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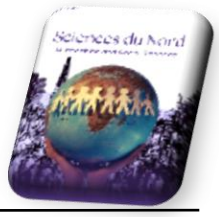

The Internet of Things (IoT) and the Transformation of Social Interaction: A Bibliometric Analysis

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ABSTRACT

This study explores the evolving relationship between the Internet of Things (IoT) and social interaction through a comprehensive bibliometric analysis. By examining indexed literature from the Scopus database, the research maps the intellectual structure, thematic trends, and global collaboration patterns in this interdisciplinary domain. Using VOSviewer for visualization, the study identifies core research themes—such as smart environments, artificial intelligence, emotion recognition, data privacy, and trust management—and reveals a transition from infrastructure-based studies to socially and cognitively oriented applications. The analysis highlights key authors, dominant publication clusters, and countries leading the field, with the United States, China, and India emerging as major contributors. Co-authorship and keyword co-occurrence networks show increasing emphasis on ethical, affective, and user-centric dimensions of IoT. Temporal and density analyses confirm a shift toward emerging concerns in healthcare, education, and social behavior. The findings emphasize the need for inclusive and socially responsive approaches in future IoT research and development, positioning IoT not only as a technological innovation but as a transformative force in shaping human relationships and communication.

Keywords: *Internet of Things (IoT); Social Interaction; Bibliometric Analysis; VOSviewer*

INTRODUCTION

The rapid development of the Internet of Things (IoT) has redefined not only how individuals interact with their environment but also how they communicate with each other. IoT refers to the networked interconnection of everyday objects embedded with computing devices that enable them to send and receive data [1]. From smart home devices and wearable technology to connected vehicles and industrial sensors, IoT has permeated virtually every sector of modern life. As these technologies become more accessible and ubiquitous, their social implications, particularly in the context of human interaction, are becoming increasingly significant. The shift from human-human interaction to human-device and device-mediated interaction has introduced new dynamics in both private and public communication spaces [2], [3].

Social interaction, traditionally bounded by spatial and temporal constraints, has been fundamentally altered by the pervasive connectivity that IoT offers. For example, smart devices in homes and workplaces facilitate real-time communication and coordination, even when individuals are physically distant. In public spaces, IoT create interactive infrastructures that mediate how citizens engage with each other and with institutions [4]. Wearable devices also encourage more personalized interactions by providing health or location-based information in real time, thereby shaping social behavior in novel ways. These innovations suggest that IoT is not only transforming the efficiency of systems but also reconstructing the very fabric of human relationships and social norms [5].

Moreover, the integration of IoT into daily life raises complex questions about privacy, autonomy, and the authenticity of interaction. For instance, the presence of smart surveillance in

urban areas may inhibit spontaneous social behaviors, while algorithmically curated interactions via IoT platforms can influence user perceptions and decision-making processes. These developments align with the broader theoretical discourse on mediated communication and technological determinism, where technology is seen as a driving force behind changes in human social structures [6]. Thus, IoT's impact on social interaction must be explored not only through technological metrics but also through sociological, ethical, and psychological lenses.

As the research field continues to expand, bibliometric methods provide a valuable tool to map the intellectual landscape of IoT and its relationship to social interaction. Bibliometric analysis allows scholars to systematically review and quantify existing literature, trace thematic evolution, and identify key authors, institutions, and conceptual clusters in the domain [7]. This is especially pertinent given the interdisciplinary nature of IoT, which encompasses engineering, computer science, sociology, communication studies, and more. Through such mapping, we can better understand how academic attention to the social dimensions of IoT has evolved, and where research gaps and emerging frontiers lie.

Despite growing interest, comprehensive analyses specifically addressing the intersection of IoT and social interaction remain limited. While numerous studies have explored IoT from a technological or industrial perspective, fewer have systematically examined how this technology reshapes interpersonal communication, social norms, and collective behaviors. Understanding these dynamics is critical not only for academic inquiry but also for policymakers, designers, and technologists seeking to build human-centered and socially responsible IoT systems. A bibliometric review can help bridge this gap by highlighting dominant research trends, influential publications, and thematic concentrations, thereby laying the groundwork for future studies.

Although the Internet of Things has emerged as a transformative technological paradigm, the academic exploration of its effects on social interaction remains fragmented and underrepresented in the broader scholarly discourse. Existing research tends to prioritize technical implementation, infrastructure, and efficiency, while the nuanced social consequences of pervasive IoT integration such as changes in interpersonal communication, social trust, and human agency are often overlooked or addressed in isolated studies. This lack of synthesis makes it difficult to capture the holistic impact of IoT on the evolving patterns of human interaction, impeding both theoretical advancement and the development of socially informed IoT applications. This study aims to conduct a bibliometric analysis of scholarly literature at the intersection of the Internet of Things (IoT) and social interaction to uncover key research trends, influential authors and publications, conceptual hotspots, and potential research gaps.

METHOD

This study adopts a bibliometric analysis approach to systematically explore the academic literature concerning the relationship between the Internet of Things (IoT) and social interaction. Bibliometric methods are widely used to evaluate scientific output, map research trends, and identify intellectual structures within a particular field [7]. The methodology is designed to ensure transparency, reproducibility, and analytical rigor. The main steps in the methodology are outlined below.

Data Source Selection

The bibliographic data for this study were retrieved from the Scopus database, recognized for its broad coverage of peer-reviewed academic journals across various disciplines including computer science, engineering, and social sciences. Scopus was selected over other databases (e.g., Web of Science, Google Scholar) due to its structured metadata, comprehensive indexing, and compatibility with bibliometric software tools [8].

Search Strategy and Query Design

To ensure the relevance and comprehensiveness of the dataset, a carefully constructed search query was formulated using a combination of keywords related to the Internet of Things and social interaction. The search was conducted using the TITLE-ABS-KEY field in Scopus, covering the article title, abstract, and keywords. The query used was: (TITLE-ABS-KEY("Internet of Things" OR "IoT")) AND (TITLE-ABS-KEY("social interaction" OR "interpersonal communication" OR "social behavior" OR "human interaction")). The search was limited to journal articles, conference papers, and reviews published in English. No restriction was applied to the publication year in order to capture the historical evolution of the topic. The data collection was performed in May 2025, and the final dataset consisted of 750 documents.

Data Extraction and Preprocessing

The full bibliographic records, including authors, titles, abstracts, keywords, source titles, publication years, countries, affiliations, and citations, were exported in CSV and RIS formats. Data preprocessing involved removing duplicates, filtering non-relevant record based on abstract screening, standardizing author names and keywords for consistency, and verifying subject area by manual inspection of titles or abstracts. These steps ensured the dataset represented valid and coherent literature at the intersection of IoT and social interaction.

Bibliometric Analysis Tools

The analysis was conducted using VOSviewer (version 1.6.xx), a widely used software tool for building and visualizing bibliometric networks [9]. The bibliometric maps generated through VOSviewer used the full counting method, and minimum thresholds for inclusion were set (e.g., minimum number of documents per author = 2, minimum keyword occurrences = 5) to maintain clarity in the visualization outputs.

RESULT

Keyword Co-Occurrence Analysis

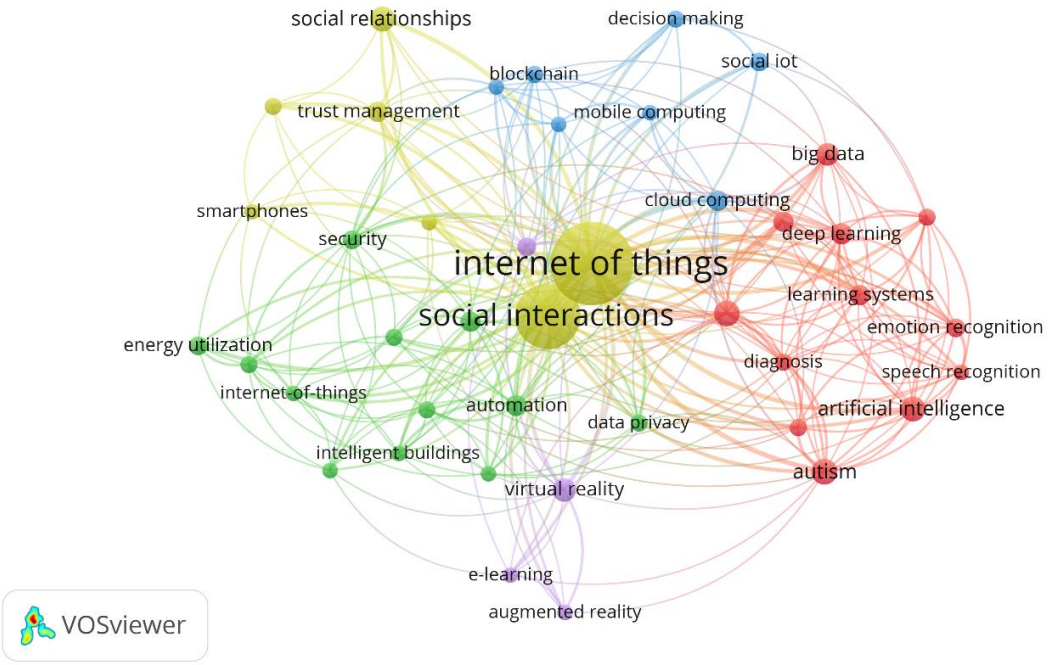

Figure 1. Network Visualization
Source: Data Analysis

The visualization presents a keyword co-occurrence map based on bibliometric data related to the intersection of Internet of Things (IoT) and social interactions. The size of the nodes represents

the frequency of keyword appearances, while the proximity and thickness of connecting lines indicate the strength of co-occurrence relationships. The central nodes like "internet of things" and "social interactions" are the most dominant terms, forming the core around which other clusters are organized. This centrality signifies that these topics are the conceptual hub of the research field and frequently co-occur with a wide range of other themes across disciplines. The network is divided into several thematic clusters, each represented by a different color. The green cluster to the left includes keywords like smartphones, security, energy utilization, and intelligent buildings, indicating research that focuses on IoT infrastructure, smart environments, and physical connectivity tools. These studies appear to explore how IoT technologies mediate human interaction through devices and built environments. This cluster represents a more applied and engineering-oriented dimension of the IoT-social interaction nexus.

The red cluster on the right connects IoT to artificial intelligence, deep learning, big data, emotion recognition, and autism. This group highlights a growing research interest in how IoT devices integrated with AI are used in cognitive and emotional analysis, healthcare diagnostics, and assistive technologies. The inclusion of “autism” suggests a focus on therapeutic or educational applications of IoT in supporting individuals with special needs, reflecting the social dimension of IoT in enhancing interaction capabilities for specific populations. Another notable group is the blue cluster, which revolves around terms such as blockchain, mobile computing, decision-making, and social IoT. This cluster reflects an emerging discourse on the ethical, secure, and decentralized aspects of IoT-supported interactions. The integration of blockchain and decision-making technologies suggests a push toward more autonomous, transparent, and privacy-respecting systems. Meanwhile, the yellow cluster, with keywords like social relationships and trust management, underscores the importance of affective and relational aspects of IoT-mediated communication.

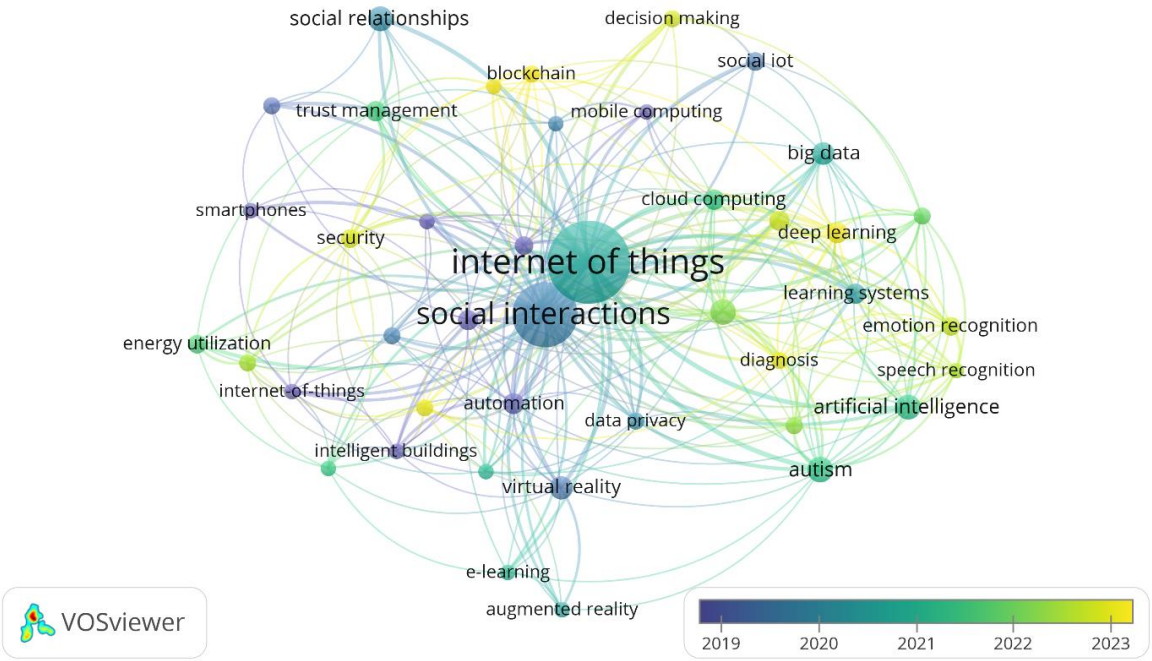

Figure 2. Overlay Visualization
Source: Data Analysis

The overlay visualization illustrates the temporal evolution of research keywords associated with Internet of Things (IoT) and social interactions between 2019 and 2023. The color gradient, ranging from purple (older) to yellow (more recent), represents the average publication year of documents linked to each keyword. The central terms “internet of things” and “social interactions”

are shown in a teal hue, indicating that they have been consistently discussed throughout the observed time frame. This reinforces their role as foundational concepts in the domain. Emerging research topics are clearly reflected in yellow and green-colored nodes, which indicate more recent scholarly interest. Keywords such as blockchain, decision-making, deep learning, emotion recognition, and learning systems are among the newer focal points, reflecting a shift toward integrating intelligent decision support systems and affective computing within IoT frameworks. The presence of autism, diagnosis, and speech recognition also suggests an increasing focus on health and assistive applications of IoT technologies, particularly in personalized and socially meaningful contexts. In contrast, keywords with darker hues, such as security, smartphones, e-learning, and intelligent buildings, represent earlier areas of IoT-social interaction research. These topics formed the technological backbone of early IoT implementations, emphasizing hardware infrastructure and basic user connectivity. The temporal mapping thus reveals an important trajectory: research is transitioning from infrastructure-oriented themes to more advanced, socially and cognitively engaged applications.

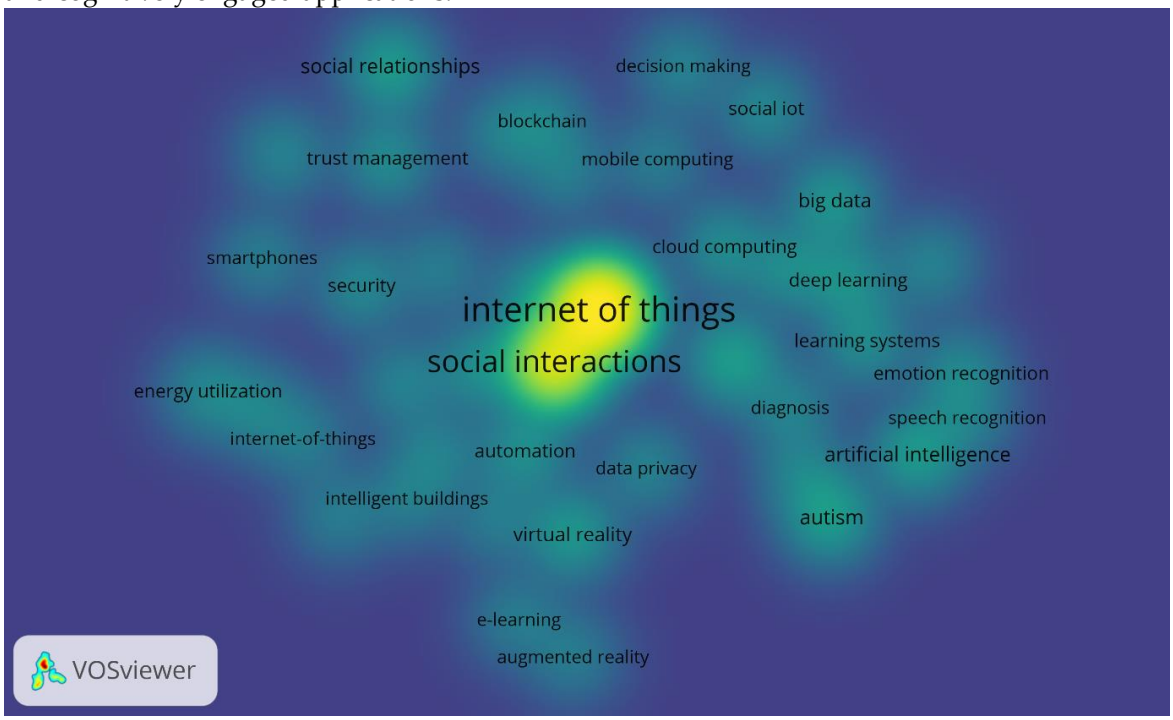

Figure 3. Density Visualization
Source: Data Analysis

The heatmap visualization highlights the density of keyword occurrences and co-occurrences within the research field connecting the Internet of Things (IoT) and social interactions. The central yellow zone—occupied by the terms "internet of things" and "social interactions"—indicates the highest frequency and strongest linkage across the literature, confirming their status as the primary thematic core. Surrounding this central hub, terms like cloud computing, automation, data privacy, and artificial intelligence form moderate-density regions (green areas), representing well-established but slightly less central themes in the scholarly discourse. In the peripheral areas, keywords such as augmented reality, e-learning, energy utilization, and social IoT appear in cooler tones (blue to green), signaling lower levels of research intensity or more niche contributions within the overall field. Despite their relatively lower frequency, these terms still play an important role in defining the interdisciplinary nature of IoT research, particularly in specialized applications like smart education, energy systems, and immersive technologies.

Co-Authorship Analysis

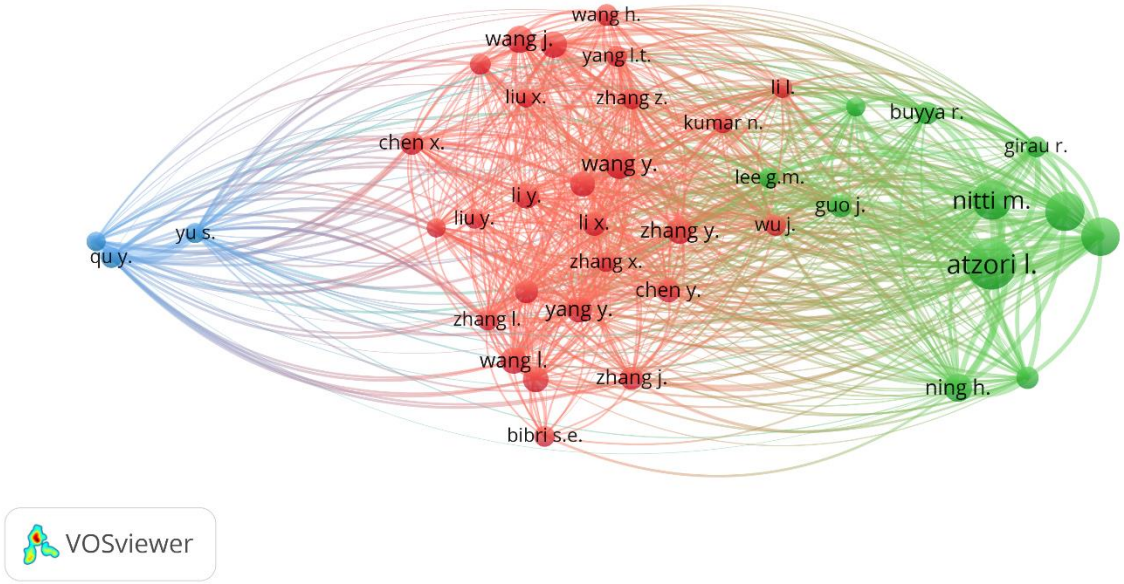

Figure 4. Author Visualization
Source: Data Analysis

The co-authorship network visualization highlights the collaborative structure among prolific researchers in the field of the Internet of Things (IoT) and social interactions. The graph is divided into three major clusters, each represented by a distinct color, green, red, and blue indicating closely linked communities of authors based on co-authorship strength. The green cluster, led by prominent figures such as Atzori I., Nitti M., and Ning H., suggests a core group of foundational IoT researchers who have extensive collaboration within and across institutions, likely contributing significantly to the theoretical and architectural development of IoT systems. The red cluster features densely interconnected scholars like Zhang Y., Wang Y., and Li X., indicating a highly collaborative Asian research group focused on technical implementations, applied systems, and social computing. The blue cluster, although smaller, includes Qu Y. and Yu S., who are more peripheral but still contribute through cross-cluster collaborations.

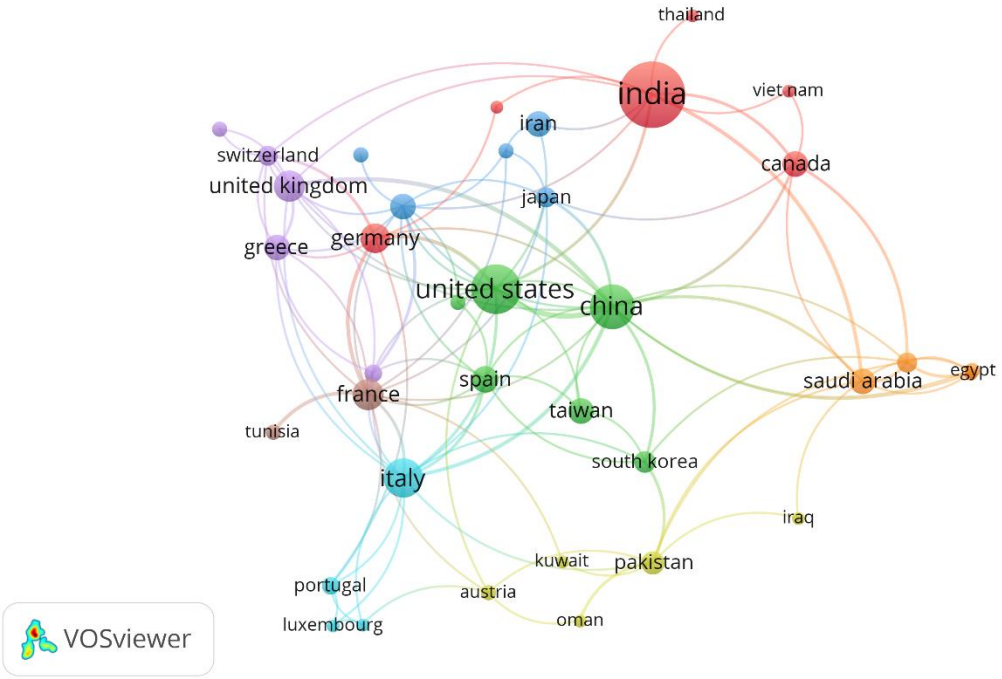

Figure 4. Country Visualization
Source: Data Analysis

The country collaboration network map visualizes international co-authorship patterns in the field of IoT and social interaction research. The United States, China, and India emerge as the most prominent nodes, indicating their central role and high publication volume in this domain. These countries also exhibit strong bilateral and multilateral ties, particularly with nations like the United Kingdom, Germany, Italy, and Saudi Arabia, suggesting active global research partnerships. The color-coded clusters represent regional or linguistic collaboration blocs: for example, European countries like France, Germany, and Switzerland cluster together, while Middle Eastern nations form a distinct group led by Saudi Arabia and Egypt. The thickness of the connecting lines reflects the frequency and strength of joint publications, showing that transnational cooperation is vibrant, particularly among technologically advanced and emerging economies.

Citation Analysis

Table 1. Most Cited Article

Citations	Author and Year	Title
261	[10]	THE INTERNET OF THINGS : AN OVERVIEW Understanding the Issues and Challenges of a More Connected World
156	[11]	Artificial Intelligence: A European Perspective
101	[12]	BIM+Blockchain: A Solution to the Trust Problem in Collaboration?
99	[13]	Metaverse and Virtual Health Care in Ophthalmology: Opportunities and Challenges
77	[14]	Integration of social and IoT technologies: architectural framework for digital transformation and cyber security challenges
63	[15]	Digital Twin: Empowering Enterprises Towards a System-of-Systems Approach
58	[16]	Internationalization and Digitalization: Applying digital technologies to the internationalization process of small and medium-sized enterprises

58	[17]	Social Media and the Internet of Things towards Data-Driven Policymaking in the Arab World: Potential, Limits and Concerns
46	[18]	Towards the Internet of Services: The THESEUS Research Program
45	[19]	Transformation of insurance technologies in the context of a pandemic

Source: Scopus, 2025

DISCUSSION

Thematic Concentration and Conceptual Clusters

The keyword co-occurrence network revealed several distinct yet interconnected thematic clusters. At the core of the literature lie the foundational concepts of "Internet of Things" and "social interactions," which serve as anchoring points for various subdomains. One major cluster focused on infrastructural technologies such as smartphones, intelligent buildings, energy utilization, and security. These topics reflect early-stage research exploring how IoT is embedded in everyday environments and devices to support human connectivity and social coordination. A second, increasingly dominant cluster revolves around artificial intelligence, deep learning, emotion recognition, and speech recognition. This group represents a shift toward cognitive technologies and affective computing, where IoT is leveraged to interpret, respond to, or even simulate human emotions and behavior. Notably, keywords like autism and diagnosis in this cluster suggest emerging applications of IoT in assistive and healthcare contexts, emphasizing its social utility beyond productivity or automation [20], [21]. This aligns with the broader societal turn in technology studies, where the human experience is increasingly central to innovation narratives. A third notable cluster comprises conceptual and ethical elements such as trust management, social relationships, and data privacy. This points to a growing recognition that technological systems must be evaluated in terms of their impact on social trust, human agency, and privacy norms. As IoT devices become increasingly autonomous and embedded, they mediate not only actions but also values, prompting critical inquiry into how social norms are reconfigured in technologically dense environments [22].

Temporal Evolution of Research Themes

The overlay visualization reveals a significant temporal trend in the evolution of the literature. Early research, primarily from 2019–2020, focused on foundational issues such as security, smartphones, intelligent buildings, and virtual reality. These topics reflect the technological underpinnings necessary for IoT-enabled environments to support human interaction. As the field matured, attention shifted toward more nuanced and socially complex topics, including deep learning, emotion recognition, learning systems, and decision-making, which peaked in frequency around 2021–2023. This progression illustrates a clear shift from hardware and connectivity to cognition, perception, and ethics, suggesting that researchers are increasingly concerned with how IoT affects not only what people do but also how they feel, decide, and relate to others. For instance, the rise of emotion-aware systems and learning algorithms demonstrates a turn toward designing IoT systems that are socially intelligent and contextually aware. These findings are consistent with literature indicating that next-generation IoT is moving beyond automation toward augmentation of human social functions [23]. Furthermore, the emergence of blockchain, social IoT, and trust management as recent topics suggests growing attention to decentralized, secure, and socially responsible IoT infrastructures. This indicates that privacy-preserving and user-empowering architectures are becoming central to contemporary discourse, in part due to rising concerns over data surveillance and algorithmic manipulation in smart environments [24].

Research Density and Emerging Frontiers

The heatmap visualization confirms that the densest research activity is concentrated around the central themes of IoT and social interactions, surrounded by second-tier themes such as automation, data privacy, artificial intelligence, and cloud computing. However, the peripheral

zones, while less dense, signal emerging frontiers that merit further exploration. For example, the lower density of terms like augmented reality, e-learning, and autism suggests they are still underdeveloped yet potentially high-impact domains. These areas could serve as future avenues for innovation, especially in educational and therapeutic applications of IoT. Notably, the relatively modest focus on social relationships in the heatmap and co-occurrence network implies a gap in research on the qualitative dimensions of interaction, such as intimacy, empathy, and collective identity in IoT-mediated settings. Most current research still centers on the functional or utilitarian aspects of IoT rather than its impact on the fabric of social life. Future studies could benefit from incorporating perspectives from sociology, anthropology, and psychology to better understand these dimensions.

Authorship Networks and Intellectual Influence

The co-authorship network analysis sheds light on the collaborative patterns and intellectual leadership in the field. The network is divided into three major clusters. The green cluster, led by scholars such as Atzori I., Nitti M., and Ning H., appears to represent a theoretically grounded group working on the foundational concepts and architecture of IoT. These scholars are frequently cited and have formed the intellectual core of the field. The red cluster, consisting of densely connected authors like Zhang Y., Wang Y., and Li X., reflects a highly productive and collaborative network of primarily Asian scholars. Their work appears to be focused on applied systems, technical optimization, and algorithmic implementation of IoT technologies. The density of internal connections in this group indicates strong intra-regional collaboration and co-authorship practices, which contribute significantly to the field's technical advancement. Meanwhile, the blue cluster, though smaller, includes influential contributors such as Qu Y. and Yu S., who appear more peripheral yet still maintain strong inter-group connections. These bridging scholars are crucial for cross-pollination of ideas across technical and theoretical domains. The overall structure of the co-authorship network confirms that the field is both globally distributed and intellectually interconnected, though certain regions and groups remain more dominant in publication and influence.

Geographic Patterns of Collaboration

The country collaboration map reveals a highly globalized research field. The United States, China, and India are the three most prominent contributors, forming the backbone of international collaboration in this area. These countries have strong bilateral ties, particularly between the United States and China, and between India and the Middle East. Their high centrality is consistent with their research infrastructure, technological investment, and population-driven demand for IoT solutions. European countries such as the United Kingdom, Germany, France, and Italy—form a tight collaborative cluster, suggesting active intra-European research partnerships and contributions from the EU's digital innovation agenda. Interestingly, countries in the Middle East (e.g., Saudi Arabia, Egypt) and Southeast Asia (e.g., Thailand, Vietnam) also appear as emerging contributors, likely reflecting national investments in smart city and digital infrastructure projects. The geographic diversity of the collaboration map underscores the transnational relevance of IoT in shaping social life across different contexts, cultures, and policy regimes. However, the map also reveals asymmetries: developing countries are underrepresented, suggesting the need for more inclusive research networks and capacity-building initiatives to ensure equitable participation in IoT innovation and policymaking.

CONCLUSION

This study has demonstrated that research at the intersection of the Internet of Things (IoT) and social interaction is rapidly evolving into a rich, interdisciplinary field. Through bibliometric analysis, it is evident that scholarly attention has shifted from foundational infrastructure and connectivity issues toward more complex themes such as artificial intelligence, emotion recognition,

privacy, and human-centered applications. The central role of concepts like "social interaction" and "IoT" confirms their foundational status, while the emergence of newer topics like autism, trust management, and blockchain suggests expanding interest in the ethical and relational dimensions of IoT-mediated communication. The collaboration networks among authors and countries reveal both concentrated centers of influence and a growing global engagement, although notable disparities remain in geographic representation.

REFERENCES

[1] M. H. Asghar, G. Kumar, dan M. K. Patra, "Societal change and transformation by Internet of Things (IoT)," *Comput. Sci. J.*, vol. 7, no. 2, hal. 18–24, 2015.

[2] G. Z. Karimova dan A. Shirkhanbeik, "Society of things: An alternative vision of Internet of things," *Cogent Soc. Sci.*, vol. 1, no. 1, hal. 1115654, 2015.

[3] L. Atzori, A. Iera, G. Morabito, dan M. Nitti, "The social internet of things (siot)–when social networks meet the internet of things: Concept, architecture and network characterization," *Comput. networks*, vol. 56, no. 16, hal. 3594–3608, 2012.

[4] J. Abed, "Digital technology in changing social relations—the social internet of things: developing a new method for leveraging the friendships between IoT devices," in *DIGITAL STRATEGIES AND ORGANIZATIONAL TRANSFORMATION*, World Scientific, 2023, hal. 151–178.

[5] B. Gulzar, S. A. Sofi, dan S. Sholla, "Exploring personalized internet of things (PIoT), social connectivity, and artificial social intelligence (ASI): a survey," *High-Confidence Comput.*, hal. 100242, 2024.

[6] M. Malekshahi Rad, A. M. Rahmani, A. Sahafi, dan N. Nasih Qader, "Social Internet of Things: vision, challenges, and trends," *Human-centric Comput. Inf. Sci.*, vol. 10, no. 1, hal. 52, 2020.

[7] N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, dan W. M. Lim, "How to conduct a bibliometric analysis: An overview and guidelines," *J. Bus. Res.*, vol. 133, hal. 285–296, 2021.

[8] I. Zupic dan T. Čater, "Bibliometric methods in management and organization," *Organ. Res. methods*, vol. 18, no. 3, hal. 429–472, 2015.

[9] N. Van Eck dan L. Waltman, "Software survey: VOSviewer, a computer program for bibliometric mapping," *Scientometrics*, vol. 84, no. 2, hal. 523–538, 2010.

[10] K. Rose, S. Eldridge, dan L. Chapin, "The internet of things: An overview," *internet Soc.*, vol. 80, no. 15, hal. 1–53, 2015.

[11] A. Annoni *et al.*, "Artificial intelligence: A european perspective," Joint Research Centre, 2018.

[12] M. Mathews, D. Robles, dan B. Bowe, "BIM+ blockchain: A solution to the trust problem in collaboration?," 2017.

[13] T. F. Tan *et al.*, "Metaverse and virtual health care in ophthalmology: Opportunities and challenges," *Asia-Pacific J. Ophthalmol.*, vol. 11, no. 3, hal. 237–246, 2022.

[14] S. Mendhurwar dan R. Mishra, "Integration of social and IoT technologies: architectural framework for digital transformation and cyber security challenges," *Enterp. Inf. Syst.*, vol. 15, no. 4, hal. 565–584, 2021.

[15] M. Dietz dan G. Pernul, "Digital twin: Empowering enterprises towards a system-of-systems approach," *Bus. Inf. Syst. Eng.*, vol. 62, hal. 179–184, 2020.

[16] A. Hervé, C. Schmitt, dan R. Baldegger, "Internationalization and Digitalization: Applying digital technologies to the internationalization process of small and medium-sized enterprises," *Technol. Innov. Manag. Rev.*, 2021.

[17] F. Salem, "Social Media and the Internet of Things: Towards Data-Driven Policymaking in the Arab World: Potential, Limits and Concerns," *Arab Soc. Media Report, Dubai MBR Sch. Gov.*, vol. 7, 2017.

[18] W. Wahlster, H.-J. Grallert, S. Wess, H. Friedrich, dan T. Widenka, *Towards the internet of services: The THESEUS research program*. Springer, 2014.

[19] S. Volosovych, I. Zelenitsa, D. Kondratenko, W. Szymla, dan R. Mamchur, "Transformation of insurance technologies in the context of a pandemic," *Insur. Mark. Co.*, vol. 12, no. 1, hal. 1–13, 2021.

[20] O. Vermesan dan J. Bacquet, *Cognitive Hyperconnected Digital Transformation: Internet of Things Intelligence Evolution*. CRC Press, 2022.

[21] N. Ahmad dan A. M. Zulkifli, "Internet of Things (IoT) and the road to happiness," *Digit. Transform. Soc.*, vol. 1, no. 1, hal. 66–94, 2022.

[22] H. Ning dan H. Liu, "Cyber-physical-social-thinking space based science and technology framework for the Internet of Things," *Sci. China. Inf. Sci.*, vol. 58, no. 3, hal. 1–19, 2015.

[23] W. H. Dutton, "Putting things to work: Social and policy challenges for the Internet of things," *info*, vol. 16, no. 3, hal. 1–21, 2014.

[24] J. P. Shim, M. Avital, A. R. Dennis, M. Rossi, C. Sørensen, dan A. French, "The transformative effect of the internet of things on business and society," *Commun. Assoc. Inf. Syst.*, vol. 44, no. 1, hal. 129–140, 2019.