyond traditional monocultural filters to include both **English and French** publications (LIMIT-TO (LANGUAGE, "English") OR LIMIT-TO (LANGUAGE, "French")), reflecting the bilingual epistemological foundations of global public administration and social policy research.

Disciplinary filters were strictly locked to the Scopus macro-subject areas of **Social Sciences (SOCI)** and **Economics, Econometrics, and Finance (ECON)**. Purely technical computer engineering architectures, robotic hardware configurations, or clinical medical trials that did not evaluate the wider societal, managerial, or economic impacts of the technology were systematically excluded.

Crucially, to eliminate peripheral conceptual noise and isolate the absolute core of the intellectual domain, the search was constrained using exact keyword matching. The final sample was restricted exclusively to papers formally indexed with the mandatory descriptors of "Artificial Intelligence", "Well Being", or "Quality Of Life".

c. Data Processing and Refinement

Following execution of the refined query string, the final analytical corpus settled at 2,165 highly specialized, peer-reviewed documents. The comprehensive bibliographic metadata—comprising full author names, institutional affiliations, abstract text strings, journal origins, specific citation counts, and standardized author keywords—was exported from Scopus in raw BibTeX format to preserve structural formatting strings.

Data processing was performed within the R computational environment (version 4.3.2) using the open-source Bibliometrix engine (Aria & Cuccurullo, 2017) and its web-based graphical interface, Biblioshiny. The raw dataset underwent an automated programmatic cleaning pass to eliminate duplicate entries and resolve multi-author affiliation syntax inconsistencies. Missing metadata fields were resolved by cross-checking DOI identifiers against the CrossRef API, establishing a highly complete, unified bibliographic matrix ready for statistical network generation.

d. Analysis and Bibliometric Mapping

The structural analysis of the refined 2,165-document dataset is divided into three analytical layers:

This layer establishes descriptive metrics including annual scientific growth trends, average citation rates per paper over time, and international publishing volumes based on corresponding author locations. Journal productivity is categorized by applying Bradford's Law of scattering, which segments the active journals into three concentric zones based on publication density, identifying the core scientific journals driving the global conversation.

Collaboration networks are generated to map structural co-authorship loops between global institutions and nation-states. To prevent multi-author publications from distorting regional performance metrics, a fractional counting approach is applied. This method distributes equal fractional credit across all affiliated institutions listed on a single manuscript, revealing true transnational research hubs.

The semantic architecture of the field is mapped by applying the Callon (1983) clustering algorithm to co-occurring author keywords. This technique maps terms onto a two-dimensional strategic matrix based on two distinct mathematical indicators: **Centrality** and **Density**.

$$\text{Centrality} = \sum w_{ij}$$

Where w_{ij} measures the structural strength of external connections linking keywords in cluster i to keywords located in entirely separate clusters, indicating the overall prominence of a theme within the global field.

$$\text{Density} = \frac{\sum w_{kk}}{N}$$

Where w_{kk} measures the internal connection strength between keywords contained entirely within a single cluster, indicating the developmental maturity and internal cohesion of that specific research theme.

This matrix effectively separates the academic discourse into four distinct quadrants: Motor Themes (well-developed and structurally central), Niche Themes (well-developed but isolated), Emerging/Declining Themes (weakly developed and peripheral), and Basic/Foundational Themes (underdeveloped but central to the wider discipline).

5. Analysis and Overview

a. Main Information and Bibliometric Overview

The macro-structural configuration of the extracted Scopus dataset reveals a highly dynamic, interdisciplinary, and rapidly expanding research ecosystem at the intersection of artificial intelligence and social welfare metrics. Comprising 2,160 peer-reviewed documents published between 1995 and 2026, the corpus is distributed across 1,196 unique publication sources, including specialized journals, edited books, and conference proceedings. This wide dispersion across media channels highlights a heterogeneous intellectual landscape that draws heavily from public economics, urban sociology, and organizational management, rather than remaining confined to a narrow academic niche. This vibrant domain is driven by an active network of 6,941 contributing authors, whose intellectual output is characterized by a high degree of thematic complexity, as evidenced by the presence of 10,578 Keywords Plus and 5,719 Author Keywords.

Figure 1: Summary Information.



From a temporal and operational standpoint, the domain exhibits exponential growth dynamics, highlighted by a remarkable annual publication growth rate of 21.13%. Although the historical timeline spans three decades, the mean document age sits at an exceptionally low 2.58 years, proving that the vast majority of scientific production is concentrated within the most recent 3-to-5-year window. This recent surge reflects the academic community's urgent mobilization to evaluate the social impacts of machine learning deployment.

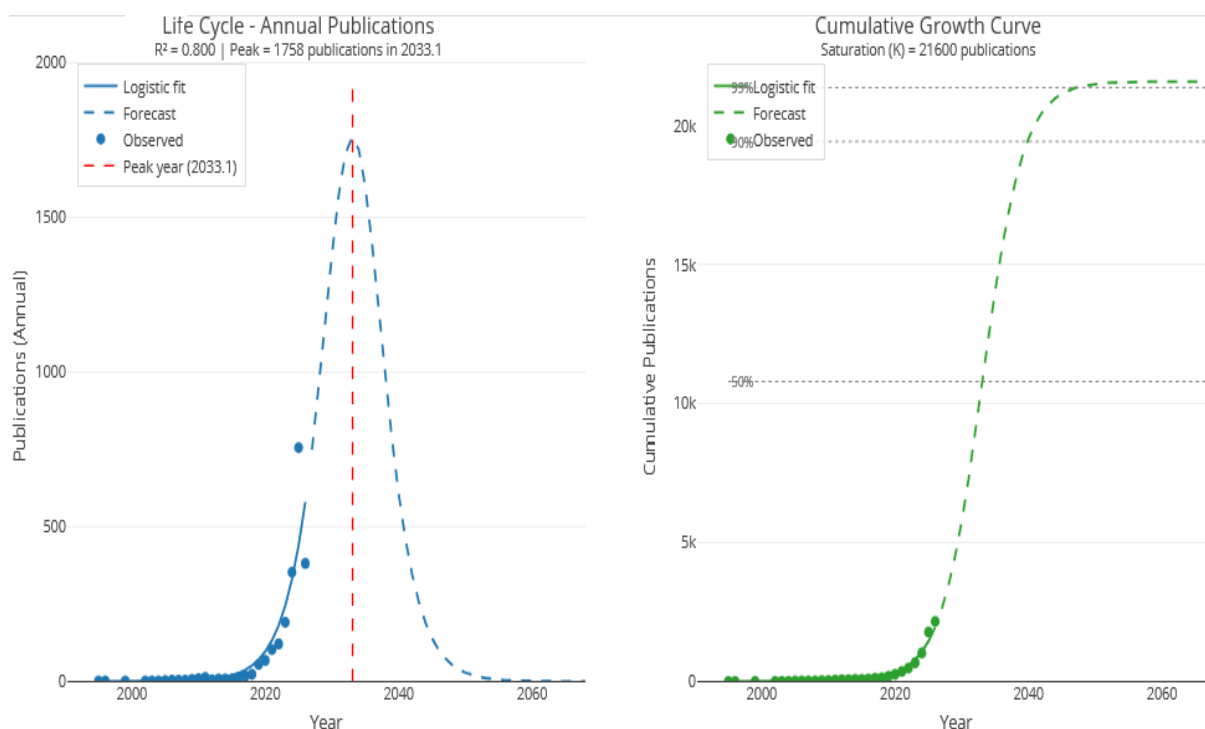
Despite the extreme recency of these publications, they demonstrate substantial academic influence, averaging 13.12 citations per document. This impact is achieved primarily through a deeply collaborative research culture. The corpus registers an average of 3.61 co-authors per document, with single-authored papers accounting for only 18% (388 documents) of total output. Transnational collaboration is also highly prominent, with international co-authorship ties crosscutting 24.4% of the entire collection.

Structurally, the publication landscape is dominated by original research articles (969), supplemented by a substantial volume of book chapters (561) and conference papers (417) that facilitate the rapid dissemination of preliminary socio-technical findings. Finally, a consolidated block of 106 review papers indicates that the field has reached a stage of structural maturity where scholars are actively synthesizing existing knowledge to guide future public policy frameworks.

b. Life Cycle of Scientific Production and Growth Dynamics

The temporal evolution of the 2,160 documents exhibits a clear logistic growth pattern, which is typical for the lifecycle development of emerging scientific disciplines. Modeling the data reveals that the domain is currently positioned on the accelerating left side of a bell-shaped trajectory for annual output, demonstrating an exponential increase in yearly publications. Mathematically, the logistic curve provides an excellent fit for the observed data, yielding a coefficient of determination (R^2) of 0.800 for annual publications and a goodness-of-fit value of 0.7998 for cumulative accumulation, with a Root Mean Squared Error (RMSE) of 72.938. Although a minor post-2020 surge pushes recent empirical observations slightly above the fitted curve—indicating that contemporary academic interest is outperforming standard projections—the model successfully captures the overarching structural trend.

Figure 2: Life Cycle of Scientific Production



The underlying mathematical parameters provide strategic insights into the field's long-term horizon. The estimated carrying capacity (K) is projected at 21,600 cumulative publications, representing the theoretical saturation threshold of the domain under current parameters. The growth period width ($\Delta_t = 13.499$ years) indicates a concentrated, rapid transition from initial emergence to structural maturity. The model estimates that the cumulative growth curve's inflection point—which marks the peak year for annual publication output (t_0)—will occur in approximately 2033.1, reaching a forecasted peak of 1,758 annual documents.

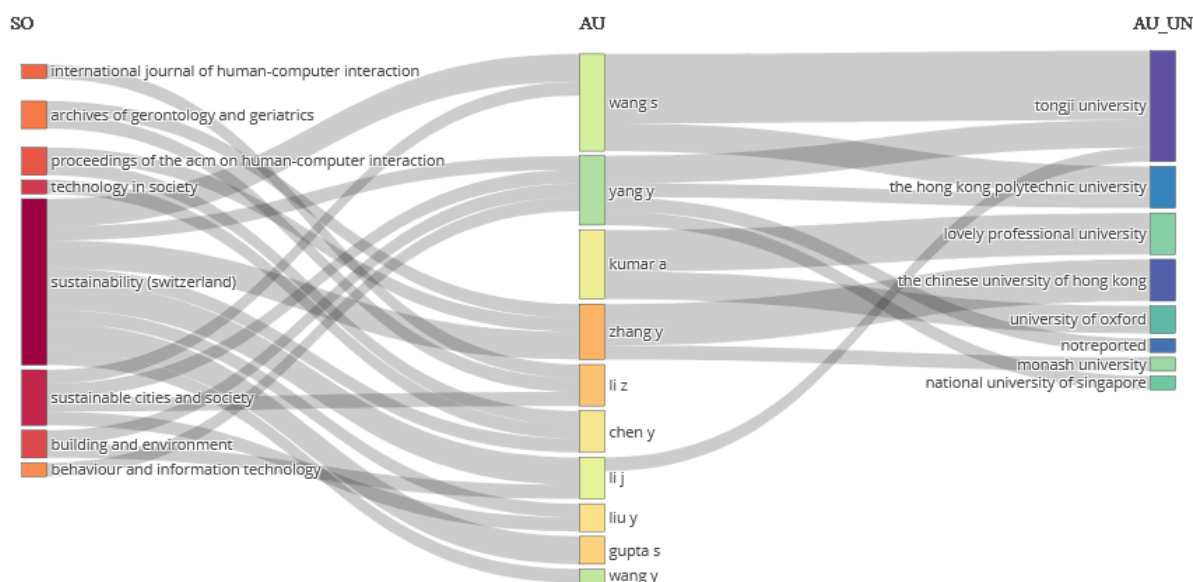
Historically, the domain has transitioned from an *Emergence Phase* (late 1990s to 2018), characterized by single-digit annual outputs, into a high-momentum *Expansion Phase* driven by interdisciplinary convergence, increased funding, and the rising public policy relevance of algorithmic governance. The model forecasts that the *Maturity Phase* will begin post-2033, with cumulative production reaching 90% of its carrying capacity around 2040, before eventually flattening into a stable plateau by 2050–2060 as foundational theoretical frameworks become fully institutionalized.

c. Structural Mapping of the Intellectual Pipeline via Three-Field Plot

A relational Sankey mapping—configured as a Three-Field Plot linking publication venues (Left: SO), contributing authors (Center: AU), and institutional affiliations (Right: AU_UN)—reveals the explicit structural flow of global knowledge production. The operational backbone of this network is anchored by *Sustainability* (Switzerland), which emerges as the dominant publishing venue, acting as a massive central hub for a prolific cluster of Asian researchers, including Yang Y., Kumar A., Li J., and Liu Y. However, structural diversification is also visible; key scholars such as Wang S. cross-cut the ecosystem by bridging their output between *Sustainability* and technical specialized outlets like the *International Journal of Human-Computer Interaction* and the *Archives of Gerontology and Geriatrics*. At the institutional level, Tongji University stands out as a major research center, driven by the intense output of Wang

S., followed by the Chinese University of Hong Kong (strongly linked to Yang Y.) and the Hong Kong Polytechnic University (linked to Liu Y.).

Figure 3: Three-Field Plot



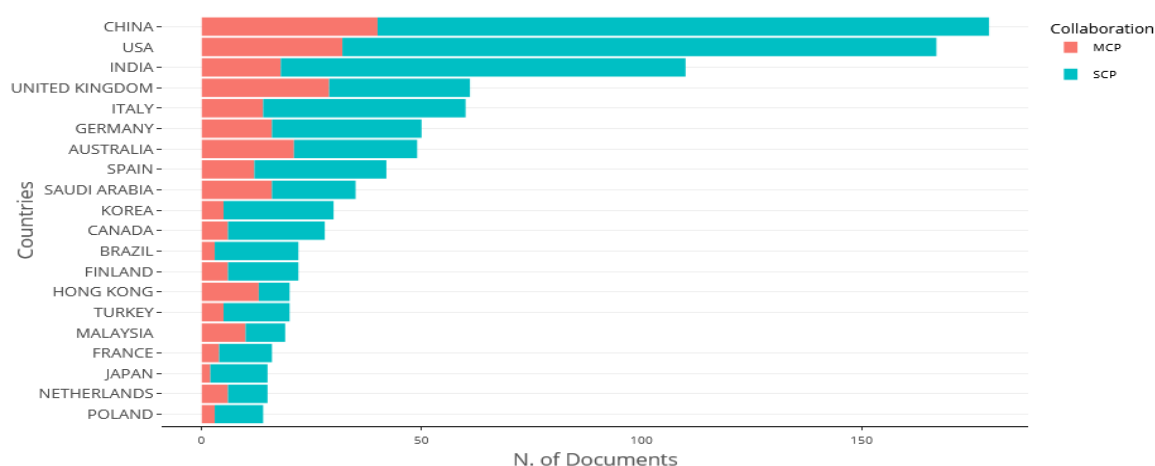
This structural architecture underscores two critical aspects of the domain: a strong geographic concentration and varying author publication strategies. The heavy concentration of links around Tongji University, the Chinese University of Hong Kong, and the National University of Singapore highlights a significant East Asian research footprint in the field of AI-driven social indicators and quality of life metrics, while institutions like the University of Oxford and Monash University provide global intellectual balance. The network demonstrates a clear dichotomy between highly specialized publishing strategies, where researchers focus their output within a single core journal like *Sustainability*, and multi-disciplinary approaches that distribute findings across computer science, gerontology, and built-environment literature. This distributed approach reflects the intrinsic cross-disciplinary requirements of evaluating automated decision-making frameworks within public management systems.

6. Bibliometric Analysis by Country

a. Corresponding Author Country Analysis

The geographic origin of the corresponding authors provides crucial insights into the global leadership and structural distribution of research within this domain. A macroeconomic view of national production reveals a field dominated by a powerful trio of scientific producers: China leads global output with 179 articles, followed closely by the United States (167 articles) and India (110 articles). These three nations serve as the primary institutional engines driving the domain's expansion, outstripping the secondary tier of highly productive European states, which includes the United Kingdom (61 articles), Italy (60 articles), and Germany (50 articles).

Figure 4: Affiliation Productivity Over Time.

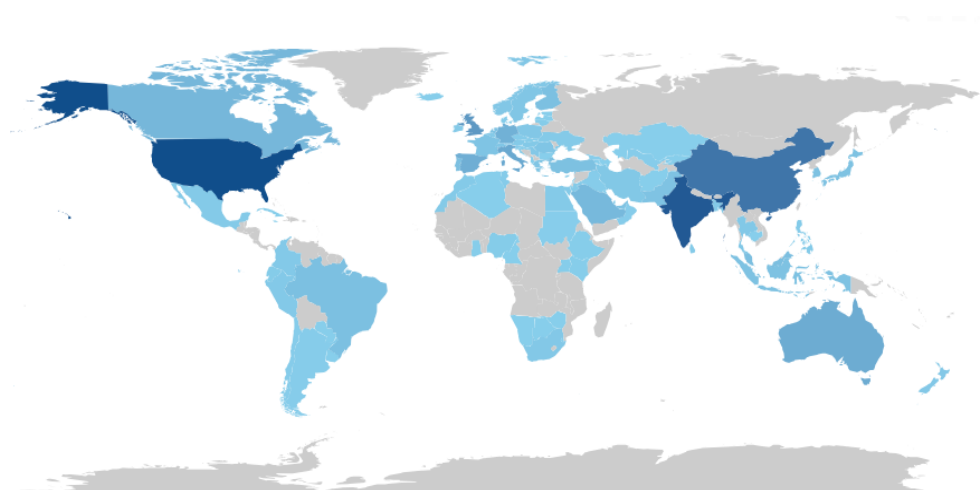


Evaluating the structural balance between Single Country Publications (SCP) and Multiple Country Publications (MCP) highlights two distinct national research strategies. Large domestic powerhouses like the United States (MCP=19.2%) and India (MCP=16.4%) operate primarily within self-sufficient national frameworks, relying on vast internal infrastructure to anchor their domestic output. Conversely, smaller, highly integrated nodes leverage international partnerships as their primary mode of knowledge creation; this is exemplified by Hong Kong's exceptional international collaboration ratio (MCP=65.0%) and Malaysia (MCP=52.6%), where cross-border co-authored papers outnumber purely domestic publications. This highlights a clear structural divide between nations utilizing self-contained, domestic research ecosystems and those employing globally integrated strategies to accelerate knowledge production.

b. 6.2. Scientific Output Analysis by Country

A quantitative mapping of cumulative scientific productivity by country reveals a distinct hierarchical structure led by Anglo-American, South Asian, and East Asian research powerhouses. The United States anchors the global network with a dominant output of 740 publications, closely followed by India with 668 documents, and China with 501 documents. Together, these three nations generate the foundational volume of the literary corpus, leveraging extensive university networks and targeted national research funds to maintain leadership in the field of public management, artificial intelligence, and social well-being indicators.

Figure 5: Scientific Output by Country

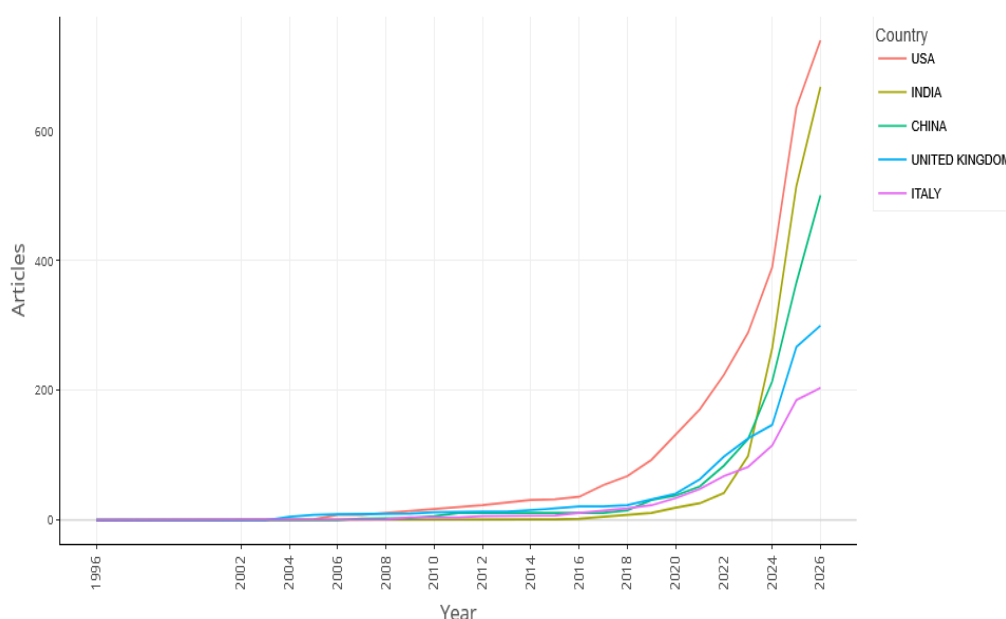


Beyond this leading tier, a robust secondary cluster of European and Commonwealth nations establishes a significant, highly visible research footprint. The United Kingdom acts as the primary European hub with 300 publications, followed by an active Mediterranean and continental contingent comprising Italy (204), Spain (175), and Germany (158). This group is structurally balanced by Australia (188), Canada (125), and Saudi Arabia (114). The substantial output from these diverse institutional ecosystems reflects a global academic commitment to evaluating the operational impacts of digital transformations and territorial governance models within modern public administrations.

c. Longitudinal Analysis of National Scientific Production

A longitudinal examination of cumulative scientific production across the top five leading nations reveals a clear structural division between early academic adopters and rapidly rising research ecosystems. The United States and the United Kingdom established the field's historical foundations in the mid-2000s; the USA published its initial documents in 2003 and reached a substantial volume of 36 articles by 2016, while the UK followed a similar baseline, moving from 5 articles in 2004 to 21 in 2016. Italy represents a steady continental progression, initiating production in 2006 and maintaining a gradual, linear development throughout the subsequent decade. During this early phase, East and South Asian nations maintained a minimal or non-existent footprint, reflecting a period where the foundational conceptual frameworks of algorithmic governance and digital public management were primarily driven by Western academic institutions.

Figure 6: Countries' Production over Time.

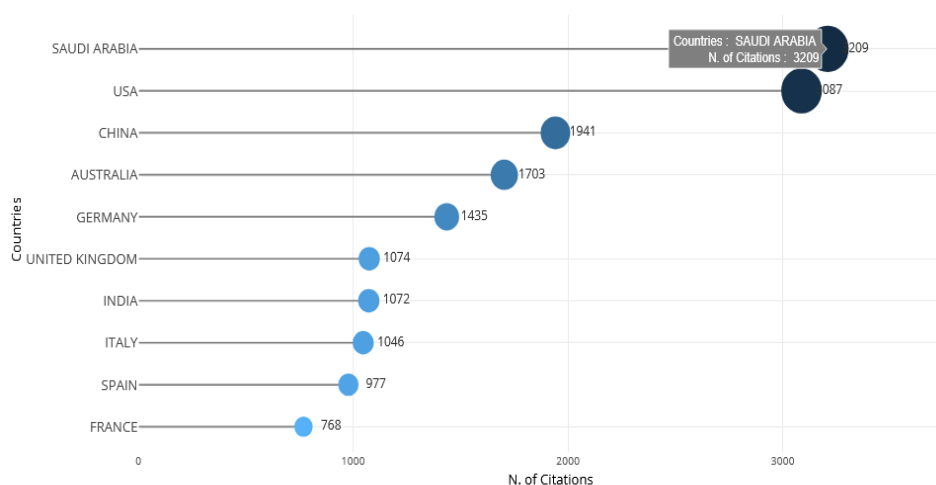


The historical distribution shifted dramatically after 2018, giving way to an intense, synchronized expansion phase across all five countries. The most striking hyper-exponential surge is observed in India, which escalated from just 7 cumulative publications in 2018 to 265 in 2024, ultimately reaching 668 by 2026—positioning it as a major rival to the long-standing leadership of the United States (740). China exhibits a similarly aggressive growth trajectory, climbing from 15 publications in 2018 to 501 by 2026. This parallel surge across the United States, India, and China underscores a massive global mobilization of research capital over the last four years. The contemporary explosion of literature reflects an urgent academic effort to keep pace with rapid technological deployments and the socioeconomic implications of automated public administration on a global scale.

d. Citation Impact and Academic Influence by Country

An evaluation of the total citation (TC) counts and average article citations (AAC) by country introduces an essential shift in how we understand academic influence, decoupling raw publication volume from actual scientific impact. While the United States and China generate a high volume of documents, Saudi Arabia emerges as the most influential node in terms of citation density, accumulating a total of 3,209 citations with an extraordinary average of 91.70 citations per document. The United States follows closely in total volume with 3,087 citations but maintains a more distributed baseline impact ($AAC=18.50$). China establishes a firm presence with 1,941 total citations ($AAC=10.80$), while Australia displays a highly efficient footprint, translating 188 publications into 1,703 citations, resulting in a strong average of 34.80 citations per paper.

Figure 7: Most Cited Countries



The European research landscape exhibits a structurally stable and cohesive impact profile. Germany leads the continental cluster with 1,435 total citations ($AAC=28.70$), followed by a highly synchronized group comprising the United Kingdom (1,074 citations; $AAC=17.60$), Italy (1,046 citations; $AAC=17.40$), and Spain (977 citations; $AAC=23.30$). Although France sits at the baseline of the top ten with 768 total citations, it achieves a highly notable efficiency metric, registering an average of 48.00 citations per document. Conversely, India demonstrates a highly dispersed citation structure; despite ranking as the second most productive country globally with 668 documents, it yields a modest average of 9.70 citations per paper. This variance underscores a clear divergence between nations focused on high-volume production and those generating high-impact, widely cited theoretical frameworks within the global discourse.

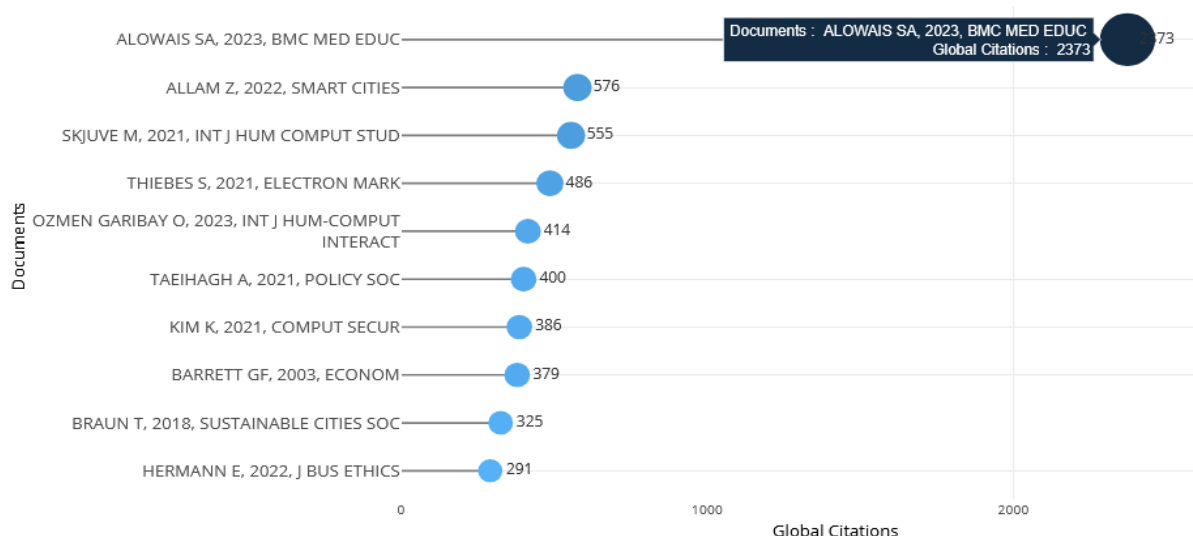
7. Document-Level Bibliometric Analysis

a. Analysis of Most Globally Cited Documents and Intellectual Core

A microscopic evaluation of the specific papers driving the domain's intellectual foundation reveals a highly concentrated citation structure, led by a single landmark publication. The article by Alowais et al. (2023), published in *BMC Medical Education*, acts as the absolute citation anchor of the corpus, accumulating an extraordinary 2,373 total citations (TC) and a massive, annualized impact of 593.20 citations per year. This foundational work is followed by Allam et al. (2022) in *Smart Cities* (576 citations) and Skjuve et al. (2021) in the *International Journal of Human-Computer Studies* (555 citations). The prominent positioning of these contemporary documents proves that the primary intellectual weight of the field is deeply tied to the rapid,

post-2020 integration of machine learning within institutional, educational, and smart urban infrastructure systems.

Figure 8: Most Global Cited Documents.



The wider distribution of the top ten cited works highlights a balanced cross-disciplinary landscape where technology interacts with public policy, ethics, and economic structures. High-impact contributions such as Thiebes et al. (2021) in *Electronic Markets* (486 citations) and Ozmen Garibay et al. (2023) in the *International Journal of Human-Computer Interaction* (414 citations) establish a firm connection between human-centric systems and digital platforms, while Taeihagh et al. (2021) in *Policy and Society* (400 citations) centers the discourse on public sector risk and policy responses.

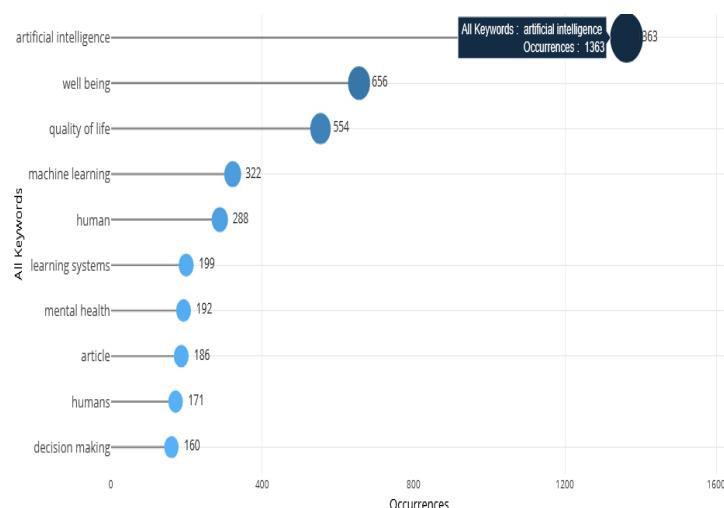
While the field is heavily dominated by recent publications, a critical, long-standing economic anchor remains: the classic paper by Barrett (2003) in *Econometrica* maintains significant structural relevance with 379 total citations. The steady influence of this older study alongside contemporary ethical frameworks, such as Hermann (2022) in the *Journal of Business Ethics* (291 citations), underscores a field that successfully balances quantitative, data-driven economic indices with evolving socio-technical and algorithmic governance requirements.

8. Bibliometric Analysis by Keywords

a. Lexical Density and Most Frequent Keywords

A quantitative analysis of lexical frequencies within the corpus metadata reveals the explicit thematic boundaries and conceptual pillars of the domain. Unsurprisingly, the core technological anchor is dictated by the term "artificial intelligence", which appears 1,363 times, establishing it as the primary computational descriptor. The socio-economic and human-centric outcomes of this technology are tracked through the highly frequent terms "well being" (656 occurrences) and "quality of life" (554 occurrences). This lexical distribution proves that the dataset is highly specialized and explicitly aligned with the research objectives, showcasing a domain that is structurally built around evaluating how computational intelligence alters human life standards and social indicator metrics.

Figure 9: Most Frequent Words



The secondary tier of high-frequency words outlines the methodological and operational mechanisms through which this relationship is mediated. Technical implementation strategies are captured by "machine learning" (322) and "learning systems" (199), while the structural focus on human institutional interactions is reinforced by the overlapping nodes "human" (288) and "humans" (171). Crucially, the appearance of "mental health" (192) and "decision making" (160) highlights the primary operational arenas of this literature. This reveals that the contemporary academic discourse focuses heavily on evaluating the ethical, clinical, and psychological impacts of automated decision-making frameworks as they increasingly govern public resource distribution and socio-spatial welfare systems.

b. Conceptual Mapping and Word Cloud Topography

A word cloud synthesis visually weights keywords based on their metadata frequency, offering an immediate graphic representation of the domain's conceptual topography. At the absolute epicenter of this semantic landscape sits the massive visual anchor of "artificial intelligence" (1,363 occurrences), which functions as the gravitational core of the entire research space. branch out from this technical epicenter are two equally prominent, interconnected typographic clusters: "well being" (656) and "quality of life" (554). The visual dominance of these three terms immediately communicates the primary objective of the field, demonstrating that the literature is not merely interested in computational mechanics, but is explicitly focused on the societal and existential outcomes of digital transformation.

Figure 10: WordCloud

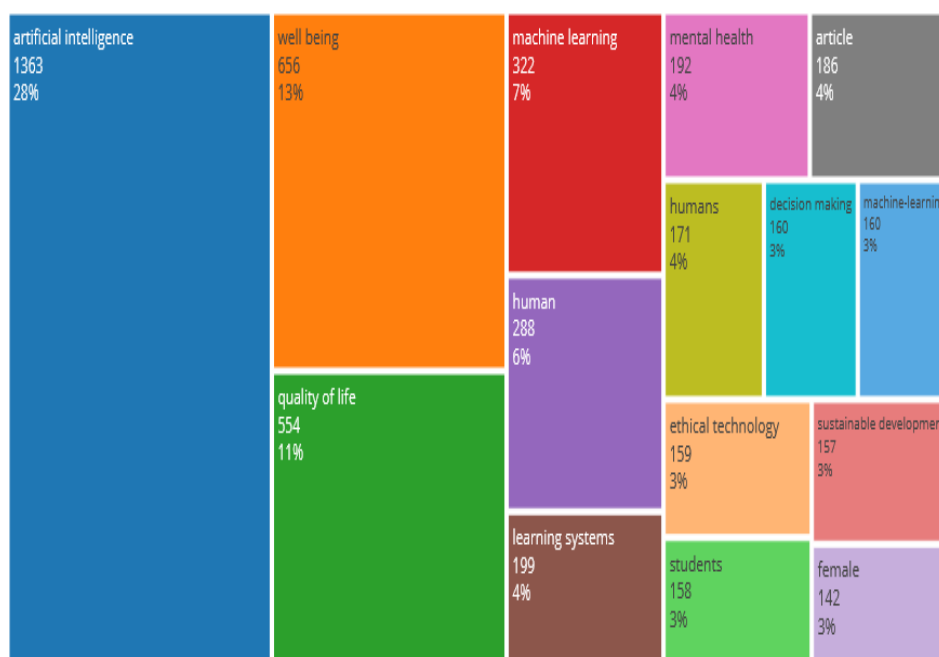


The outer rings of the word cloud reveal the specific methods and clinical dimensions that support the core research. The computational tools are represented by a dense technical sub-cluster containing "machine learning" (322) and "learning systems" (199), which frame the analytical methods used to process complex social indicators. This technical framework directly connects with the human-centric nodes "human" (288) and "humans" (171). Finally, the inclusion of "mental health" (192) and "decision making" (160) at the visual borders shows the practical application areas of the field. This configuration highlights a research landscape that uses advanced computational models to evaluate, predict, and govern social welfare and human psychological outcomes.

c. TreeMap Analysis

A treemap decomposition provides a nested, hierarchical view of the corpus metadata, partitioning the thematic surface area according to the absolute weight of each descriptor. The structural space is vastly dominated by the primary block of artificial intelligence, which commands 1,363 occurrences and establishes the overarching technological boundary of the entire domain. Immediately adjacent to this computational space are two massive, tightly integrated social partitions: well being (656 occurrences) and quality of life (554 occurrences). This hierarchical arrangement visually underscores how the literature distributes its analytical focus, allocating the largest share of conceptual real estate to measuring the direct impact of automated systems on human existence and social indicators.

Figure 11: WordCloud

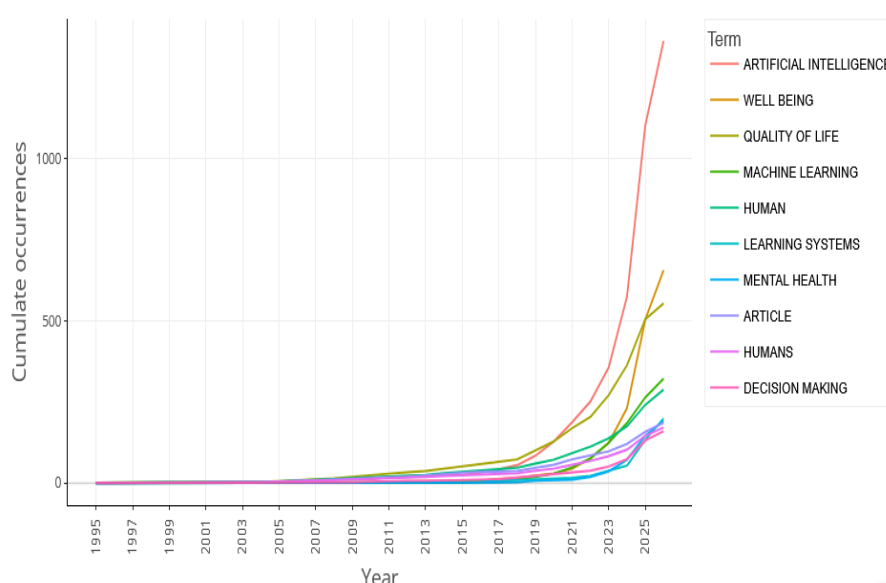


The remaining surface area of the treemap is subdivided into smaller, specialized structural blocks that define the methodological and operational dimensions of the research. The methodological sub-sectors are filled by machine learning (322) and learning systems (199), which represent the foundational tools used to extract patterns from complex social datasets. These technical partitions directly border the demographic and practical nodes of human (288), mental health (192), humans (171), and decision making (160). The proportional distribution within these lower tiers reveals a balanced integration of algorithmic processes and behavioral tracking, showing that the intellectual core of the field relies on using automated decision systems to address public welfare and psychosocial indicators.

d. Longitudinal Word Frequency and Evolutionary Trajectories

A longitudinal analysis of cumulative keyword frequencies from 1995 to 2026 reveals a clear paradigm shift in the intellectual structure of the domain, transitioning from early quality of life studies to an intense, algorithmically driven focus. Throughout the emergence phase spanning from 1995 to the late 2000s, the literature was primarily dominated by social and clinical metrics, with quality of life and human serving as the initial conceptual baselines, while artificial intelligence maintained zero or minimal presence. The early 2010s marked a subtle turning point as computational terms began to emerge, with artificial intelligence rising to 11 occurrences in 2010 and well being recording its initial entries, signaling the start of an empirical convergence between data science methodologies and social indicators.

Figure 12: Keyword Frequency Over Time



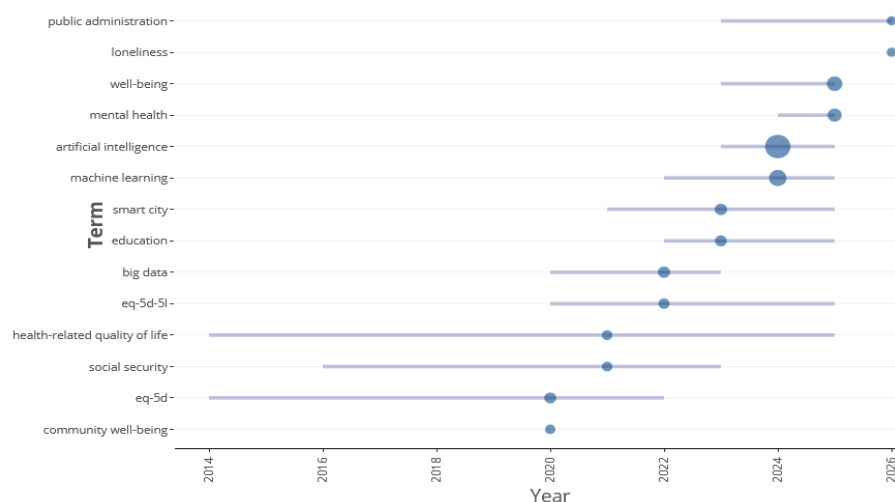
The evolutionary trajectory transformed completely after 2018, giving way to an unprecedented exponential surge across all top keywords. Artificial intelligence experienced a massive explosion, climbing from 55 occurrences in 2018 to 574 in 2024, and ultimately peaking at 1,363 by 2026 to become the dominant core of the entire discipline. This technological acceleration synchronized perfectly with a dramatic increase in social and clinical outcomes, as well being surged to 656 occurrences and quality of life reached 554 by 2026. This parallel growth pattern indicates that modern research has evolved from separate disciplinary paths into a highly integrated, socio-technical research domain, where machine learning, mental health, and decision making are simultaneously deployed to analyze and govern global human welfare frameworks.

e. Emerging Frontiers and Thematic Evolution

An analysis of the trending topics from 2014 to 2025 reveals a profound structural shift in global research priorities, moving from localized social metrics to an advanced socio-technical paradigm. During the early baseline period between 2014 and 2020, the academic discourse focused primarily on health and social security frameworks. This era was characterized by the frequent appearance of specialized instruments such as community well-being, eq-5d, and health-related quality of life. The visual indicators for these early terms display modest bubble sizes and tight interquartile ranges, indicating that while these social and medical indicators

were foundational, their influence remained confined to traditional disciplinary boundaries before the integration of advanced digital tools.

Figure 13: Trending Topics



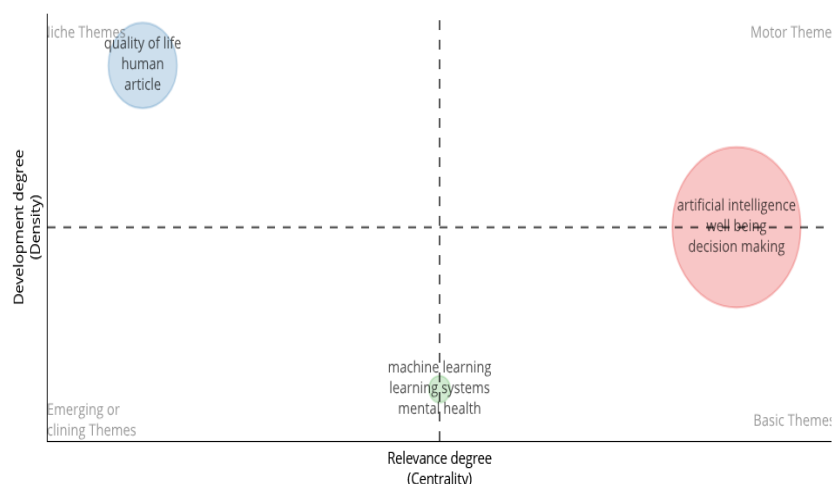
The thematic landscape transformed completely after 2022, characterized by the explosive, synchronized rise of machine learning and artificial intelligence alongside critical human-centric domains. Artificial intelligence commands the largest bubble size and a wide interquartile range across the 2024–2025 period, establishing itself as the dominant catalyst for contemporary scientific inquiry. Crucially, this technological surge did not displace social research but instead merged with it, as evidenced by the concurrent rise of substantial nodes for mental health, well-being, and loneliness. The contemporary coupling of automated intelligence with public administration and psychosocial indicators highlights an active research frontier dedicated to leveraging algorithmic frameworks to evaluate, understand, and govern human welfare in a digitized society.

9. Network Approach

a. Strategic Mapping and Thematic Coherence

A strategic mapping of the merged keyword network using the Louvain clustering algorithm provides an advanced, macroscopic layout of the field's intellectual architecture. By plotting the underlying thematic nodes across four separate quadrants based on their centrality and density metrics, the map successfully distinguishes between driving forces and peripheral specializations. The upper-right quadrant establishes the absolute motor themes of the domain, characterized by high centrality and high density, which represent well-developed, highly influential research tracks. This structural foundation is counterbalanced by specialized niche themes in the upper-left quadrant (low centrality, high density) and nascent or declining domains positioned in the lower quadrants, offering a comprehensive view of how technological integration interacts with institutional and human outcomes.

Figure 14: Thematic Map



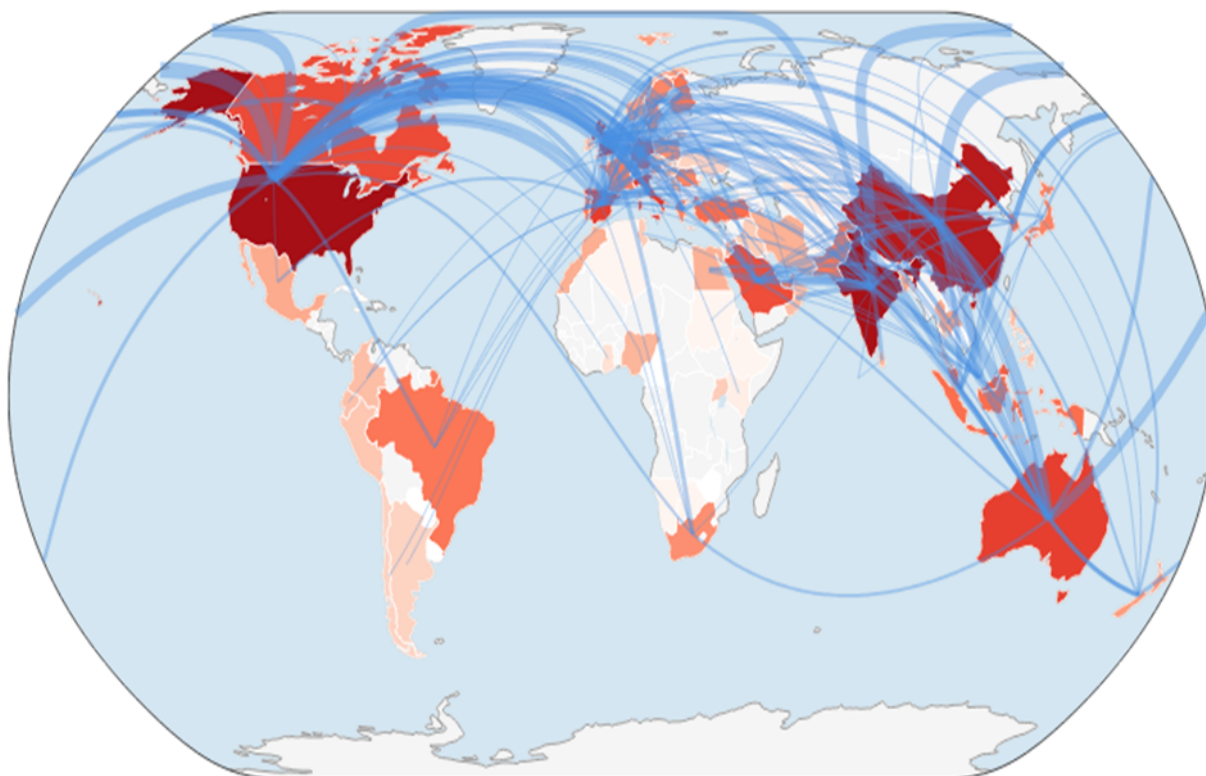
The empirical distribution of specific clusters reveals a dynamic and shifting research front. The core engine of contemporary scholarship is anchored by the cluster containing artificial intelligence, well being, and decision making, which operates as a highly developed motor theme that directly examines how algorithmic systems reshape public policy and human cognitive choices. Conversely, traditional social indicators focused on quality of life and human behavior as a specialized niche theme, maintaining rich internal development within sociomedical literature but remaining structurally isolated from broader digital breakthroughs. Finally, the cluster linking machine learning, learning systems, and mental health behaves as an emerging theme, signaling a growing but unintegrated research frontier that utilizes automated data processing to address clinical and psychosocial vulnerabilities within territorial governance.

b. Countries' Collaboration World Map

A network decomposition of the global cross-border partnership data reveals an interconnected, multi-polar research ecosystem led by dominant scientific hubs. The operational backbone of this international network is anchored by intense bilateral channels connecting the United States, China, and the United Kingdom. Specifically, the collaborative axis between the United States and China represents one of the highest frequencies in the dataset with 21 joint publications, followed closely by strong structural partnerships connecting the United States and Canada (15), the United Kingdom and the Netherlands (13), and the United Kingdom and Spain (12). This topology highlights a field where the core intellectual flow is driven by well-funded, highly integrated research corridors stretching across North America, East Asia, and Western Europe.

Beyond these high-density nodes, the network exhibits an extensive global outreach program that integrates diverse regional economies into the broader socio-technical discourse. Middle Eastern and Commonwealth nations act as critical bridges; this is exemplified by Saudi Arabia's active co-authorship channels with the United Kingdom (5) and Australia (3), alongside Australia's strong regional links to Singapore (5) and New Zealand (5). The presence of peripheral, single-frequency links extending to nations such as Algeria, Bangladesh, and Nigeria demonstrates that while the core structural capital remains concentrated within advanced Anglo-American and Asian research institutions, the practical implications of algorithmic public management and automated social indicators are actively expanding into emerging administrative systems worldwide.

Figure 15: World map of countries collaboration



10. Discussion

The structural lifecycle and temporal dynamics of the collected literature reveal a research field experiencing an intense, hyper-exponential expansion phase. As demonstrated by the logistic growth parameters, the domain exhibits substantial upward momentum, with its projected inflection point and peak annual output estimated to occur around 2033.1. This prolonged window before structural saturation provides fertile ground for immediate academic contributions, confirming that the current intellectual capital is actively expanding rather than stabilizing around fixed theoretical baselines. The post-2018 surge in publication frequency underscores an urgent global academic response to the rapid operational deployment of automated systems within institutional frameworks.

This explosive growth is characterized by a distinct multi-polar geographic concentration and divergent national research strategies. While Anglo-American and South Asian ecosystems, led by the United States and India, function as the primary volume engines of domestic production, East Asian nodes like China and Hong Kong command the central pipelines of specialized sustainability and technical literature. The structural dichotomy between large, self-sufficient national frameworks and highly integrated, cross-border collaborative models (exemplified by Hong Kong's and Malaysia's high multiple-country publication ratios) highlights a divided global approach. This variance suggests that while some administrative environments rely on internal research infrastructure, others actively leverage transnational networks to accelerate their socio-technical insights.

When evaluating scientific impact, the explicit decoupling of raw publication counts from citation density introduces a crucial qualitative shift in the global hierarchy. Although the

United States and India generate the highest absolute volume of documents, nodes such as Saudi Arabia and France register the highest citation efficiency, demonstrating a profound capacity to anchor the intellectual core with highly visible, authoritative frameworks. Microscopic tracking of individual manuscripts confirms this concentration, where a single landmark study commands the citation baseline, flanked by recent socio-technical, ethical, and urban governance papers. This distributed influence reflects a field that evaluates the validity of algorithmic public management not merely by the scale of its literature, but through targeted, cross-disciplinary conceptual benchmarks.

The lexical topography and temporal evolution of keywords map the transformation of the discipline from an isolated social welfare focus into an advanced computational paradigm. Over the last decade, early research priorities centered on traditional community metrics, clinical indicators, and health-related quality of life instruments have been systematically integrated into a massive visual and structural anchor dominated by artificial intelligence and machine learning. As highlighted by the strategic mapping, the intersection of automated intelligence, well-being, and decision-making now operates as the mature motor theme driving the entire domain. Meanwhile, applications linking learning systems directly to mental health behave as an active, emerging research front, reflecting an academic commitment to assessing how automated public administration reshapes psychological, spatial, and socioeconomic welfare indicators.

11. Conclusion

This comprehensive bibliometric investigation has successfully mapped the intellectual architecture, evolutionary trajectories, and collaborative networks defining the integration of artificial intelligence within public management and human welfare systems. By analyzing the structural lifecycle of the literary corpus, this study confirms that the domain is currently positioned on the accelerating left side of its growth curve, experiencing a high-momentum expansion phase that is projected to peak in the early 2030s. The findings establish that the discipline has transitioned from an early focus on traditional, isolated social indicators into an integrated, algorithmically driven socio-technical research domain.

The empirical analysis highlights a clear structural division in global knowledge production, characterized by distinct geographic hubs and collaborative strategies. The global distribution is driven by a powerful trio of scientific producers—the United States, India, and China—while the highest citation densities are anchored by highly efficient nodes like Saudi Arabia. Furthermore, the relational mapping reveals a clear split between large, self-contained national research ecosystems and smaller, globally integrated environments that rely heavily on cross-border partnerships to accelerate their scientific output.

Thematically, the conceptual core of the discipline has undergone a significant paradigm shift, with automated intelligence increasingly central to modern quality of life assessments. Strategic mapping confirms that the synthesis of computational mechanisms, cognitive decision-making, and subjective well-being now serves as the primary motor theme guiding contemporary academic discourse. Concurrently, the rise of specialized research tracking the ethical, psychological, and behavioral impacts of machine learning points to a critical, emerging front focused on safeguarding human vulnerability within automated administrative systems.

In terms of prospective trajectories, these patterns offer vital insights for future research, institutional design, and territorial governance models. As algorithmic frameworks increasingly manage the distribution of public resources and social indicators, the baseline established in this chapter underscores the urgent need for frameworks that balance advanced data processing with ethical accountability. Future scholarship must actively bridge the gap between technical

machine learning applications and human-centric design principles, ensuring that the ongoing digital transformation of public administration serves to enhance, rather than compromise, global societal welfare and human dignity.

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