

Digital Marketing in The Property Industry: A Bibliometric Analysis

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ABSTRACT

Keywords:

Digital Marketing,
Property Industry,
Bibliometric Analysis,
Sustainable Innovation,
Digital Transformation.

Abstract: This study maps the development of global research on digital marketing within the property industry through a bibliometric analysis of Scopus-indexed publications from 2019 to 2025. Using Biblioshiny in R, the study examines publication trends, patterns of scholarly collaboration, and the thematic structure of the existing literature. The findings reveal a marked increase in research output since 2019, reflecting growing scholarly interest in the digital transformation of the property sector. Three principal thematic clusters emerge from the analysis: first, digital marketing and artificial intelligence-driven innovation as key catalysts for digitalisation; second, blockchain technology and intellectual property protection as mechanisms for strengthening transparency and trust in digital transactions; and third, sustainable and human-centred innovation as a pathway towards Property Industry 5.0. Building on these findings, the study proposes a Digital-Integrated Property Industry framework that connects digital marketing capabilities, artificial intelligence integration, and the creation of smart property value. Overall, the findings demonstrate that the strategic adoption of digital technologies can enhance operational efficiency, transactional transparency, and competitive advantage within the contemporary property industry.

Kata Kunci:

Pemasaran Digital,
Industri Properti,
Analisis Bibliometrik,
Inovasi Berkelanjutan,
Transformasi Digital.

Abstrak: Penelitian ini bertujuan untuk memetakan perkembangan riset global mengenai pemasaran digital dalam industri properti menggunakan pendekatan analisis bibliometrik berdasarkan data Scopus periode 2019–2025. Analisis dilakukan dengan perangkat *Biblioshiny* pada R untuk mengidentifikasi tren publikasi, kolaborasi penulis, dan struktur tematik riset. Hasilnya menunjukkan peningkatan signifikan publikasi sejak 2019, yang menandakan meningkatnya perhatian terhadap transformasi digital dalam sektor properti. Tiga klaster utama ditemukan, yaitu: (1) *digital marketing* dan kecerdasan buatan (*AI-driven innovation*) sebagai penggerak utama digitalisasi, (2) *blockchain* dan perlindungan kekayaan intelektual sebagai penopang transparansi transaksi digital, serta (3) inovasi berkelanjutan dan orientasi manusia (*human-centric innovation*) sebagai arah menuju *Property Industry 5.0*. Penelitian ini mengusulkan kerangka Digital-Integrated Property Industry, yang menghubungkan kemampuan pemasaran digital, integrasi AI, dan penciptaan nilai properti cerdas. Hasil penelitian menegaskan bahwa penerapan teknologi digital meningkatkan efisiensi, transparansi, dan daya saing industri properti modern.

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A. INTRODUCTION

Digital transformation has become a major force reshaping industries worldwide, including the property and construction sectors. Industry 4.0, characterised by advances in technologies such as the Internet of Things (IoT), artificial intelligence (AI), and digital twins, has created new opportunities to improve efficiency, sustainability, and productivity across industrial and construction activities (Sopi & Hanafi, 2024). Global investment in industrial digital transformation reportedly exceeded USD 1.6 trillion in 2024, underscoring the increasingly important contribution of digitalisation to global economic growth (Lam et al., 2023). As an integral component of the construction industry, the property sector has progressively adopted digital technologies to streamline design, accelerate

construction processes, and improve asset management. Against this background, the present study employs bibliometric analysis to examine the relationship between the digital and property industries by mapping publication trends, patterns of scholarly collaboration, and emerging directions for future research.

Digital transformation in the property industry contributes directly to the achievement of Sustainable Development Goal 9: Industry, Innovation and Infrastructure, which promotes resilient and sustainable infrastructure through technological innovation (Youssef & Mejri, 2023). The topic also aligns with Indonesia's National Research Master Plan in the field of Information and Communication Technology, particularly its emphasis on strengthening national research capacity through the development of the digital economy and creative industries. Moreover, it supports the third priority of the Asta Cita agenda, which seeks to expand access to high-quality employment while advancing the country's creative and digital industries. In the Indonesian context, greater digital integration within the property sector could strengthen domestic supply chains, improve the efficiency of development projects, and accelerate permit and licensing procedures through integrated digital systems. A bibliometric analysis is therefore essential for mapping the existing research landscape, identifying global trends, and establishing future innovation priorities that respond to both national development needs and international research agendas (Rakić et al., 2023).

Bibliometric studies of the digital industry have increasingly examined research trends across a wide range of sectors. Marmin et al. (2025), for example, found that workforce preparedness and national innovation policies strongly influence the adoption of digital transformation in the energy and manufacturing sectors. Similarly, Baik (2025) identified a substantial increase in publications addressing Building Information Modelling (BIM), digital twins, and the Internet of Things (IoT) within the construction industry between 2019 and 2024. Bibliometric analysis enables researchers to identify dominant thematic clusters, emerging areas of inquiry, and patterns of international collaboration. These insights provide a valuable empirical basis for developing a conceptual framework that explains and guides digitalisation within the property sector.

Buri and Kiss (2025) further demonstrate that the transition from Industry 4.0 to Industry 5.0 places greater emphasis on the human dimension of industrial digitalisation, particularly sustainability and the need to balance technological advancement with workforce participation. Within the property sector, this perspective offers a means of improving construction efficiency while safeguarding environmental and social sustainability. Accordingly, the present study applies bibliometric analysis to develop a conceptual framework that maps prevailing research trends, patterns of scholarly contribution, and the principal themes shaping the digital transformation of the property industry.

Most bibliometric research on digital transformation has concentrated on the manufacturing, logistics, and energy sectors, while the property and construction industries have received comparatively limited attention. Although studies such as Golubtsov et al. (2023) have examined the digitalisation of logistics and distribution centres, the literature still lacks a comprehensive bibliometric investigation that connects Industry 4.0 with innovation in the real estate sector. This gap creates scope for exploring emerging themes, including smart property management, PropTech innovation, and sustainable digital infrastructure. The present study therefore addresses this deficiency by conducting a data-driven bibliometric mapping of the intellectual and thematic intersections between the digital and property industries.

The central problem addressed by this study is the absence of a comprehensive bibliometric analysis that systematically identifies research trajectories, patterns of scholarly collaboration, and dominant themes within the digitalisation of the property industry. To address this gap, the study formulates the following research questions:

RQ1: What publication trends characterise research on the relationship between the digital industry and the property industry, as measured by annual publication output and the most productive journals?

RQ2: Which countries and authors have made the most substantial contributions to this field, and which publications have exerted the greatest scholarly influence based on citation performance?

RQ3: What are the principal research themes in the digitalisation of the property industry, and which areas offer the greatest potential for future investigation?

Accordingly, this study conducts a bibliometric analysis of scholarly publications issued between 2019 and 2025 to trace the evolution of the field, assess publication productivity, and identify its dominant thematic clusters. This approach provides a systematic quantitative and visual account of knowledge development within the digitalisation of the property industry (Marmin et al., 2025). It also enables the identification of underexplored areas and emerging research directions, including Smart Property, PropTech ecosystems, and sustainable digital infrastructure (Baik, 2025).

B. METHOD

This study employs bibliometric analysis to identify research trends, patterns of scholarly collaboration, and key thematic developments concerning digital marketing within the property industry. Bibliometric analysis is particularly suitable for this purpose because it provides a systematic and quantitative account of knowledge development through the evaluation of scholarly publications, citation patterns, and networks of author collaboration (Baik, 2025).

The data were retrieved from the Scopus database in January 2026 using the following search strategy: (TITLE-ABS-KEY("*digital marketing*") AND TITLE-ABS-KEY("property industry")) AND (LIMIT-TO(SUBJAREA, "BUSI") OR LIMIT-TO(SUBJAREA, "SOCI") OR LIMIT-TO(SUBJAREA, "ECON")) AND LIMIT-TO(DOCTYPE, "ar") AND LIMIT-TO(LANGUAGE, "English")

The search was restricted to journal articles published in English within the Business, Management and Accounting; Social Sciences; and Economics, Econometrics and Finance subject areas.

The search yielded 23 relevant documents, comprising English-language journal articles in the business and social sciences subject areas (BUSI and SOCI). Conference papers and other document types were excluded from the dataset. The complete bibliographic records were subsequently exported from Scopus in BibTeX (.bib) format and analysed using Biblioshiny within the RStudio environment. Marmin et al. (2025) adopted a comparable approach by combining Scopus data with VOSviewer and Biblioshiny to examine patterns of digital transformation across multiple industrial sectors.

The analysis was conducted using Biblioshiny, the graphical interface of the Bibliometrix package in R, which supports comprehensive bibliometric evaluation. The analytical procedure comprised three principal components:

1. **Performance analysis**, which assessed publication productivity by year, journal, author, and country.
2. **Science mapping**, which examined relationships among research topics through co-word analysis, co-authorship network analysis, and citation analysis.
3. **Thematic evolution analysis**, which traced changes in the principal concepts underpinning research on digital marketing and the property industry between 2019 and 2025.

This method provides a systematic account of the field's intellectual structure and the evolving direction of global research (Youssef & Mejri, 2023).

1. Data Screening Process (PRISMA Flow Diagram)

The study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency, methodological rigour, and reproducibility throughout the article selection process. The screening procedure comprised four stages:

- a. Identification: The initial database search identified 46 records.
- b. Screening: The researchers excluded 15 records because of duplication or a lack of relevance to the study context, including publications addressing non-digital aspects of the property sector.
- c. Eligibility: A further eight records were excluded because they fell outside the business and social sciences subject areas or comprised ineligible document types, such as conference papers.
- d. Inclusion: The final dataset consisted of 23 journal articles that met all eligibility criteria and were included in the bibliometric analysis.

This process produced a valid and thematically focused dataset. Recent bibliometric studies have widely adopted the PRISMA protocol to strengthen the transparency, integrity, and objectivity of the study-selection process (Ciucu-Durnoi et al., 2024).

2. Validity and Reproducibility

To enhance the quality and external validity of the analysis, the study included only articles published in Scopus-indexed Q1 and Q2 journals. The researchers validated the findings by comparing the identified trends with evidence from previous studies on digital transformation and property marketing. This process of cross-checking the results follows the recommendation of Buri and Kiss (2025), who emphasise the importance of methodological triangulation in maintaining the consistency and robustness of bibliometric findings.

C. RESULTS AND DISCUSSION

Publication and distribution trends about the Digital Industry in the Property Industry

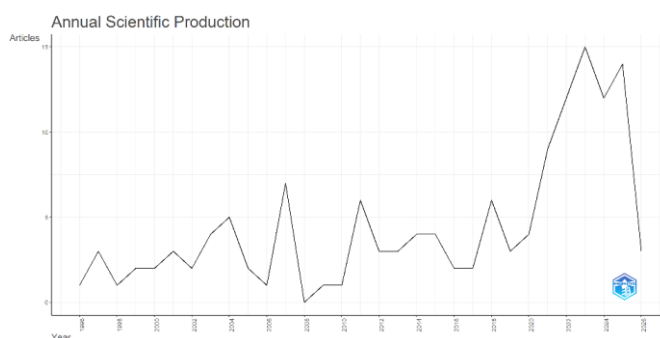


Figure 1. The distribution of studies over the years. Source: Visual map extracted from Rstudio

Figure 1 *Annual Scientific Production*, illustrates changes in the volume of scholarly publications addressing the digital industry within the property sector between 1995 and 2026. Overall, research output fluctuated until 2018 before rising sharply from 2019 and reaching a peak in 2023, when annual publication output exceeded 15 articles. Following this peak, the number of publications declined moderately in 2025 and 2026. This apparent reduction may reflect delays in Scopus indexing and the incomplete publication cycle for the most recent years rather than a substantive decline in scholarly interest (Baik, 2025).

The substantial increase in publication output after 2019 indicates growing international interest in the digitalisation of the property industry. The COVID-19 pandemic further accelerated the adoption of digital technologies across construction, property marketing, and asset management (Marmin et al., 2025). Recent studies suggest that this period represents a significant transition from

conventional property management towards data-driven smart property systems supported by artificial intelligence (Rakić et al., 2023).

1. Phases of Growth and Shifts in Research Focus

The publication trajectory reveals three distinct phases in the development of the field:

- a. **Early Phase (1995–2010):** Research output remained sporadic and focused primarily on construction efficiency and the application of computer-aided design (CAD). Annual publication levels were generally low, with fewer than five articles per year, reflecting the limited adoption of digital technologies within the property sector during this period (Buri & Kiss, 2025).
- b. **Growth Phase (2011–2018):** The emergence of Industry 4.0 and smart building technologies stimulated a steady increase in scholarly output. Research increasingly examined the integration of the Internet of Things (IoT) and Building Information Modelling (BIM) into construction processes and property asset management.
- c. **Accelerated Expansion Phase (2019–2024):** Publication output rose sharply, driven by advances in digital innovation, the growing use of artificial intelligence for property market forecasting, and the adoption of digital marketing strategies to enhance investment value. Increased research funding and stronger international collaboration in the digitalisation of the construction industry further supported this expansion (Youssef & Mejri, 2023).

The modest fluctuations observed in 2025 and 2026 are likely to reflect publication delays and the incomplete updating of bibliometric records. Nevertheless, the longer-term trajectory indicates that digital transformation in the property industry has emerged as a strategically important interdisciplinary field spanning technology, economics, and public policy.

The growth in scholarly publications over the past two decades reflects a broader global shift towards Property Industry 4.0, in which digitalisation has evolved from an optional enhancement into a strategic imperative. The analysis indicates that recent research increasingly positions sustainability, smart city integration, and digital marketing as key drivers of innovation in the contemporary property sector (Lam et al., 2023).

This expansion in publication output therefore signifies more than growing academic interest. It also reflects a substantive transformation in industry practice, as property organisations move away from conventional systems towards data-driven property management models that enhance operational efficiency, transparency, and long-term sustainability.

2. Analysis of Scholarly Contributions by Country, Institution, and Author

One of the principal indicators used in bibliometric analysis is the average number of citations received per year, which provides a measure of a publication's scholarly influence within a particular research field. A high citation rate suggests that a study has informed subsequent research and contributed meaningfully to the development of theoretical knowledge, methodological approaches, or professional practice (Buri & Kiss, 2025).

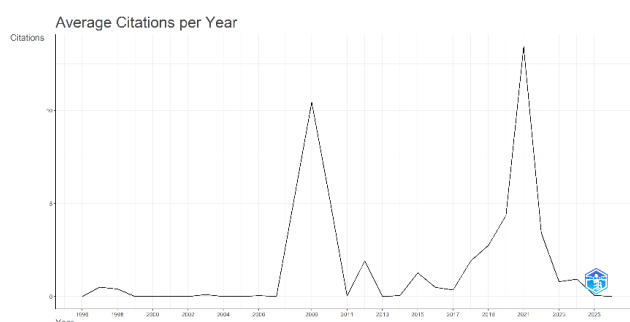


Figure 2. Average Citation per Year. Source: Visual map extracted from Rstudio

The Average *Citations per Year* graph reveals two pronounced peaks in scholarly influence, occurring around 2009 and 2021. These peaks represent important stages in the development of the literature on the digitalisation of the property industry. During the early phase from 1995 to 2010, citation levels remained comparatively low, indicating that research on property digitalisation was still limited and had yet to attract sustained international scholarly attention. The marked rise in 2009, however, suggests the emergence of influential publications linking digital modelling with building information systems in construction and property-related contexts (Baik, 2025).

The second peak, recorded in 2021, reflects a substantial increase in citation impact alongside the expansion of post-COVID-19 research on digital technology adoption, virtual property visualisation, and artificial intelligence-based asset management. This pattern suggests that digital transformation in the property sector had developed beyond a predominantly technological concern to become a strategically important issue for the wider global economy (Youssef & Mejri, 2023).

The decline in average citation rates between 2022 and 2025 can be explained by the limited citation window available to more recent publications. Newly published articles often require two to three years to accumulate a substantial number of citations, a pattern commonly described as the citation delay effect. Consequently, the lower citation averages observed in the most recent period should not be interpreted as evidence of declining research relevance; rather, they reflect the publication and citation lag inherent in scholarly communication (Marmin et al., 2025). From a conceptual perspective, the graph also illustrates the evolving intellectual foundations of research on digital technologies within the property industry.

- a. Phase 1 (1995–2010): The literature was dominated by early technical studies focusing on building information systems. Scholarly influence remained relatively limited because most research emphasised practical applications rather than conceptual or theoretical development.
- b. Phase 2 (2011–2019): Citation impact increased gradually alongside the growing prominence of Industry 4.0, the Internet of Things, and digital twin technologies in asset management and smart construction.
- c. Phase 3 (2020–2023): Citation levels rose most sharply during the post-pandemic acceleration of digital transformation. Research increasingly examined the integration of digital marketing, smart building technologies, and sustainability frameworks.

The sustained citation performance observed during this period indicates that digital transformation in property management has become an established component of global academic debate. This body of scholarship draws on several disciplines, including information technology, the digital economy, and the governance of the construction industry (Sopi & Hanafi, 2024). From an academic perspective, the citation peak in 2021 suggests a period of intensified conceptual development in property digitalisation, particularly concerning the integration of digital marketing with data-driven asset management models supported by big data analytics. These findings demonstrate that digitalisation not only improves operational efficiency but also reshapes property market behaviour and transforms the ways in which organisations communicate and engage with customers through digital channels (Lam et al., 2023).

From a strategic perspective, the citation trajectory reflects an international research agenda increasingly centred on sustainability, smart technologies, and digital resilience in the real estate sector. The pattern therefore captures more than changes in research productivity. It also identifies critical stages in the development of digital transformation as a foundation for the emergence of Property Industry 5.0. Within research on digital technologies in the property

industry, an analysis of the most highly cited documents is essential for identifying the core literature that has shaped the field's intellectual foundations. It also provides insight into the development of interdisciplinary research themes, particularly sustainability, the digitalisation of industrial processes, and technological innovation.

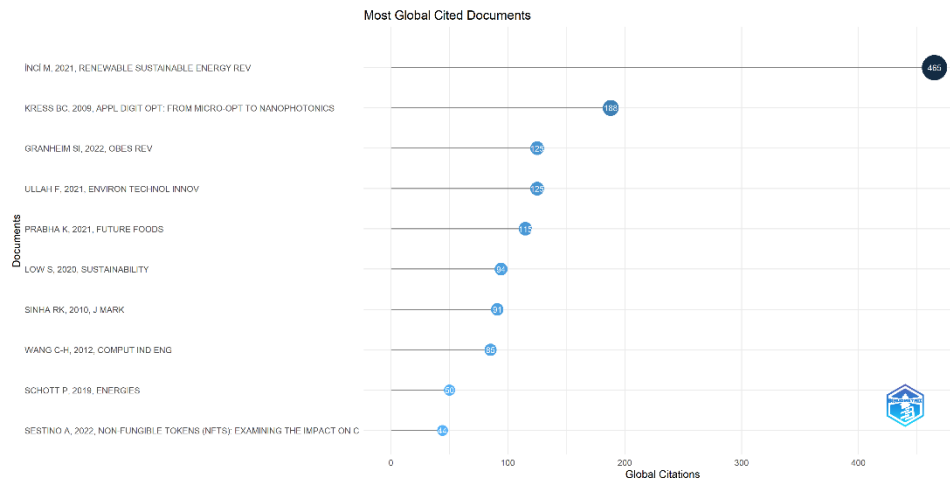


Figure 3. Most Global Cited Document

The *Most Globally Cited Documents* graph shows that the article by Inci M. (2021), published in *Renewable and Sustainable Energy Reviews*, received the highest number of citations, with 465 citations. The study examines the integration of digital technologies and sustainable energy systems as essential components of smart industrial ecosystems, with implications for the property and construction sectors. The publication by Kress B. C. (2009), which received 188 citations, ranked second. Its substantial citation impact highlights the importance of digital optics and imaging technologies in advancing property visualisation systems, including digital twins and virtual design applications (Baik, 2025).

The articles by Granheim S. I. (2022) and Ullah F. (2021) ranked next, each receiving 125 citations. Their citation performance indicates a substantial contribution to research on environmental innovation and technological sustainability. Both studies demonstrate that digital transformation in the construction and property industries must be considered alongside the wider agendas of the green economy and climate-responsive construction (Youssef & Mejri, 2023). Other influential publications include Low S. (2020) in *Sustainability* and Sinha R. K. (2010) in the *Journal of Marketing*. These studies contributed to the development of digital economy perspectives and digital marketing strategies relevant to the property sector. Although they attracted fewer citations, ranging from 91 to 94, they strengthened the conceptual relationship between digital adoption, consumer behaviour, and the emergence of data-driven business models in the property industry.

Conceptually, the graph indicates that the most influential studies lie at the intersection of technological innovation, sustainability, and digital strategy. The prominence of highly regarded journals such as *Renewable and Sustainable Energy Reviews*, *Environmental Technology & Innovation*, and *Sustainability* further demonstrates that research on digital transformation in the property industry has assumed an increasingly strategic position within the international scholarly literature.

3. Thematic Patterns and Evolution of Digital Marketing Research Topics in the Property Industry

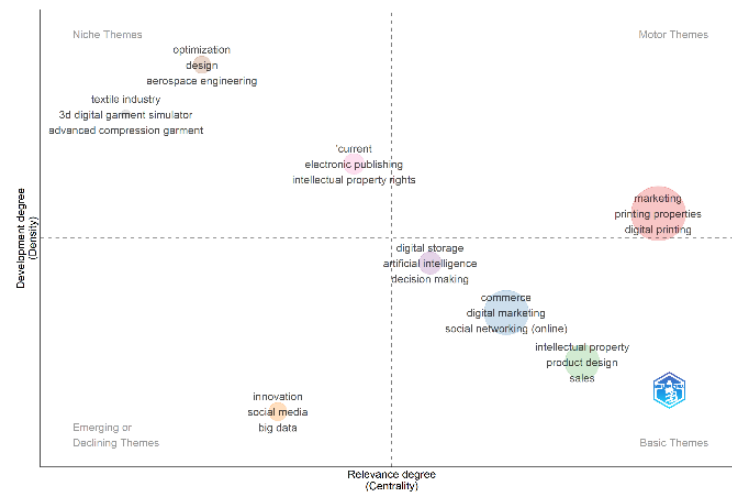


Figure 4. Thematic Map

Conceptually, the graph indicates that the most influential studies lie at the intersection of technological innovation, sustainability, and digital strategy. The prominence of highly regarded journals such as *Renewable and Sustainable Energy Reviews*, *Environmental Technology & Innovation*, and *Sustainability* further demonstrates that research on digital transformation in the property industry has assumed an increasingly strategic position within the international scholarly literature.

The upper-right quadrant of the thematic map represents the Motor Themes and contains the topics of marketing, printing properties, and digital printing. These themes exhibit both high centrality and strong development, indicating that research on digital marketing and digital printing technologies occupies a prominent position within the current literature. In the property industry, digital marketing enables firms to promote real estate assets more effectively through online platforms, artificial intelligence-based recommendation systems, and virtual property visualisation technologies (Lam et al., 2023). Digital printing also functions as an enabling technology for three-dimensional architectural modelling and property prototyping. Its application can shorten design cycles, improve the precision of physical and visual representations, and support more efficient communication among project stakeholders. Collectively, these motor themes suggest that the adoption of digital technologies plays a direct role in strengthening innovation, operational capability, and global competitiveness within the property industry (Baik, 2025).

The lower-right quadrant contains several foundational yet comparatively underdeveloped themes, including commerce, digital marketing, online social networking, product design, and sales. These topics provide the conceptual basis for research on the digital property industry, particularly by highlighting the growing integration of digital technologies with online consumer behaviour in the development of new property business models. International studies indicate that e-commerce, social media marketing, and data-driven personalisation have become central strategies for extending the digital reach of property markets (Youssef & Mejri, 2023). Although these themes have not yet achieved substantial conceptual depth, their high centrality suggests that they will continue to exert a strong influence on the future direction of research in this field.

The upper-left quadrant contains themes such as optimisation, aerospace engineering, design, the textile industry, three-dimensional digital garment simulation, and advanced compression garments. Although these topics exhibit strong internal development and thematic density, they remain peripheral to research on digitalisation in the property industry. This pattern

suggests that the literature has developed primarily within specialised domains of digital design and manufacturing rather than in direct relation to the real estate sector (Rakić et al., 2023).

Nevertheless, several associated technologies, particularly three-dimensional simulation and design optimisation, retain relevance for building visualisation, digital interior design, and architectural modelling. Future research could therefore examine how these capabilities might be incorporated into broader frameworks for property design innovation.

The lower-left quadrant represents emerging or potentially declining themes, including innovation, social media, and big data. Although these topics currently display relatively low thematic density and centrality, they indicate promising directions for future research, particularly in the application of big data analytics and social media intelligence to the analysis of property market behaviour. Recent studies suggest that big data can support property price forecasting, refine digital marketing strategies, and improve the quality of investment decision-making (Marmin et al., 2025). These themes may therefore constitute important emerging research avenues, particularly as artificial intelligence-driven property analytics and digital consumer profiling become increasingly prominent.

Overall, the thematic map indicates that research on digitalisation in the property industry has progressed from a predominantly technological focus towards a more integrated consideration of digital marketing, design innovation, and big data analytics. Motor themes, particularly digital marketing, currently drive the field's scholarly development, while emerging themes such as innovation and big data are likely to assume greater prominence over the next five to ten years. This thematic structure suggests that research on the digital property sector is increasingly moving towards a Property Industry 5.0 model that combines sustainability, artificial intelligence, and digitally enhanced user experience within a unified framework (Youssef & Mejri, 2023).

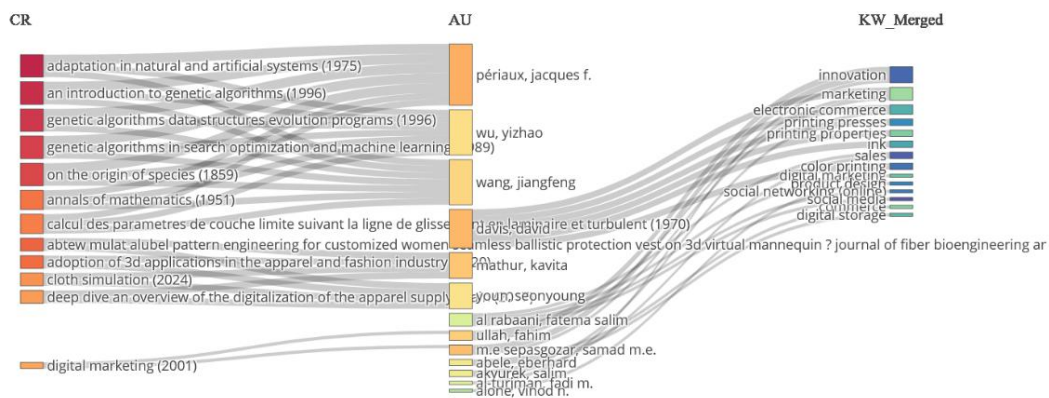


Figure 5. Sankey Diagram

The Sankey diagram, generated in Biblioshiny within R using data retrieved from Scopus, illustrates the relationships among cited references (CR), authors (AU), and consolidated keywords (KW_Merged) in research on digitalisation within the property industry. It therefore provides a visual account of how foundational literature, contemporary scholars, and emerging digital themes interact to shape the intellectual structure of this field (Baik, 2025).

The left-hand section of the diagram, representing cited references (CR), highlights several frequently referenced foundational works, including *Adaptation in Natural and Artificial Systems* by Holland (1975), *An Introduction to Genetic Algorithms* by Mitchell (1996), and *Genetic Algorithms in Search, Optimization, and Machine Learning* by Goldberg (1989). These publications established key principles of evolutionary computation and digital optimisation that

subsequently informed research on design automation and machine learning, including applications relevant to the digital property sector (Rakić et al., 2023).

Contemporary researchers, including Yizhao Wu, Jiangfeng Wang, and Kavita Mathur, appear to connect these theoretical foundations with applications in three-dimensional modelling, digital simulation, and data-driven design. This pattern indicates that current research on the digital property industry extends beyond marketing and commerce to encompass algorithmic optimisation and computational modelling grounded in established theories of computer science.

The central section of the diagram highlights the contribution of individual authors to the development of contemporary research themes. Scholars such as Fahim Ullah, Samad Sepasgozar, and Salim Al Raba'ani have consistently examined digital transformation and innovation within the real estate sector. Their work connects themes including digital marketing, e-commerce, artificial intelligence-assisted decision-making, and online social networking with the management and promotion of property assets (Marmin et al., 2025).

These linkages demonstrate the increasingly multidisciplinary character of research on the digital property industry, which now draws together perspectives from technology, business, and design. The authors therefore occupy an important bridging position between established theoretical foundations and their application to contemporary digital practices.

The right-hand section of the diagram presents the dominant merged keywords, including innovation, digital marketing, social media, e-commerce, printing properties, and digital storage. Among these terms, innovation and digital marketing function as the principal connecting nodes, displaying the strongest links with both authors and cited references. This pattern indicates that research in the field has progressed beyond the simple adoption of technology towards a more strategic model of innovation driven by industrial digitalisation (Youssef & Mejri, 2023).

The emergence of terms such as printing properties and digital printing also highlights the growing importance of three-dimensional printing in architectural visualisation and property-related prototyping. These developments suggest that digitalisation is transforming not only property marketing but also the processes through which property assets are designed, planned, visualised, and communicated to prospective consumers.

The observed pattern of relationships suggests that the diagram represents three principal layers of knowledge within research on the digital property industry: the conceptual layer, represented by cited references (CR); the applied layer, represented by authors (AU); and the thematic layer, represented by merged keywords (KW_Merged). The integration of these layers demonstrates that research in this field does not develop through a linear progression. Instead, it advances through multidisciplinary interactions among established theories, emerging technologies, and contemporary marketing strategies.

The Sankey diagram indicates that scholarship on digitalisation in the property industry has evolved from classical theories of algorithms and optimisation towards data-driven innovation and digital marketing practices. Contemporary scholars act as intellectual bridges between computational science and the commercial realities of the digital property sector. This development has strengthened the strategic importance of the field within Industry 5.0, where intelligent technologies, sustainability, and human-centred interaction constitute key foundations of the digital economy (Buri & Kiss, 2025).

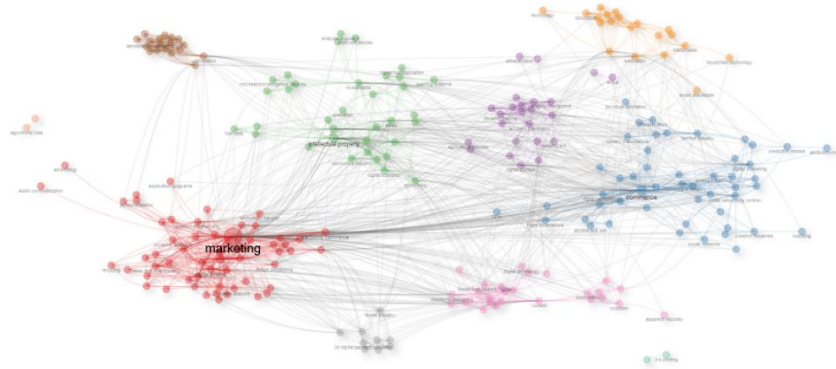


Figure 6. Network Visualization Map

A keyword co-occurrence map is a central bibliometric tool for examining the intellectual structure and thematic development of a research field. Each node represents a keyword used in the analysed publications, while the connecting lines indicate the frequency with which pairs of keywords appear within the same document. Node size reflects the relative prominence of a concept, as measured by its frequency of occurrence, whereas colour denotes the thematic clusters identified through algorithmic analysis (Baik, 2025). In the present study, the network map illustrates how digital marketing, commerce, artificial intelligence, blockchain, and intellectual property interact to shape the conceptual structure of research on digital transformation in the property industry.

The largest and most prominent cluster, shown in red, centres on the keyword *marketing*, which forms the principal hub of the network and connects with concepts such as advertising, e-commerce, data mining, recycling, and corporate strategy. The density of these connections indicates that digital marketing constitutes a central organising theme in research on the digitalisation of the property industry. This cluster highlights the growing importance of strategies such as search engine marketing, social media advertising, and artificial intelligence-driven customer analytics in enhancing property marketability and improving promotional efficiency (Lam et al., 2023). The links between data analysis and corporate decision-making further demonstrate how digital marketing increasingly intersects with big data analytics to support the development of digitally enabled property business models.

The blue cluster centres on the keyword *commerce* and is closely associated with digital marketing, online social networking, creative industries, and branding. These connections indicate that current research increasingly examines the transition of the property market towards an e-commerce ecosystem in which property sales, lettings, and promotional activities are conducted through digital platforms (Sopi & Hanafi, 2024).

The cluster's links with smart real estate, three-dimensional virtual simulation, and predictive models further suggest that contemporary scholarship extends beyond economic considerations to incorporate visualisation technologies and artificial intelligence-based market forecasting. This pattern confirms that the property industry is evolving into a digital ecosystem in which asset valuation, promotion, transactions, and consumer behaviour are increasingly mediated by technology.

The purple cluster comprises keywords such as artificial intelligence, decision-making, learning systems, and Industry 4.0. It represents the integration of intelligent technologies into decision-making processes within digital property management. Recent studies show that artificial intelligence supports property market valuation, price trend identification, and the optimisation of sales strategies and asset design (Youssef & Mejri, 2023). The association between decision analytics and learning algorithms further indicates a shift towards property

technology, or PropTech, an interdisciplinary field that combines artificial intelligence, the Internet of Things, and data analytics to enable more efficient, predictive, and evidence-based property asset management.

The orange cluster comprises themes related to innovation, blockchain, trademarks, and smart real estate. It reflects an emerging research direction concerned with strengthening the transparency and security of digital transactions in the property industry through blockchain technology. Smart contracts and digital ownership verification have become particularly important for reducing fraud risks and accelerating property transactions conducted through digital platforms (Marmin et al., 2025). The cluster's association with innovation further suggests that researchers increasingly view blockchain not merely as a security mechanism, but also as a catalyst for developing new technology-enabled business models within the property sector.

The green cluster centres on intellectual property, digital transformation, learning systems, and the electronics industry. Research within this cluster addresses the economic and legal dimensions of digitalisation, particularly the protection of intellectual property rights associated with digital assets, architectural designs, and virtual property content. These issues have become increasingly important as property developers and marketers make greater use of three-dimensional digital models and metaverse-based real estate platforms, both of which require appropriate forms of legal and digital protection (Buri & Kiss, 2025).

The light-brown and grey clusters contain terms such as optimisation, aerospace engineering, and the textile industry. Although these themes appear peripheral to the core research domain, they remain methodologically relevant because they employ simulation, three-dimensional modelling, and design optimisation techniques that also support digital architectural visualisation in the property sector (Rakić et al., 2023). This pattern indicates that cross-sector design innovation, including knowledge transferred from textile manufacturing and mechanical engineering, contributes to the advancement of digital technologies for representing and modelling property assets.

Overall, the keyword network reveals a highly interconnected and multidisciplinary knowledge structure within the digital property industry. Keywords such as marketing, commerce, artificial intelligence, blockchain, and intellectual property function as central nodes linking the fields of economics, technology, and digital law. The map also indicates a gradual transition towards an Industry 5.0 paradigm, in which artificial intelligence, sustainability, and human-centred innovation increasingly shape the management and marketing of digital property assets (Youssef & Mejri, 2023).

D. CONCLUSIONS AND SUGGESTIONS

This study provides a comprehensive account of the development and emerging direction of global research on digital marketing in the property industry through a bibliometric analysis of Scopus-indexed publications. The findings reveal substantial growth in scholarly output between 2019 and 2024, reflecting increasing recognition among academics and industry practitioners of the strategic importance of digital transformation. This development highlights the growing role of digital marketing in improving operational efficiency, enhancing market transparency, and strengthening the competitiveness of the property sector within an increasingly digital economy.

From a theoretical perspective, this study advances the literature on digital transformation and marketing innovation by proposing a new conceptual model, the Digital-Integrated Property Industry Framework. The framework positions digital marketing capability as its central component and links it to artificial intelligence integration and smart property value creation. It therefore offers a coherent basis for examining how technological, marketing, and value-creation capabilities interact

within the property sector. Future empirical research may use this framework to test the relationships among the variables that shape the effectiveness of digital transformation in the industry.

Overall, this study demonstrates that the digitalisation of the property industry is a multidimensional process that requires the coordinated integration of technology, innovation, and sustainable governance. The strategic development of digital marketing capabilities, stronger international research collaboration, and the adoption of advanced technologies such as artificial intelligence and blockchain will play a central role in enhancing the sector's competitiveness within the emerging context of Property Industry 5.0. Accordingly, this study not only extends academic understanding of the global research landscape but also offers strategic guidance for industry stakeholders and policymakers seeking to address the evolving challenges of the digital economy.

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