

Artificial Intelligence in Urban Planning: Co-Word Analysis for Emerging Topics

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Abstract

Artificial intelligence (AI) has become a discussed topic across various disciplines. In this context, studies focusing on AI in urban and regional planning come to the fore. The aim of this study is to identify the research trends related to AI in urban planning with its integration. The research is guided by three questions: i. What are the prevailing themes of AI in urban planning? ii. How does AI integrate into these themes? and iii. When do these themes become prominent? For this purpose, the study conducts a bibliometric analysis approach, specifically co-word analysis, to reveal trends and forecast areas in the field of social science and environmental science. The study analyzes all open access publications retrieved from SCOPUS database between 2000 and 2024. The main themes that emerged from the analysis are machine learning, smart cities and decision support systems, while sub-themes are deep learning, neural network, computer vision, sustainability, resilience and climate change. As a result, this study provides a comprehensive overview of the topics by identifying prevailing themes, how integrated AI in urban planning, temporal trends, and emerging key areas for future research.

1.0 INTRODUCTION

The integration of artificial intelligence (AI) into urban planning during the information and communication era has become more prominent due to the increasing complex challenges of cities. The notion of AI can be dated back to 1956, when The Dartmouth Summer Research Project on Artificial Intelligence was initiated (McCarthy et al., 2006). In parallel to this, urban planning researchers try to integrate AI methods in urban planning in 1960s, though with limited success in terms of efficiency. However, the implementation of AI-based applications in urban planning starts a new era in planning history for the first time with risks and opportunities (Cugurullo et al., 2023). Today, global institutions such as United Nations Development Program (UNDP), UN-HABITAT, and UNESCO put AI on their agendas to achieve inclusive and sustainable urban development. UNDP emphasizes that AI can be an accelerator for the Sustainable Development Goals (SDGs) if it can be designed responsibly and equitably and can play a supportive role to establish an inclusive AI system for both people and all the world (UNDP, n.d.). The AI systems such as data analytics, modelling, Internet of Things (IoT), and decision support systems (DSS) have potential to solve social, economic, and environmental problems about energy, water and waste management, urban planning and governance in cities (HABITAT, 2020). UNDP also works to ensure that all countries have the capacity to participate in shaping and harnessing the transformative potential of AI (UNDP, n.d.). On the other hand, UNESCO and UNDP discuss the ethical dimension (Hamdar et al., 2023; UNESCO, 2021). UNESCO highlights ethics for AI in terms of respect to people, environmental sustainability and cultural diversity. It includes human rights, non-discrimination, fairness, data privacy and protection, ethical governance and regulation (UNESCO, 2021). In urban planning literature, potential ethical challenges of AI cover bias, transparency, accountability, privacy and misinformation (Du et al., 2024; Sanchez et al., 2024).

AI is mainly defined as the theory and creation of computer systems performing tasks that require human intelligence. In recent years, AI becomes more significant to transform and reshape the field of urban planning (Peng et al., 2023; Sanchez et al., 2023). AI technologies include algorithms, robotics, drones, autonomous vehicles and autonomous systems, augmented reality, automation, big data, biometrics, block chain, deep learning (DL) platforms, digital twins, machine learning (ML) platforms, natural language generation and virtual agents (Caprotti et al., 2024; Cearley et al., 2017).

IBM evaluates AI by matching human capabilities such as discovering, inferring and reasoning. ML is a subset within AI basically is capability of predictions or decisions based on data. DL is further subset within ML is scalable ML that automates IoT of feature extraction process away and eliminates for usable data set. DL refers to the depth of layers in a neural network which is the backbone of DL algorithms (IBM, 2023). Burry (2022) highlights additionally AI-related technologies such as neural networks, IoT, pattern recognition and image analysis that are changing traditional workflows of urban planning (Burry, 2022) with advanced methods such as Geographic Information System (GIS) that is the most notable, database management systems (DBMS), decision support systems (DSS), planning support systems (PSS), and expert systems (ES) (Kontokosta, 2018).

In the literature, AI is discussed in urban planning (Burry, 2022; Korada, 2021; Sanchez et al., 2023) within the context of AI-based methods, applications or tools (S. Allam, 2018; Kimm, 2022; Mehmood et al., 2019; Odongo & Ma, 2021; Tekouabou et al., 2022), sustainability (Leal Filho et al., 2024; Tekouabou et al., 2022) and smart city (Z. Allam & Dhunny, 2019; Benini et al., 2024; A. Gupta et al., 2022; Yigitcanlar & Cugurullo, 2020), public safety (Rajitha, 2021; Yigitcanlar, Desouza, et al., 2020), healthcare services (Wang et al., 2021; Zeng et al., 2020; Zhao et al., 2022), urban infrastructure and management (Caprotti et al., 2024; Totara, 2022), traffic management or transport planning (Burry, 2022; Cugurullo et al., 2021, 2023; McCarroll & Cugurullo, 2022; Stone et al., 2016), smart waste management (P. K. Gupta et al., 2019), urban robotics (While et al., 2021), smart electricity storage grids (Cirella et al., 2021), and IoT security, which is context-aware security data analysis based on smart cameras (Zhang et al., 2021), citizen participation (Mager & Hein, 2020), and ethical frameworks (Bartneck et al., 2021; Floridi et al., 2018; Hajrasouliha, 2023).

Besides that; AI, information technologies, computer vision and robotics are becoming remarkable for architecture and urban planning for more sustainable, engaging, accessible, efficient and responsive environments that offer to facilitate interactions, provide information and ensure safety for all users (Hanna & Parvaresh, 2024). AI-based data collection devices such as sensors, cameras, drones and social media provide big data resources (Peng et al., 2023). In all these developments, AI tools and techniques act as catalysts for inclusive and sustainable urban development with applications, software, and technological systems based on intelligent systems, algorithms, and generative design systems (Ghisleni, 2024; Leal Filho et al., 2024; Yigitcanlar & Cugurullo, 2020).

The emergence of AI is a transformative tool for novel ways to research or analysis methods, visualize, plan, and develop urban landscapes. In this context, new concepts such as Urban Artificial Intelligence (Urban AI), AI urbanism and Generative Artificial Intelligence (Gen-AI) have emerged. Popular AI tools based on ML and DL models and the concepts ChatGPT and DALL-E are used in urban planning practices.

The concept of Urban AI includes robots, autonomous vehicles, city brains and software agents used for best solutions or urban decision-making (Beroche, 2021; Cugurullo, 2020). The integration of urban AI in urban life, governance, and urban planning has formed a new term: AI urbanism that encompasses smart and eco urbanism (Cugurullo et al., 2023; Palmi & Cugurullo, 2024). Another term is Gen-AI, relies on DL models to simulate human brain to respond to users' questions with original content such as text, image, video, audio or software code. It became popular with ChatGPT in 2022 (IBM, 2024). Urban planners and designers use ChatGPT-like models for data processing, creative content generation, decision-making support, increased public engagement, and improved educational opportunities (Jiang et al., 2025), coding process (Çobanlı & Kahraman, 2025), making maps and designing mental maps (Tao & Xu, 2023). ChatGPT is one of the GEN-AI models that has potential for data filtration, mitigation of bias, integration with complementary AI technology for holistic functions, and real-time updates. However, they also include issues of data privacy, the mitigation of algorithmic bias, and the assurance of technical feasibility (Jiang et al., 2025).

DALL-E is an image creation tool that has significant potential as a transformer-based text-to-image model for generating realistic images and scenes, re-imagining any places particularly in environment-related disciplines such as urban planning and design. The evaluated model can generate images related to urban scenes, such as natural real-world scenes, abstract representations, realistic renders in relevant format domains such as SketchUp, architectural models, and Minecraft (Littlefield, 2022; Seneviratne et al., 2022).

As a result, despite all these advancements, the network of the prevailing themes related with AI and urban planning is unclear. There are several studies focus on concepts, prospects, approaches or technologies of AI in urban planning (İ. As et al., 2022; Feng & Xu, 1999; Othengrafen et al., 2025; Sanchez et al., 2023; Yigitcanlar, Kankanamge, et al., 2020), reviews or systematic surveys to analyze literature of AI (He & Chen, 2024; Szpilko et al., 2023; Tekouabou et al., 2022; Yigitcanlar, 2025).

This study goes beyond the themes such as smart city and sustainability, that are often discussed in the literature and explains what additional prominent themes related to AI and urban planning and how they are integrated in planning processes. This article aims to fill the gap in the literature with providing a comprehensive overview and identifying the prevailing themes and trends through co-word analysis of the topics AI and urban planning processes. The study is guided by the following research questions: i. What are the prevailing themes of AI in urban planning? ii. How does AI integrate into these themes? and iii. When do these themes become prominent? To answer the questions, the study conducts bibliometric analysis of the literature between 2000 to 2024. The other sections include methodology, key findings and discussion. The study concludes with answering research questions, identifying research gaps and suggesting directions for future studies.

2.0 METHODOLOGY

This study aims to investigate the conceptual relationship and trends between AI and urban planning with bibliometric analysis, co-word analysis and VOSviewer for visualization software. In this framework, the methodology is structured on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) method, a systematic review approach, to analyze literature from scientific databases. It is used in bibliometric analysis for systematically filter and grouping a large volume of publications. It involves three stages: identification, screening & eligibility and inclusion (Page et al., 2021). PRISMA is selected because of providing structured and transparent approach to inclusion and exclusion criteria.

The first phase includes identifying academic databases, defining search queries and timespan. The second step involves inclusion or exclusion filtering criteria to have clear list of publications. Finally, the third phase consists of all included publications for answering research questions.

2.1 Data Collection with PRISMA Method

Firstly, this study focuses on SCOPUS database from 2000 to 2024. The search query is “artificial intelligence”, “AI” and “urban planning”. In the search query, the Boolean operators (“AND” and “OR”) used. The operator “AND” is used to retrieve results that contain all of the selected keywords, while “OR” is to retrieve results that contain any of the two keywords. Thus, the query is in SCOPUS as: *TITLE-ABS-KEY (“artificial intelligence” OR “AI”) and (“urban planning”)*). There are 1250 publications in first step.

The exclusion criteria are determined in the second step. The publications are excluded by subject area (engineering, computer science, medicine, energy, etc.), document type (reviews, books) and language (non-English). The study scope covers articles, conference papers and book chapters in English with a focus on social and environmental sciences (Table 1).

Table 1. Dataset Criteria.

Criterion	Inclusion Criterion
Database	SCOPUS
Keywords	(“artificial intelligence” OR “AI”) AND (“urban planning”)
Search within	Article title, Abstract, Keywords
Subject area	Social Science and Environmental Science
Timespan	2000-2024
Document Type	Journal articles, conference papers, book chapters
Language	English
Open Access	All open access
Searching Date	15/12/2024

Although AI-related studies are common in engineering and computer science, this study focuses on urban planning that is covered by social sciences and environmental sciences. After filtration, 409 publications are selected. Last step is related with all publications for analysis to answer the research questions. When all open access publications are selected, there are retrieved 152 publications (Figure 1).

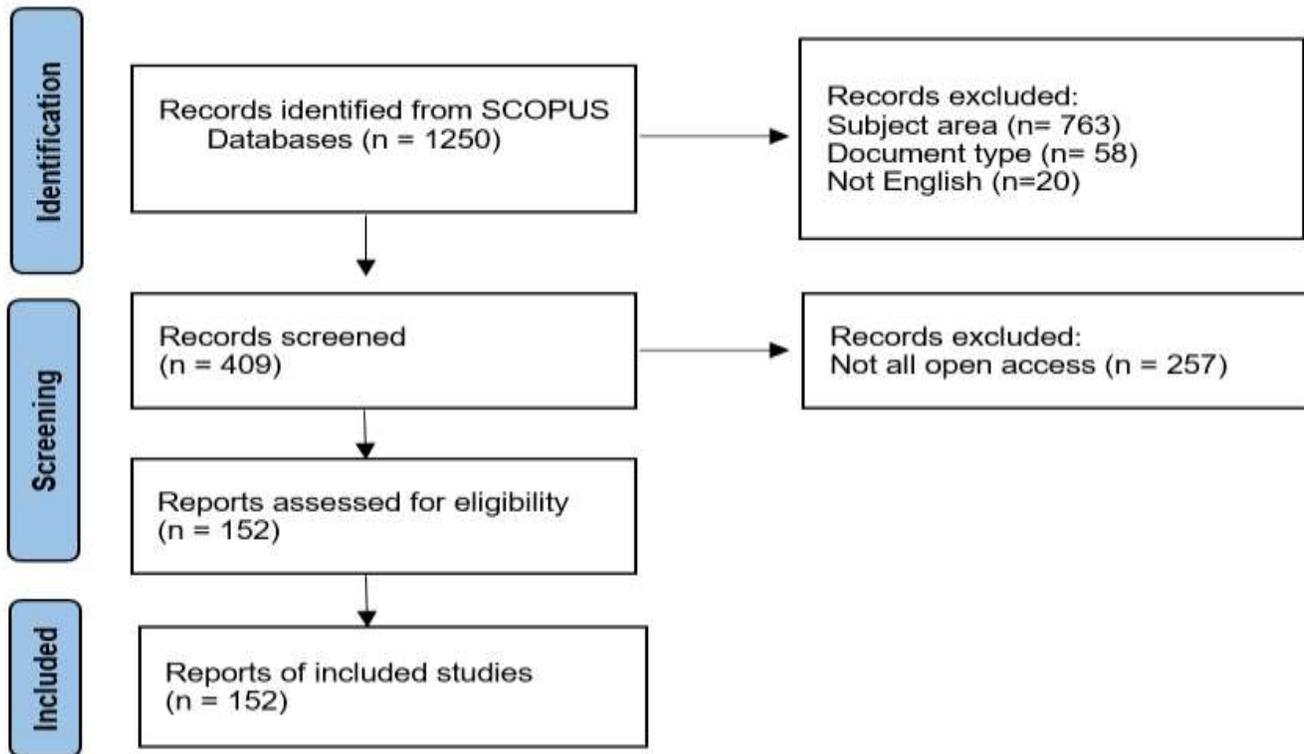


Figure 1. PRISMA Literature Selection Method.

3.0 METHODS

This study conducts on bibliometric analysis, co-word analysis and VOSviewer for visualization of 152 publications from SCOPUS database. Bibliometric analysis is a systematic study based on a quantitative approach to analyze documents using mathematical and statistical methods to reveal relationships, patterns, trends and impact in the field. Furthermore, it is the process of obtaining numerical analysis like number of articles per year, most studied topics, top journals in the field, authors with the most papers, number of citations and keywords. Furthermore, bibliometric analysis is the process of obtaining numerical analysis such as number of articles per year, most studied topics, universities with most publications, top journals in the field, authors with most papers, number of citations and keywords. It is a popular technique for analyzing large amounts of scientific data. Its main steps are data collection, data cleaning and refinement, subjecting the data to bibliometric methods (Donthu et al., 2021; Öztürk et al., 2024; Passas, 2024). There are two techniques in bibliometric analysis; performance analysis and science mapping. Performance analysis focuses on metrics related to publications and citations. On the other hand, science mapping focuses on mapping of the structure of scientific publications and their dynamics. The techniques are cited works' analysis to identify the most influential publications, co-citation analysis to further understand relationships between referenced works, bibliographic coupling to link related publications, co-word analysis to show relationships on topics, and co-authorship to understand relationships on social interactions between authors (Donthu et al., 2021; Passas, 2024). Co-word analysis focus on “words” that examines the actual content of publications from article titles, abstracts

and full text for the analysis to discover the relationships between keywords and it reveals thematic relationships with each other (Donthu et al., 2021). A pre-processing phase is also carried out to establish standard principles for co-word analysis. The collected keywords are refined in Excel to prepare them as singular/plural forms, upper/lower case letters, abbreviations, and full words written together.

For the visualization of the co-word analysis, the tools Bibexcel, Citespace, CoPalRed and VOSviewer are used to create and visualize bibliometric maps (Cobo et al., 2011). VOSviewer is one of the popular visualization tools developed by Van Eck and Waltman to build networks of journals, authors, keywords and publications to visualize the results (van Eck & Waltman, 2014). Network visualization represents the relationship between keywords in a map that includes nodes (keywords) and edges (connections). Overlay visualization provides additional data such as publication years or other metrics to understand research trends or emerging fields (Van Eck & Waltman, 2010).

The research questions of this study are: i. What are the prevailing themes of AI in urban planning? ii. How does AI integrate into these themes? and iii. When does these themes become prominent? To answer these questions, bibliometric analysis is conducted using a co-word analysis approach supported by the VOSviewer software for visualization of network map and overlay map. This methodology provides a comprehensive analysis of the literature to reveal hidden thematic trends in the field. Co-word analysis focuses on the co-occurrence of author keywords to identify the prevailing keywords and thematic clusters. A thesaurus file is created to refine keywords in Excel as singular/plural forms, upper/lower case letters, abbreviations, and full words are used. For example; “AI”, “artificial intelligence (AI)” and “artificial intelligence models” are combined under the keyword of “artificial intelligence” for this study. 48 keywords from 563 keywords when appearing fewer than two times are excluded. These keywords are clustered using VOSviewer’s grouping algorithm and to identify dominant themes and their interconnections through the network visualization. The clusters’ label is defined by authors based on emerging themes within the clusters.

The network visualization maps are used to answer the first and second research questions with prevailing themes and the integration of AI into urban planning. The overlay visualization map addresses the third question with identifying temporal trends.

4.0 FINDINGS AND DISCUSSIONS

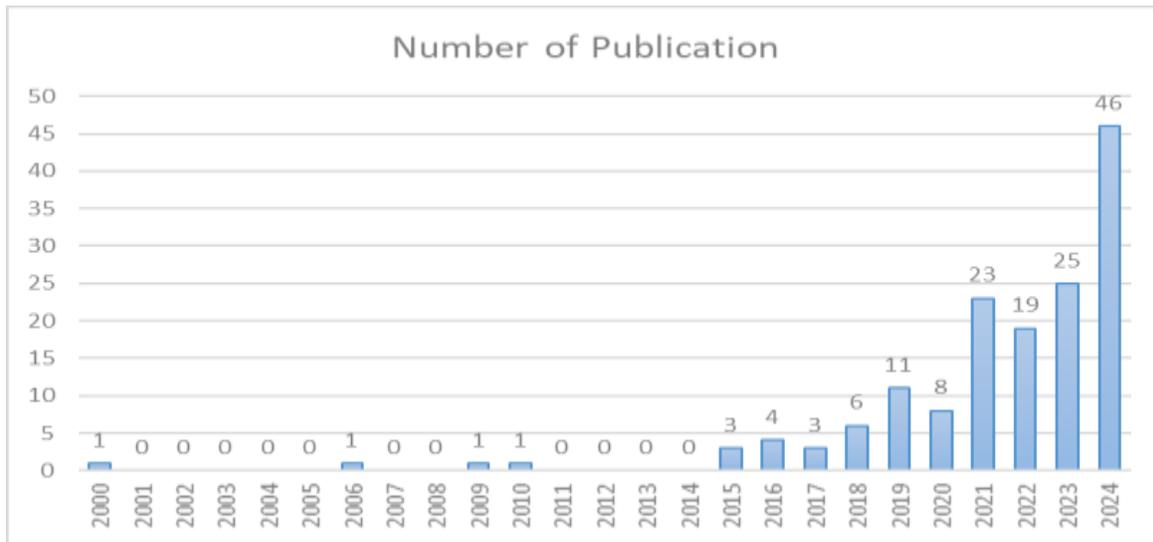
The data are obtained from 152 publications for analyzing. Initially, the descriptive characteristics of the publications are evaluated. They are then transferred to the VOSviewer software for visualization of the co-word analysis.

4.1 Descriptive Characteristics of the Publications

This section focuses on the quantitative evaluation of publications. The number of documents per year, the country/territory of publication, document types, titles of journals, and the most cited journals of topics are presented.

The number of publications is shown for each year from 2000 to 2024 (Table 2). Although there were few or no publications until 2015, it can be seen that the number of studies increased after 2015. The announcement of the SDGs in 2015, the acceleration of studies on smart city, big data and IoT in cities influence the beginning of AI based researches in urban planning. Another turning point started in 2019, which is directly related to COVID-19. Recently, the popularity of GPT and technological developments have led to more researches in the literature on AI and urban planning to search and find solutions to urban challenges like climate change and disasters and to develop AI-based tools.

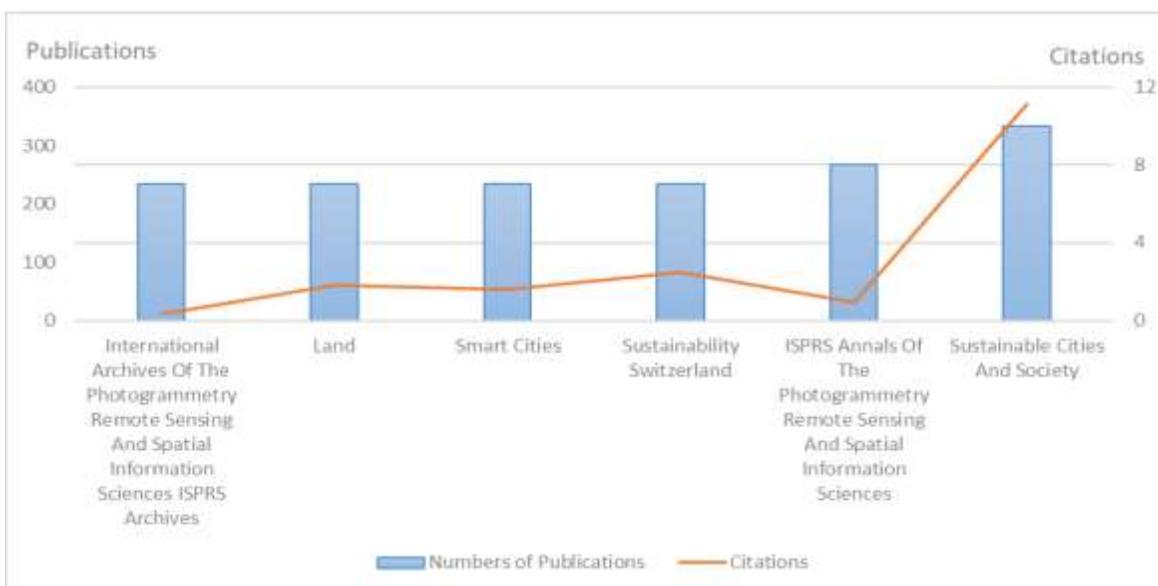
Table 2. The number of publications yearly (source: SCOPUS).



The geographical distribution of researchers varies. The top three countries contributing to more than 10% of the research are 21% China (n=33), 14% United Kingdom (n = 22) and 13% United States (n=21). Researchers from China focus on AI-based (ML and DL) methods to analyze the built environments due to the urbanization and its effects. Researchers from the UK work on AI-based smart city, urban design and urban planning. Researchers from the US focus on smart city and urban planning and sustainability.

The distribution of the publications in this study is 79.6% articles, 17.1% conference papers and 3.3% book chapters. In particular, “Sustainable Cities and Society” stands out as the first journal. “ISPRS Annals of the Photogrammetry Remote Sensing and Spatial Information Sciences”, “International Archives of the Photogrammetry Remote Sensing and Spatial Information Sciences ISPRS Archives”, “Land”, “Smart Cities” and “Sustainability Switzerland” are other journals. The most cited journal also “Sustainable Cities and Society”, which shows that the range of topics covers mainly sustainability or related topics (Table 3).

Table 3. Number of publications and citations between 2000 and 2024 (source: SCOPUS).



4.2 Co-word Analysis

The co-word analysis is based on articles, conference papers and book chapters published from 2000 to 2024 in the SCOPUS database. It aims to analyze the trends and explore the dominant themes of research topics on AI in urban planning. A total of 48 keywords are filtered out of 563 keywords from 152 publications for the co-word analysis. VOSviewer is used for creating mappings as the visualization tool.

The keyword with the most occurrence is artificial intelligence (n=43). It is followed by urban planning (n=25), machine learning (n=20), smart city (n=16) and decision support system (n=14). The top 10 keywords are highlighted in Table 4.

Table 4. Top 10 words with the most occurrences.

Label	<Occurrences>	<Links>	<Total link strength>
Artificial Intelligence	43	31	72
Urban Planning	25	25	45
Machine Learning	20	23	36
Smart City	16	18	36
Decision Support System	14	14	22
Neural network	8	8	14
Deep learning	8	10	13
GIS	7	10	15
Resilience	7	8	9
Sustainable Urban Development	7	7	9

In the network visualization, keywords are represented by circles, where the size of each circle corresponds to the weight or frequency of the keyword. The color of the circles indicates the clusters to which the keywords belong, while the thickness of the lines reflects the strength of the relationships between them (Van Eck & Waltman, 2013). The keywords with a frequency greater than 2 consist of five different clusters (Table 5), which contain a total of 48 keywords as shown in Figure 2.

As a result of the co-word analysis on AI in urban planning, the clusters are labeled according to thematic focus. The prevailing themes are smart city, machine learning and decision support system. In addition to main themes, deep learning, neural networks, computer vision, sustainability, resilience, and climate change also emerged as sub-themes.

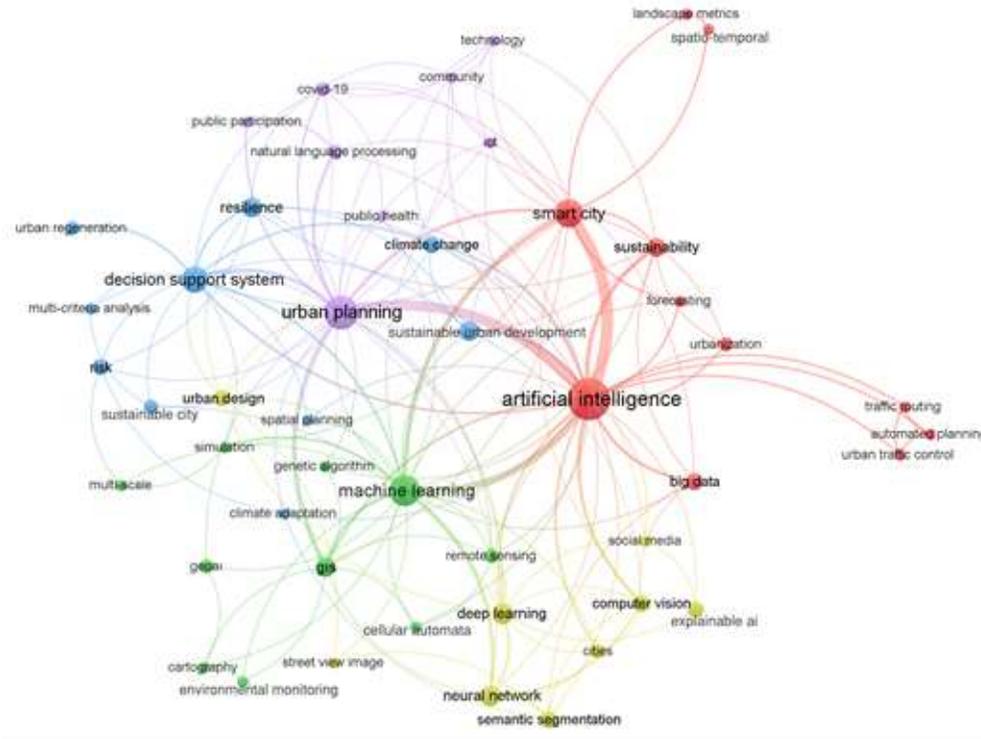


Figure 2. Visualization network map of prominent 48 keywords in studies published between 2000-2024 (Source: VOSviewer).

Table 5. Cluster of keywords (Source: Author’s interpretation derived from VOSviewer analysis).

Cluster No and Colour	Keywords	Cluster Label
#1 (Red)	Artificial intelligence, automated planning, big data, forecasting, landscape metrics, smart city, spatio-temporal, sustainability, traffic routing, urban traffic control, urbanization	AI-based smart city
#2 (green)	Cartography, cellular automata, environmental monitoring, genetic algorithm, GEO-AI, GIS, machine learning, multi-scale, remote sensing, simulation	ML-based analysis tools
#3 (blue)	Climate adaptation, climate change, decision support system, multi-criteria analysis, resilience, risk, spatial planning, sustainable city, sustainable urban development, urban regeneration	DSS for resilience
#4 (yellow)	Cities, computer vision, deep learning, explainable-AI, neural network, semantic segmentation, social media, street view image, urban design	AI techniques of image processing
#5 (purple)	Community, COVID-19, IoT, natural language processing, public health, public participation, technology, urban planning	Technology-enabled public health

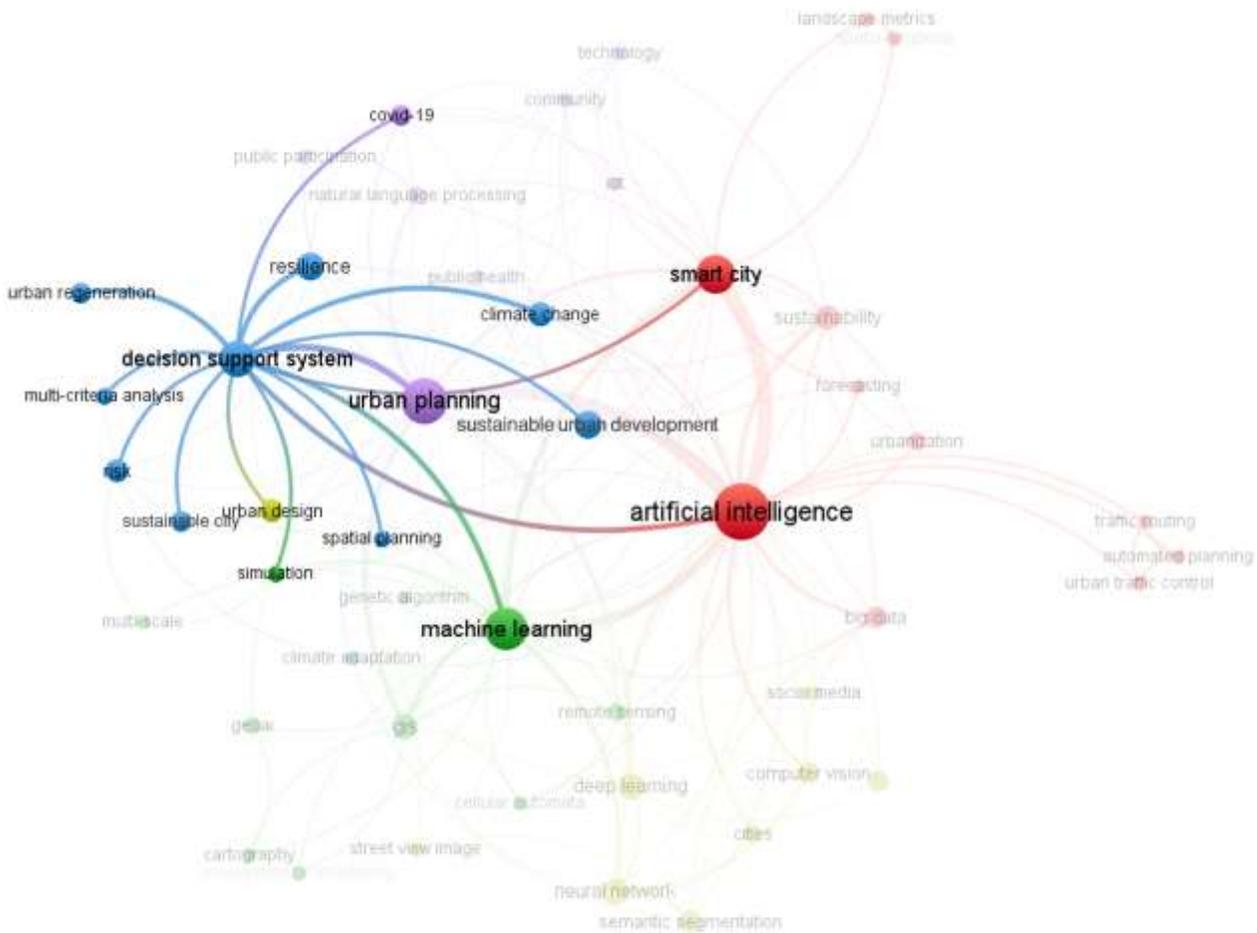


Figure 5. Visualization network map based on decision support system keyword (Source: VOSviewer).

Cluster 4 is named as “AI techniques of image processing”, focusing on the sub-themes of deep learning, neural networks and computer vision, which are subsets of AI. These technologies work together to solve problems by analyzing visual data retrieved from sources such as street view images (Ibrahim et al., 2019). Furthermore, visual data processing is important for spatial analysis, mapping or urban design criteria evaluation (Marasinghe et al., 2024). The cluster is directly related with collection and analysis of visual data from open access databases as indicated by keywords such as street view image and social media. It also includes the urban design keyword that shows the scope of cluster.

Cluster 5 revolves around the main theme of urban planning but designated as technology-enabled public health with the keywords community, COVID-19, IoT, natural language processing and public participation. It directly focuses on COVID-19 period that is a turning point for literature. IoT has an important role for data transmission without human interaction in COVID-19 to be able to control it (Castiglione et al., 2021). Similarly, natural language processing (NLP) generates data from a variety of sources such as health systems, medical literature or social media to text-based data in COVID-19 (Al-Garadi et al., 2022). The cluster is based on the interconnection of urban planning and public health technologies. It is connected with other clusters’ keywords such as climate adaptation and climate change, underscoring the applicability of IoT and NLP in disaster scenarios.

The keywords in the clusters are determined by co-word analysis. The clusters were created with based on the focus of the words in the cluster and the most frequently mentioned words in the co-word analysis. These clusters also demonstrate the integration in AI and planning.

5.0 DISCUSSION

The integration of AI in urban planning studies has started after 2015 that is directly related with declaration of SDGs. The literature also changes according to global issues like COVID-19, emergence of AI-based tools like ChatGPT and DALL-E.

The co-word analysis for prevailing themes show that AI centered in urban planning with smart city, machine learning and decision support systems. The integration of AI in urban planning through these keywords with other perspectives. AI is integrated into urban planning with smart city, ML-based tools, DSS for resilience, image process techniques and public health.

In this point, there are a few examples of the integration AI in cities as novel applications or methods. Although there is not widespread, the examples are selected on similar themes or clusters. One of them is AI-based smart city that is discussed with smart manufacture, agriculture, security, education, water, town planning, waste management (Ashwini et al., 2022). Other examples focus on ML-based tools in cities. Dublin City Council collaborated with Citibeats, based on NLP and ML, works as a social intelligence and speech analysis platform. It collected data via social media to give insights to local authorities how citizen experience and feel about civic issues in the cities (Citibeat, 2019). In similarly, Nigeria with Data Science Nigeria (DSN) aimed to pilot an AI solution for citizen feedback to monitor in sample locations (World Bank, 2020). Jakarta collaborates for developing DSS platform including crowdsource building-level data, simulations, and modeling to harness AI capabilities for predictive disaster analysis enabling better preparedness and response (*Empowering Resilience in a Sinking City: A Decision Support System (DSS) for Participatory Knowledge Exchange, Urban Simulation, and Modelling*, 2024). The city of Seodaemun-gu, located in Seoul, South Korea collaborates with external experts to solve citizen loneliness, particularly socially disadvantaged elderly living alone. The solution involves AI speakers designed for interacting and supporting for citizens. The AI speakers provide music and creating the illusion of having a conversation with someone. Also, they recognize and respond to emergency signals (Ben Dhaou et al., 2024) for providing public health and increasing quality of lives vulnerable citizens.

Furthermore, although the ethical dimension of AI is not highlighted in the co-word analysis, city councils focus on this issue. The City Council of Barcelona presented the "Municipal Strategy on Algorithms and Data to Ethically Drive Artificial Intelligence", the government measure under discussion that outlines the mechanisms for applying AI to municipal management and services, while safeguarding citizens' digital rights. Barcelona joins global cities such as Amsterdam, New York, Helsinki, Toronto and Seattle in having a human rights-based AI and emerging technologies policy (Barcelona Digital City, n.d.) for citizens' city rights.

6.0 CONCLUSIONS

This study provides a comprehensive overview of the integration of AI in urban planning through bibliometric and co-word analysis examining the dominant themes. It focuses on publications from the SCOPUS database from 2000 to 2024. The findings reveal a lack of continuity in publications until 2015. The increase and continuity after 2015 are related with declaration of Sustainable Urban Developments, the COVID-19 pandemic and the advancements in AI technologies like ChatGPT and DALL-E.

In similar literature review, the co-word analysis shows that machine learning, smart city and decision support systems are the prevailing themes, while deep learning, neural networks, computer vision, sustainability, resilience and climate change emerged as sub-themes. These findings proof that AI technologies are vital in global urban issues. While the study highlights prevailing themes and clusters, it also reveals a notable gap in the literature in terms of concepts explainable AI, forecasting, GEO-AI, and simulation. On the other hand, although ethical issues and data privacy are dominant in literature, they are not highlighted as prevailing themes in co-word analysis. It shows the topics of AI and urban planning should work on together from interdisciplinary perspective with computer scientists, data analysts, policymakers and lawyers.

Besides that, five thematic clusters are identified to emphasize how AI integrated into urban planning. These are AI-based smart cities, ML-based analytical tools, DSS for resilience, AI techniques for image processing,

and technology-enabled public health. The first cluster's prevailing keyword is smart city represents the integration of technology and urban planning focusing on sustainability and quality of life. AI can be supporter and accelerator to achieve sustainability for smart cities. The concepts of sustainability and smart cities have been discussed in literature mostly since 2016, because of SDGs published in 2015. Even today these concepts are significant because of global issues like climate change, strain on resources, earthquakes, drought, flood etc. The second cluster's theme is machine learning supports data collection, analysis and the development of innovative tools for urban planning processes. It is the central core of AI-based developments in urban planning. Especially when discussing global issues these days, the third cluster gains importance, which is decision support systems for resilience. It provides predictive capabilities to make environments more resilient for future.

Moreover, the temporal changes of keywords show the evolving nature of AI research in urban planning. Early emerging concept sustainable city (2016) directly related with SDGs, 2015. COVID-19 is other turning point for AI in urban planning literature. It provides studies based on COVID-19 after 2020 as seen in numbers of publications.

Despite all contributions, this study has limitations. It bases on only SCOPUS database, covers a time span of 2000-2024, and focuses on social and environmental sciences in English language. Therefore, this study may not be representative of the entire literature. Future studies could expand this scope by additional databases like Web of Science, extending the timespan, and exploring other disciplines and keywords to provide broader perspectives.

In conclusion, this article presents comprehensive overview and thematic clustering of AI integration in urban planning based on co-word analysis unlike previous reviews. This study is not only mapping prevailing trends of AI in urban planning but also provides a strategic foundation for future interdisciplinary research. It emphasizes the transformative potential tools of AI in creating sustainable, resilient, and inclusive urban environments and highlights the need for continuous exploration of ethical, technical, and governance-related dimensions.

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