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Digital Transformation and Decision Optimization in Life Insurance: A Bibliometric Analysis of Cognitive Load Reduction, Customer Decision Quality, and Emerging Research Trends

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Abstract

The rapid advancement of digital technologies is reshaping the life insurance sector by transforming traditional decision-making processes into intelligent, data-driven, and customer-centric systems. This study aims to map the global research landscape on digital transformation and decision optimization in life insurance by examining the intellectual structure, thematic evolution, and emerging research trends. A bibliometric analysis was conducted using 249 Scopus-indexed publications retrieved between 2005 and 2026 and analysed through R Studio using the Bibliometrix package and Biblioshiny interface. The study applied performance analysis, keyword co-occurrence analysis, citation analysis, thematic mapping, and collaboration network analysis to evaluate the development of this research domain. The findings reveal a substantial growth in scholarly interest, with artificial intelligence, machine learning, big data analytics, decision-support systems, and digital platforms emerging as dominant research themes. Machine learning and artificial intelligence were identified as major motor themes, reflecting the increasing importance of predictive analytics and automated decision mechanisms in insurance applications. The analysis further highlights the growing relevance of customer-oriented digital solutions and decision optimization strategies aimed at reducing information complexity and improving decision quality. However, the integration of cognitive perspectives, particularly cognitive load reduction, remains comparatively underdeveloped, indicating an important future research direction. This study contributes to the literature by providing a comprehensive overview of digital transformation research in life insurance and proposing future pathways focused on explainable artificial intelligence, human-centered digital insurance systems, and responsible technology adoption.

Keywords: Digital transformation; Life insurance; InsurTech; Artificial intelligence; Machine learning; Decision support systems; Cognitive load; Bibliometric analysis; Customer decision quality.

1. Introduction

1.1 Background and Research Context

The financial services industry has undergone substantial transformation due to the rapid advancement of digital technologies, changing customer expectations, and increasing demand for data-driven decision-making. Within this transformation, the insurance sector has emerged as one of the key domains experiencing technological disruption through artificial intelligence (AI), machine learning (ML), big data analytics, automation, and digital platforms. Life insurance, in particular, represents a complex decision environment where customers must evaluate long-term financial commitments, uncertain future risks, policy structures, premium obligations, and

multiple competing alternatives. These characteristics make life insurance decisions significantly dependent on effective information processing and decision-support mechanisms.

Digital transformation in insurance is not limited to technological adoption but represents a comprehensive restructuring of insurance value chains, including product development, underwriting, distribution, customer interaction, and risk management. Eling and Lehmann (2018) demonstrated that digitalization is reshaping the insurance industry by transforming traditional value creation processes and influencing how insurers evaluate and manage risks. The authors emphasized that digital technologies provide opportunities for improving operational efficiency, enhancing customer interaction, and developing innovative insurance solutions. Similarly, research on information and communication technologies in financial services indicates that digitalization has become a critical driver of competitiveness and service innovation within banking and insurance ecosystems (Shrivastava et al., 2023).

The increasing availability of customer data and advanced analytical capabilities has further accelerated the transition toward intelligent insurance systems. Big data analytics enables insurers to extract meaningful insights from large and diverse datasets, supporting improved risk evaluation, customer segmentation, personalization, and strategic decision-making. Sood et al. (2022) identified big data as a transformative capability for the insurance industry, highlighting its role in improving analytical efficiency and developing customer-oriented insurance solutions. Likewise, studies on big data analytics applications in insurance have emphasized the importance of advanced analytical tools for improving operational performance and enhancing decision processes (Banu, 2022; Verma et al., 2022).

Artificial intelligence and machine learning have become particularly influential in developing automated and predictive insurance environments. These technologies enable insurers to improve fraud detection, risk assessment, claims management, and underwriting decisions through advanced computational models. Aslam et al. (2022) demonstrated the effectiveness of artificial intelligence and machine learning approaches in insurance fraud detection, indicating the growing importance of intelligent systems in enhancing accuracy and efficiency. Furthermore, Rawat et al. (2021) highlighted that machine learning and data visualization techniques provide valuable decision-support capabilities for insurance organizations by enabling improved interpretation of complex information.

Despite these technological advancements, life insurance decision-making remains challenging because customers frequently encounter complex information structures, uncertain outcomes, and difficulties in comparing available alternatives. Therefore, digital transformation should not only be considered from an organizational or technological perspective but also from a human decision-making perspective. The effectiveness of digital insurance systems depends on their ability to simplify complex information, support customer understanding, and enhance decision quality.

1.2 Digital Optimization and Decision Quality in Life Insurance

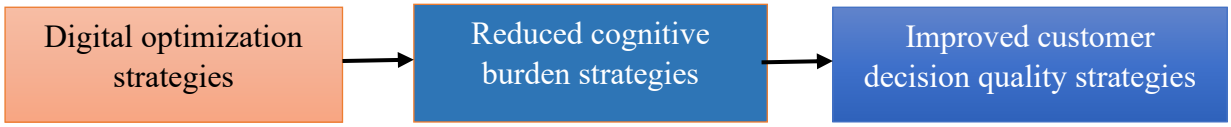
Life insurance decisions involve considerable cognitive demands because customers must process large amounts of financial, technical, and risk-related information before selecting appropriate policies. Information complexity, unfamiliar terminology, and uncertainty regarding future benefits can create significant barriers to effective decision-making. In such environments, customers may experience increased cognitive burden, resulting in difficulties in evaluating alternatives and making optimal choices.

Cognitive load theory explains that human information-processing capacity is limited and that excessive information complexity can negatively influence comprehension and decision performance. Therefore, reducing unnecessary cognitive effort has become an important consideration in designing digital decision environments. In the context of life insurance, digital optimization strategies can contribute to decision quality by organizing information more effectively, providing personalized recommendations, and supporting customers through intelligent advisory systems.

The integration of AI-driven recommendation systems, automated decision-support tools, and personalized digital platforms provides opportunities to reduce information overload and improve customer confidence. For example,

machine learning-based decision-support applications can identify patterns within complex datasets and provide meaningful insights that assist both insurers and customers (Rawat et al., 2021). Similarly, big data-driven approaches allow insurers to develop more customized solutions by understanding customer characteristics, preferences, and risk profiles (Sood et al., 2022).

Consequently, digital optimization can be conceptualized as a mechanism linking technological capability with improved decision outcomes. The relationship can be represented as:



However, despite increasing technological adoption, limited research has systematically examined how digital transformation contributes to cognitive load reduction and customer decision effectiveness within life insurance. This represents an important research opportunity for integrating technological innovation with behavioral decision perspectives.

1.3 Emerging Role of InsurTech and Intelligent Technologies

The emergence of InsurTech has significantly accelerated the digital transformation of insurance services by introducing innovative technologies that improve customer interaction, operational efficiency, and decision-support capabilities. InsurTech applications include AI-based underwriting, automated claims processing, predictive analytics, digital advisory platforms, and personalized insurance recommendations.

Artificial intelligence and machine learning have become central components of modern insurance ecosystems because they enable predictive modelling and automated decision processes. Research on AI-based insurance applications demonstrates that intelligent algorithms can improve risk identification and operational accuracy while reducing manual decision complexity (Aslam et al., 2022). Similarly, machine learning-based approaches provide opportunities for developing advanced decision-support systems capable of processing complex insurance information efficiently (Rawat et al., 2021). Big data analytics represents another important technological foundation for digital insurance transformation. By integrating structured and unstructured data sources, insurers can achieve deeper customer understanding, enhance risk prediction, and develop personalized insurance products. According to Sood et al. (2022), big data has become a strategic resource for insurance organizations by enabling data-driven innovation and improving decision-making capabilities. Digital platforms and automated advisory systems are also transforming customer experiences by providing faster access to insurance information and improving transparency. These systems can reduce decision complexity by presenting relevant information according to customer needs, thereby supporting more effective insurance choices. However, the rapid development of these technologies also creates new research challenges related to trust, transparency, algorithmic fairness, and human acceptance of automated decisions.

1.4 Research Gap and Need for Bibliometric Analysis

Although previous studies have investigated digital transformation, AI applications, big data analytics, and technology adoption in insurance, the existing literature remains fragmented across different technological and managerial perspectives. Existing research has mainly focused on specific applications, including fraud detection (Aslam et al., 2022), machine learning-based decision support (Rawat et al., 2021), and big data implementation (Sood et al., 2022). While these contributions provide valuable insights, a comprehensive understanding of the overall evolution, intellectual structure, thematic development, and future direction of digital transformation research in life insurance remains limited.

In particular, several important questions remain unanswered:

1. *How has digital transformation research in life insurance evolved over time?*
2. *Which researchers, countries, institutions, and journals have significantly contributed to this domain?*

3. What knowledge clusters and emerging themes characterize digital insurance decision-making research?

4. How are AI, machine learning, big data analytics, and digital platforms influencing decision processes?

5. What future research opportunities exist for improving customer decision quality through digital optimization?

Bibliometric analysis provides an appropriate methodology for addressing these questions because it enables systematic mapping of scientific development through publication trends, citation structures, collaboration networks, and thematic evolution. By analysing a large body of published literature, bibliometric approaches provide objective insights into the development and future trajectory of emerging research fields. Therefore, this study applies bibliometric analysis to investigate the scientific landscape of digital transformation and decision optimization in life insurance. The study contributes by integrating technological and behavioral perspectives, particularly emphasizing the relationship between digital innovation, cognitive load reduction, and customer decision quality.

1.5 Research Objectives and Questions

This study aims to achieve the following objectives:

1. To map the global research landscape of digital transformation applications in life insurance decision-making using bibliometric techniques.
2. To identify dominant knowledge clusters and thematic developments associated with InsurTech, artificial intelligence, digital platforms, and customer decision processes.
3. To evaluate the evolution of cognitive load-related perspectives in digital insurance environments and their influence on decision effectiveness.
4. To assess collaboration patterns among researchers, countries, and institutions in the field of digital insurance innovation.
5. To identify future research opportunities for enhancing customer-centric decision quality through digital optimization strategies.

Based on these objectives, the study addresses the following research questions:

RQ1: How has research on digital transformation in life insurance evolved over time?

RQ2: Which authors, journals, countries, and institutions have significantly contributed to this research domain?

RQ3: What are the major intellectual and thematic clusters shaping digital decision-making research in life insurance?

RQ4: How have emerging technologies such as AI, machine learning, big data analytics, and digital platforms influenced insurance decision processes?

RQ5: What future research directions can enhance decision quality by reducing cognitive burden in digital life insurance environments?

2. Methodology

2.1 Research Design and Bibliometric Approach

This study adopts a quantitative bibliometric research methodology to systematically examine the evolution, intellectual structure, and emerging trends in digital transformation and decision optimization research within the life insurance domain. Bibliometric analysis is an established approach for evaluating large volumes of scientific literature through statistical and network-based techniques, enabling researchers to identify publication trends, influential contributors, conceptual relationships, and future research directions (Aria & Cuccurullo, 2017; Donthu et al., 2021).

Unlike conventional literature reviews that rely primarily on qualitative interpretation, bibliometric methods provide a structured and reproducible framework for analysing scientific knowledge development. This approach is particularly suitable for the present study because research on digital transformation in life insurance is interdisciplinary, integrating concepts from insurance management, financial technology, artificial intelligence, information systems, consumer behaviour, and decision sciences. Therefore, bibliometric analysis allows the identification of knowledge clusters, thematic evolution, and collaboration patterns across this expanding research field. The study follows a science mapping framework consisting of three major analytical stages: (1) data collection and refinement, (2) bibliometric performance analysis, and (3) science mapping analysis. All bibliometric analyses were conducted using R Studio with the Bibliometrix package and its graphical interface Biblioshiny. Biblioshiny was selected because it provides a comprehensive environment for analysing scientific literature, including annual scientific production, source impact, author productivity, country collaboration, keyword co-occurrence, thematic evolution, and conceptual structure mapping (Aria & Cuccurullo, 2017).

2.2 Data Source and Search Strategy

The literature dataset was retrieved from the Scopus database, which was selected due to its extensive coverage of peer-reviewed journals, standardized citation information, and wide adoption in bibliometric studies. Scopus provides reliable metadata, including author information, affiliations, keywords, citations, and references, enabling comprehensive science mapping analysis.

A structured keyword-based search strategy was developed to capture research related to digital transformation, technological innovation, and decision-making processes in the life insurance sector. The search was performed using the TITLE-ABS-KEY field in Scopus to retrieve publications where the selected concepts appeared in the title, abstract, or author keywords.

The final Scopus search string was:

> *TITLE-ABS-KEY(("life insurance" OR "insurance industry" OR "insurance sector" OR InsurTech) AND ("digital transformation" OR "digitalization" OR "digital innovation" OR "artificial intelligence" OR "machine learning" OR "big data analytics" OR "automation" OR "digital platform*") AND ("decision making" OR "decision quality" OR "decision support" OR "customer experience" OR "consumer behavior" OR "cognitive load" OR "information overload")) AND PUBYEAR > 2000 AND (LIMIT-TO (LANGUAGE,"English"))*

The search strategy was designed using three conceptual dimensions. The first dimension represented the research context (life insurance and insurance sector). The second dimension captured technological transformation (digital transformation, artificial intelligence, machine learning, big data analytics, automation, and digital platforms). The third dimension focused on decision-related outcomes (decision-making, decision quality, decision support, customer experience, consumer behaviour, cognitive load, and information overload).

The publication period was restricted to studies published after 2000 to capture contemporary developments associated with digital transformation and technology-driven insurance innovation. Only English-language publications were included to maintain consistency and comparability of the analysed literature.

2.3 Data Collection and Screening Procedure

The bibliographic data required for this study were retrieved from the Scopus database using the predefined search strategy described in Section 2.2. The retrieved records were exported in CSV format with complete bibliographic information and cited references to facilitate comprehensive bibliometric analysis. The exported dataset contained essential metadata, including authorship details, article titles, abstracts, author keywords, indexed keywords, publication sources, publication years, institutional affiliations, citation information, and reference lists. These metadata elements provided the necessary foundation for evaluating publication performance, intellectual structures, collaboration patterns, and thematic developments within the research domain.

The downloaded Scopus dataset was subsequently imported into R Studio using the Bibliometrix package and analysed through the Biblioshiny web-based interface. Prior to analysis, data preprocessing and quality checks were performed to ensure the consistency and reliability of bibliographic records. The preprocessing stage involved verification of author names, standardization of keyword information, and examination of incomplete or duplicate records to minimize potential inconsistencies during subsequent analyses.

Following data refinement, the finalized dataset was subjected to descriptive performance analysis and science mapping procedures using Biblioshiny. The analytical workflow consisted of five sequential stages: (i) literature retrieval from Scopus, (ii) bibliographic data extraction, (iii) data cleaning and standardization, (iv) bibliometric performance and network analysis, and (v) interpretation of scientific trends and emerging research themes. This systematic approach ensured methodological transparency and enhanced the reproducibility of the bibliometric investigation.

2.4 Bibliometric Analysis Framework

The study employed two complementary bibliometric analysis approaches: performance analysis and science mapping analysis.

2.4.1 Performance Analysis

Performance analysis was conducted to evaluate the productivity and impact of the research domain. The following indicators were examined:

a) Annual scientific production and publication growth

b) Most productive journals and sources

c) Leading authors and their contributions

d) Country-wise scientific productivity

e) Citation impact and influential publications

These indicators provide an overview of how digital transformation research in life insurance has developed over time and identify the major contributors shaping the field.

2.4.2 Science Mapping Analysis

Science mapping techniques were applied to explore the intellectual and conceptual structure of the research field. The following analyses were conducted using Biblioshiny: *Keyword Co-occurrence Analysis*: Keyword analysis was performed to identify major research themes and relationships among concepts. This analysis helps reveal dominant topics such as artificial intelligence, digital transformation, decision support systems, InsurTech, and customer experience. *Co-authorship Analysis:* Co-authorship analysis was conducted to examine collaboration patterns among researchers and countries. This analysis identifies major research networks and the geographical distribution of scientific collaboration. *Citation and Co-citation Analysis:* Citation analysis was used to identify influential studies within the field, while co-citation analysis was applied to determine the intellectual foundations and knowledge structures underlying digital insurance research. *Thematic Mapping and Evolution Analysis*: Thematic mapping was performed to classify research themes based on centrality and density. This approach identifies basic themes, motor themes, emerging themes, and declining research areas. Thematic evolution analysis was used to examine how research priorities have shifted over time from traditional insurance processes toward digital intelligence, customer-centric solutions, and decision optimization.

2.5 Reliability and Reproducibility of the Study

To ensure methodological transparency and reproducibility, the study reports the complete Scopus search strategy, database selection, inclusion criteria, analytical software, and bibliometric procedures. The use of Scopus and Biblioshiny provides a standardized framework that allows future researchers to replicate the analysis and extend the investigation of digital transformation in insurance decision-making.

The methodological framework adopted in this study follows established recommendations for conducting bibliometric research proposed by Aria and Cuccurullo (2017) and Donthu et al. (2021), ensuring analytical rigor and alignment with contemporary bibliometric review standards.

3. Results and Discussion

3.1 Descriptive Overview of the Bibliometric Dataset

The bibliometric investigation was conducted on a Scopus-indexed dataset focusing on digital transformation and decision optimization in life insurance. The dataset comprises 249 documents published between 2005 and 2026 and retrieved from 192 scientific sources. The annual growth rate of 20.59% demonstrates the increasing academic interest in the integration of digital technologies, intelligent systems, and customer-oriented decision mechanisms within the insurance sector. The dataset represents a multidisciplinary research landscape involving insurance management, information systems, artificial intelligence, analytics, and decision sciences.

Table 1. Main information of the bibliometric dataset.

Bibliometric Indicator	Value
Timespan	2005–2026
Sources	192
Documents	249
Annual Growth Rate	20.59%
Authors	707
Countries	61

Source: Biblioshiny analysis of Scopus records.

3.2 Annual Scientific Production and Research Growth

The annual scientific production analysis reveals the progressive development of digital transformation research in life insurance. Although publication activity remained limited during the early period, research output increased substantially in recent years, reflecting accelerated adoption of artificial intelligence, machine learning, big data analytics, automation, and digital platforms in insurance applications. The increasing publication trend indicates that digitalization has moved beyond operational improvement and has become a strategic research area concerned with improving decision processes, customer experience, and intelligent insurance services.

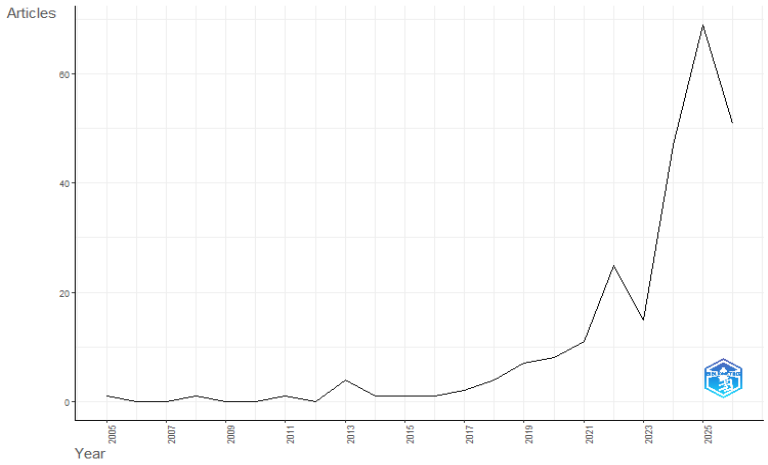


Figure 1. Annual scientific production trend in digital transformation and life insurance research.

Source: R studio's Biblioshiny analysis of Scopus dataset.

3.3 Most Relevant Sources and Publication Outlets

Source productivity analysis reveals that research on digital transformation in insurance is distributed across interdisciplinary publication outlets covering technology management, artificial intelligence, data analytics, and insurance innovation. The most productive source was Smart Innovation, Systems and Technologies, contributing eight documents, followed by AI-Powered Insurance: Exploring New Frontiers and Lecture Notes in Networks and Systems, each contributing six documents. The dominance of technology-oriented publication outlets indicates that digital insurance transformation is strongly connected with emerging computational approaches. Several productive sources focus specifically on artificial intelligence, big data analytics, and InsurTech applications, highlighting the increasing integration of advanced technologies with insurance decision processes. The presence of conference proceedings and edited academic volumes among the leading sources suggests that the research field is still developing and that emerging technological concepts are frequently introduced through interdisciplinary scientific platforms before becoming established journal-based research streams.

Table 2. Most relevant sources contributing to digital transformation and insurance research

Source	Articles
Smart Innovation, Systems and Technologies	8
AI-Powered Insurance: Exploring New Frontiers	6
Lecture Notes in Networks and Systems	6
Data Alchemy in Insurance: Revolutionizing the Insurance Industry Through Big Data Analytics	5
Data Alchemy in the Insurance Industry: The Transformative Power of Big Data Analytics	5

Source: Biblioshiny analysis of Scopus dataset.

3.4 Author Productivity and Scientific Contribution

The author productivity analysis indicates that research contributions are distributed among a large number of scholars, reflecting the multidisciplinary and expanding nature of the field. Among the most productive authors, Kukreti M and Taneja S ranked highest, each contributing four publications. Other active contributors included Baranauskas G, Das S, Grima S, Mishra KK, and Norikumo S, each contributing three publications.

The diversity of contributing authors demonstrates that digital transformation in life insurance is not confined to a single academic discipline. Instead, researchers from management, computer science, financial technology, analytics, and insurance studies are collectively contributing to the development of this research domain.

The presence of authors with expertise in artificial intelligence, data analytics, and financial innovation further confirms that contemporary insurance research is increasingly dependent on interdisciplinary collaboration. This collaboration is essential for addressing complex challenges involving technology implementation, customer behaviour, decision support, and digital trust.

Table 3. Most productive authors in digital transformation and life insurance research

Author	**Publications**
Kukreti M	4
Taneja S	4
Baranauskas G	3
Das S	3

Grima S	3
Mishra KK	3
Norikumo S	3

Source: Biblioshiny analysis of Scopus dataset.

3.5 Country Productivity and Global Research Distribution

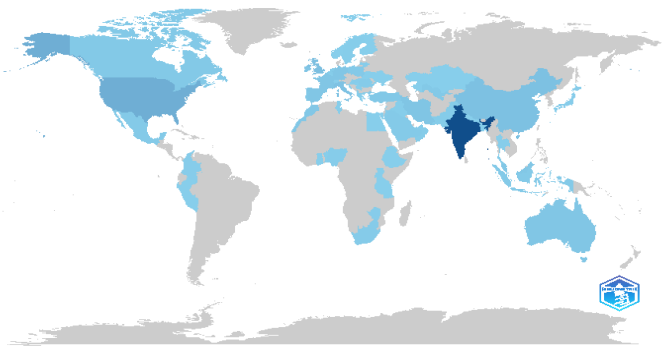
Country-level analysis demonstrates significant international participation in digital transformation research within the insurance sector. India emerged as the most productive country with 178 publications, followed by the United States (42 publications), the United Kingdom (20 publications), China (18 publications), and Italy (16 publications). The dominant contribution of India reflects the increasing importance of digital financial services, technology adoption, and insurance innovation within emerging economies. Rapid digital infrastructure development and increasing demand for technology-enabled financial solutions have encouraged substantial academic attention toward digital insurance transformation. Developed economies, including the United States, United Kingdom, Italy, France, and Germany, also demonstrate strong participation, reflecting their established insurance markets and advanced adoption of artificial intelligence, analytics, and automated decision-support systems. Although India produced the highest number of publications, citation impact reveals a different pattern. France achieved the highest total citations (160 citations) and the highest average citation impact (53.3 citations per article), indicating that research influence is not solely determined by publication quantity but also by scientific contribution and research quality.

Table 4. Leading countries by scientific production

COUNTRY	DOCUMENTS
India	178
Usa	42
Uk	20
China	18
Italy	16
Iran	13
Ireland	12
Australia	11
France	11
Germany	11

Source: Biblioshiny analysis of Scopus dataset.

Figure 2. Global distribution of scientific production in digital insurance research



Source: R studio's Biblioshiny analysis of Scopus dataset.

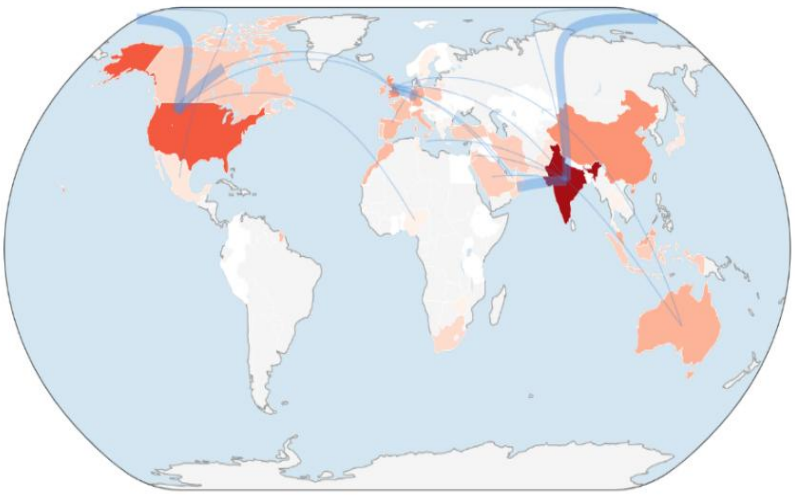
3.6 Most Cited Countries and Research Influence

Citation analysis provides additional insight into the scientific influence of different countries. While publication productivity highlights research volume, citation analysis reflects the academic impact and recognition of published contributions. France recorded the highest citation impact with 160 total citations, followed by India with 128 citations, Italy with 80 citations, and the United Kingdom with 76 citations. Saudi Arabia also demonstrated notable influence with 69 citations despite a relatively smaller publication contribution. These findings suggest that research influence within digital insurance transformation is shaped by both technological advancement and the quality of scientific contributions. Countries producing fewer but highly impactful studies may significantly influence theoretical development and methodological approaches within the field.

3.7. Country Scientific Production and International Collaboration Network

The country-level scientific production and collaboration analysis reveal the global distribution and cooperative structure of research on digital transformation and decision optimization in life insurance. The collaboration network generated through Biblioshiny demonstrates that research activity is concentrated primarily across **Asia, North America, and Europe**, with India, the United States, the United Kingdom, China, Italy, France, and Australia emerging as major contributors. India represents the most productive country in terms of publication output, reflecting the increasing importance of digital financial services, artificial intelligence adoption, and technology-driven insurance innovation in emerging economies. The United States exhibits strong international connectivity, supported by its advanced research ecosystem in artificial intelligence, financial technology, analytics, and insurance applications. European countries, including the United Kingdom, France, Italy, and Germany, contribute significantly through research on digital transformation strategies, regulatory perspectives, risk management, and customer-oriented insurance innovation. China also demonstrates an important role, particularly in areas related to artificial intelligence, big data analytics, and digital platforms for financial services. Although the collaboration network indicates increasing globalization of digital insurance research, scientific contributions remain unevenly distributed, with limited representation from regions such as Africa and South America. This geographical imbalance highlights opportunities for future collaborative research, particularly in developing economies where digital insurance solutions may enhance financial inclusion and improve access to insurance services. Overall, the collaboration structure confirms that digital transformation in life insurance is evolving as an interdisciplinary and internationally connected research domain, requiring integration of expertise from artificial intelligence, financial technology, behavioural decision science, and insurance management to develop more effective and customer-centric digital insurance ecosystems.

Figure 3. International Collaboration Network



Source: R studio's Biblioshiny analysis of Scopus dataset.

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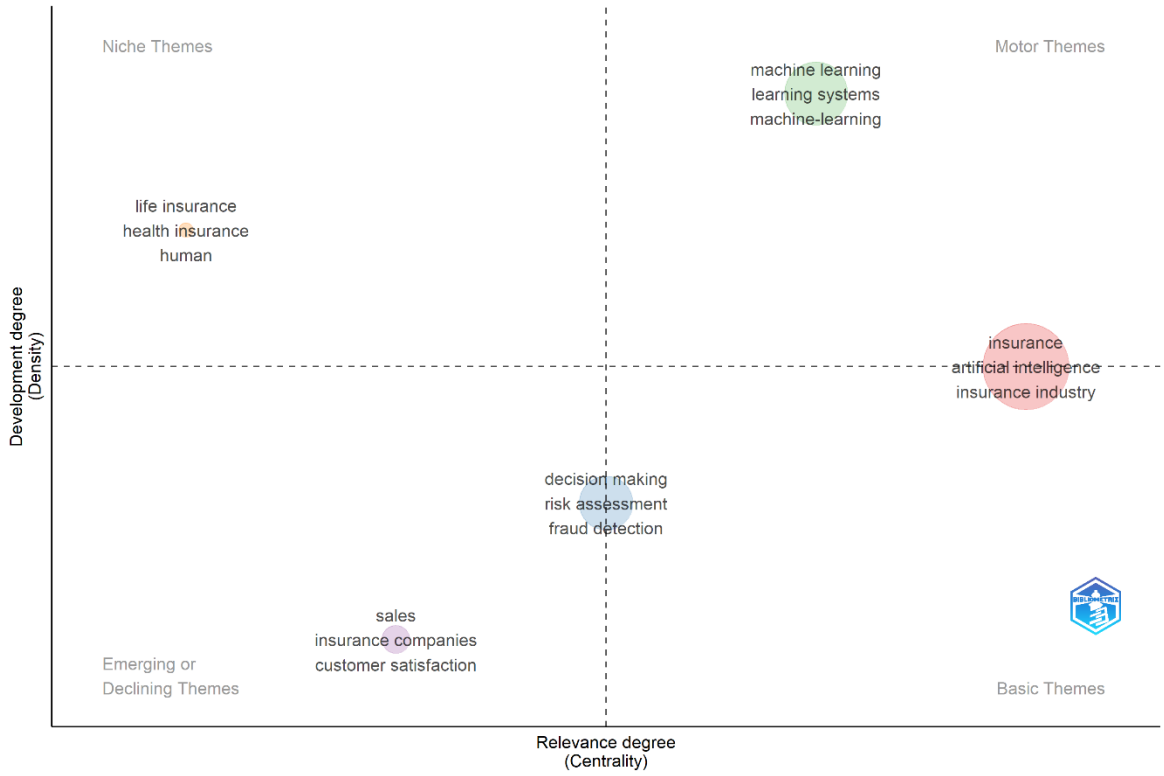
3.8 Thematic Mapping and Evolution of Research Themes

The thematic map analysis was conducted using Biblioshiny to identify the conceptual structure and developmental position of major research themes within the domain of digital transformation and decision optimization in life insurance. The thematic map classifies research themes according to two dimensions: centrality, representing the degree of relevance and interaction of a theme with the overall research field, and density, indicating the level of internal development and maturity of the theme. Based on these dimensions, themes are categorized into four quadrants: motor themes (high centrality and high density), basic themes (high centrality and low density), niche themes (low centrality and high density), and emerging or declining themes (low centrality and low density).

Figure 4. Thematic map of research themes in digital transformation and decision optimization in life insurance



Source: R studio's Biblioshiny analysis of Scopus dataset.

The thematic structure reveals that machine learning represents a prominent motor theme within the research domain. Located in the upper-right quadrant, machine learning demonstrates both high centrality and high density, indicating that it is a well-developed and highly connected research area. The cluster includes related terms such as *machine learning*, *machine-learning*, and *learning systems*, highlighting the increasing importance of intelligent computational approaches in insurance applications. This finding indicates that contemporary insurance research is increasingly focused on predictive modelling, automated decision processes, risk evaluation, and data-driven service optimization. The strong position of machine learning as a motor theme reflects the transition of insurance research from traditional statistical approaches toward advanced analytical and intelligent decision-support frameworks.

The second important motor/basic transition theme is represented by insurance, artificial intelligence, and insurance industry, positioned near the boundary between motor and basic themes. The cluster exhibits high centrality (Callon centrality = 21.405 for insurance) and substantial thematic development (Callon density = 68.485), indicating that these concepts form the foundational knowledge structure of the field. Artificial intelligence has become strongly associated with insurance transformation by enabling automated underwriting, fraud detection, customer profiling, risk assessment, and personalized insurance recommendations. The positioning of these themes demonstrates that digital transformation is no longer considered an isolated technological innovation but rather a core strategic capability influencing the entire insurance value chain.

The basic themes quadrant contains research areas that are highly relevant to the field but comparatively less internally developed. The cluster associated with decision making, risk assessment, and fraud detection represents such a theme. Decision making demonstrates considerable relevance (centrality = 13.245) and a high frequency of occurrence (342 occurrences), confirming its importance in insurance research. However, its relatively lower density compared with machine learning suggests that the theme still provides substantial opportunities for theoretical and methodological development. This positioning is particularly relevant to the present study because decision quality represents a central outcome of digital optimization strategies. The findings indicate that while digital technologies are increasingly applied to improve insurance decisions, further research is required to understand how these technologies influence human decision processes, information interpretation, and customer confidence.

The niche themes quadrant includes life insurance, health insurance, and human-related aspects. These themes demonstrate relatively high density but lower centrality, suggesting that they are internally developed but less connected with broader digital transformation research streams. The life insurance cluster shows a density value of 73.128 but comparatively lower centrality (5.176), indicating that life insurance-specific studies have developed specialized knowledge but remain insufficiently integrated with emerging digital technology discussions. This finding highlights an important research gap: although life insurance is characterized by complex consumer decisions and high information requirements, the integration of digital optimization, artificial intelligence, and cognitive decision perspectives remains underexplored.

The lower-left quadrant represents emerging or declining themes, where themes have lower centrality and density. The cluster consisting of sales, insurance companies, and customer satisfaction is positioned within this category. These themes have relatively lower development indicators (sales density = 64.808; centrality = 9.815), suggesting that traditional customer relationship and service-oriented perspectives are gradually being replaced or extended by technology-driven approaches. However, these themes remain important because customer satisfaction and sales effectiveness are increasingly influenced by digital customer experiences, personalized recommendations, and automated advisory systems.

The thematic analysis also provides insights into the evolution of insurance research toward more intelligent and customer-centric models. Traditional themes such as sales and insurance companies are gradually being connected with advanced digital concepts, while emerging themes such as machine learning and artificial intelligence are becoming central drivers of research development. This evolution reflects a broader transformation from conventional insurance service models toward digitally enabled decision ecosystems.

From the perspective of the present study, the thematic map highlights a significant research opportunity at the intersection of artificial intelligence, machine learning, decision-making, and cognitive load reduction. Although machine learning and artificial intelligence have achieved strong thematic development, limited integration is observed between these technological themes and human cognitive aspects of insurance decision-making. Future research should therefore focus on developing explainable and customer-oriented digital insurance systems that not only improve analytical accuracy but also reduce information complexity and enhance decision quality.

Table 5. Thematic clusters and their bibliometric indicators

Theme Cluster	Centrality	Density	Frequency	Thematic Interpretation
Insurance	21.405	68.485	849	Foundational theme representing the insurance research domain
Machine learning	17.123	82.770	444	Motor theme driving AI-based insurance transformation
Decision making	13.245	68.302	342	Basic theme related to decision optimization and risk evaluation
Sales	9.815	64.808	165	Emerging customer/service-oriented theme
Life insurance	5.176	73.128	114	Specialized niche theme requiring integration with digital innovation

Source: Biblioshiny thematic map analysis of Scopus dataset.

3.9 Conceptual Structure and Emerging Research Themes

Keyword and thematic analysis were conducted to identify the dominant conceptual directions within digital transformation and life insurance research. The results indicate that the field has developed around several interconnected themes, including decision support systems, insurance markets, decision-making, knowledge management, artificial intelligence, big data analytics, and customer-oriented digital services.

Among the most frequently occurring themes, decision support systems represented a major research focus, appearing with a frequency of 22 occurrences. This highlights the growing importance of intelligent systems capable of assisting complex insurance decisions. Similarly, life insurance, big data, and insurance companies emerged as important themes, demonstrating increasing attention toward technology-enabled insurance ecosystems.

The prominence of decision-related themes indicates a shift from technology adoption alone toward understanding how digital solutions influence decision effectiveness. Researchers are increasingly investigating how artificial intelligence, analytics, and digital platforms can improve information processing, reduce uncertainty, and enhance customer experience.

Table 5. Major trending research topics identified through Biblioshiny

Research Theme	Frequency	Median Year
Decision support systems	22	2023
Life insurance	25	2024
Big data	23	2024
Insurance companies	17	2023
Commerce	13	2023
Decision-making	5	2022
Insurance markets	6	2022
Knowledge management	5	2022

Source: Biblioshiny thematic trend analysis

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3.10. Cognitive Load Reduction and Customer Decision Quality Perspective

The thematic and conceptual findings of this bibliometric study reveal that research on digital transformation in life insurance is increasingly moving toward intelligent decision-support systems, artificial intelligence, machine learning, and customer-oriented digital solutions. However, the analysis also highlights a relatively limited integration between technological innovation and the cognitive aspects of insurance decision-making. This represents an important research opportunity because life insurance decisions involve considerable information complexity, uncertainty, and long-term financial consequences. Customers are required to evaluate multiple policy features, risk conditions, premiums, benefits, and future expectations, which may increase cognitive burden and negatively influence decision effectiveness.

Cognitive Load Theory provides an important theoretical foundation for understanding how digital optimization can improve insurance decision processes. According to Sweller (1988), human cognitive capacity is limited, and excessive information complexity can reduce the ability of individuals to process, understand, and apply information effectively. In the context of life insurance, complex policy structures and extensive financial information may create information overload, making it difficult for customers to compare alternatives and select suitable products. Therefore, digital transformation should not only focus on improving operational efficiency but also on designing decision environments that reduce unnecessary cognitive effort.

The increasing prominence of decision-support systems identified in the thematic analysis indicates a shift toward technology-assisted decision-making. Artificial intelligence, machine learning, and big data analytics provide opportunities to transform complex insurance information into meaningful insights through prediction, personalization, and automated recommendations. Previous research has demonstrated that AI-driven approaches can enhance insurance processes by improving risk assessment, fraud detection, and decision accuracy (Aslam et al., 2022). Similarly, big data analytics enables insurers to identify customer patterns, develop personalized services, and improve decision-support capabilities (Sood et al., 2022). However, the effectiveness of digital insurance solutions depends not only on analytical capability but also on their ability to support human understanding. Explainable artificial intelligence (XAI) has therefore emerged as an important direction for improving transparency and trust in automated decision systems. While machine learning models may provide highly accurate predictions, customers and insurance professionals require understandable explanations regarding how recommendations or decisions are generated. Transparent AI systems may reduce uncertainty, improve acceptance, and enhance customer confidence in digital insurance environments (Arrieta et al., 2020). Personalization represents another important mechanism through which digital optimization can reduce cognitive burden. By analysing customer characteristics, financial preferences, and risk profiles, intelligent insurance platforms can provide customized recommendations rather than presenting customers with complex and generic product information. Such approaches may improve decision quality by reducing irrelevant information and directing customer attention toward suitable alternatives.

Therefore, the integration of digital transformation with cognitive perspectives provides a more comprehensive understanding of insurance innovation. The future development of digital insurance ecosystems should move beyond technology adoption and focus on creating human-centered systems where artificial intelligence, analytics, and digital platforms enhance customer comprehension, reduce cognitive overload, and support informed decision-making.

4. Future Research Agenda

The bibliometric findings demonstrate that digital transformation in life insurance is evolving rapidly, with artificial intelligence, machine learning, decision-support systems, and digital platforms emerging as dominant research themes. However, several knowledge gaps remain, particularly regarding the integration of technological innovation with customer cognition, trust, ethics, and decision effectiveness. Based on the identified thematic structures and emerging research directions, the following future research opportunities are proposed.

4.1 Explainable AI in Life Insurance Decisions

Although machine learning and artificial intelligence appeared as highly developed motor themes in the thematic analysis, future research should investigate how explainable AI can improve transparency and acceptance of automated insurance decisions. Current AI-based systems are increasingly used for underwriting, risk assessment, customer profiling, and personalized recommendations; however, many advanced models operate as "black boxes," limiting users' understanding of decision processes. Future studies should examine how explanation mechanisms influence customer trust, perceived fairness, and acceptance of AI-supported insurance services. Research should also investigate the balance between predictive accuracy and interpretability, particularly in sensitive areas such as life insurance where decisions directly affect financial security and long-term planning. Developing transparent AI frameworks may enhance confidence among both customers and insurance professionals (Arrieta et al., 2020).

4.2 Human-Centered Digital Insurance Systems

The thematic analysis identified decision-making and decision-support systems as important research areas, indicating increasing attention toward technology-enabled decision processes. However, future research should place greater emphasis on human-centered digital insurance design. Digital platforms should not only provide faster services but also improve customer understanding and reduce cognitive complexity. Future studies should investigate cognitive load measurement approaches within digital insurance interfaces, including how information presentation, visual design, recommendation systems, and interactive tools influence customer decisions. Research integrating cognitive psychology, behavioural economics, and information systems can provide deeper insights into how digital environments affect customer confidence and decision quality.

Furthermore, user experience research should explore how different customer groups respond to digital insurance platforms. Factors such as age, digital literacy, financial knowledge, and previous technology experience may influence technology acceptance and decision outcomes.

4.3 Ethical and Responsible AI Adoption

The increasing reliance on AI and big data analytics introduces important ethical challenges related to privacy, algorithmic bias, transparency, and fairness. Insurance decisions often involve sensitive personal and financial information; therefore, responsible data management and ethical AI governance are critical. Future research should investigate mechanisms for ensuring fairness in automated underwriting and recommendation systems. Studies should examine whether AI-based insurance models unintentionally disadvantage specific customer groups due to biased training data or unequal access to digital technologies. Additionally, regulatory frameworks should be explored to ensure that digital insurance innovation develops within responsible and trustworthy boundaries.

4.4 Emerging Market Digital Insurance Adoption

The country collaboration analysis demonstrates strong contributions from countries such as India, the United States, China, and European economies, while several developing regions remain comparatively underrepresented. Future research should therefore examine digital insurance adoption in emerging markets, where technological innovation may contribute significantly to improving insurance accessibility and financial inclusion. Research should investigate how factors such as digital infrastructure, financial literacy, trust, affordability, and regulatory environments influence adoption of digital insurance services. Comparative studies between developed and developing economies could provide valuable insights into how digital transformation strategies should be adapted according to regional conditions.

5. Theoretical and Practical Implications

5.1 Theoretical Implications

This study contributes to existing knowledge by integrating digital transformation research with decision science and cognitive perspectives within the life insurance context. The bibliometric findings demonstrate that digital

insurance research has evolved from traditional operational perspectives toward intelligent, customer-oriented decision ecosystems. This evolution extends digital transformation theory by highlighting that successful technology adoption depends not only on technological capability but also on the ability of digital systems to improve human decision processes.

From the perspective of cognitive load theory, this study emphasizes the importance of designing digital insurance environments that reduce unnecessary information complexity. While previous digital transformation studies have primarily focused on efficiency, automation, and innovation, this research highlights the importance of cognitive support as a critical component of digital service design. Integrating cognitive load theory with digital transformation perspectives provides a stronger theoretical explanation of how technology can enhance decision quality. The findings also contribute to decision science by emphasizing the role of intelligent decision-support systems in improving information processing and reducing uncertainty. The increasing prominence of AI, machine learning, and decision-support themes indicates that future insurance research should consider the interaction between algorithmic intelligence and human judgement. Furthermore, the study contributes to technology adoption research by highlighting the importance of trust, transparency, and explainability in digital insurance environments. Technology acceptance is not determined only by system usefulness but also by customer confidence in automated decision processes.

5.2 Managerial Implications

The findings provide several practical implications for insurance organizations. First, insurers should invest in AI-based advisory systems that assist customers in understanding complex insurance products and selecting appropriate coverage options. Rather than replacing human decision-making, intelligent systems should function as decision-support mechanisms that improve customer comprehension and confidence. Second, insurers should focus on developing personalized insurance platforms using big data analytics and machine learning. Customized recommendations based on customer profiles, financial objectives, and risk characteristics can improve customer experience and reduce information overload. Third, digital insurance interfaces should be designed with simplicity and accessibility in mind. Complex information presentation may increase cognitive burden, whereas clear visualization, interactive tools, and personalized recommendations can improve customer decision quality. For policymakers and regulatory authorities, the findings emphasize the importance of establishing appropriate governance frameworks for AI-driven insurance systems. Regulations should address data privacy, algorithmic transparency, fairness, and consumer protection while supporting technological innovation.

6. Conclusion

This bibliometric study provides a comprehensive assessment of the intellectual development, conceptual structure, and emerging trends in digital transformation and decision optimization research within the life insurance sector. Based on Scopus-indexed publications analysed through Biblioshiny, the study demonstrates significant growth in scholarly interest, driven by advances in artificial intelligence, machine learning, big data analytics, and digital platforms. The findings reveal that digital insurance research has evolved from traditional insurance management perspectives toward intelligent and customer-centric decision ecosystems. Machine learning and artificial intelligence emerged as major motor themes, while decision-making and decision-support systems represented important foundational areas. The thematic evolution indicates increasing recognition of technology-enabled approaches for improving insurance efficiency, personalization, and customer experience. A key contribution of this study is the identification of cognitive load reduction as an important future research perspective. Although digital technologies provide powerful analytical capabilities, their effectiveness depends on their ability to simplify complex information environments and support human decision-making. Integrating cognitive perspectives with digital transformation research provides new opportunities for developing more accessible and effective insurance systems. The study also identifies several future research directions, including explainable AI, human-centered digital insurance design, ethical AI governance, and digital insurance adoption in emerging markets. These areas represent important opportunities for advancing both theoretical understanding and practical implementation of digital insurance innovation. Despite its contributions, this study has some limitations. The analysis was based only on Scopus-indexed English-language publications, which may exclude

relevant studies from other databases or languages. Additionally, bibliometric methods identify research patterns but cannot provide detailed causal explanations of technological impacts on customer behaviour. Future studies may therefore combine bibliometric insights with empirical investigations, surveys, and experimental approaches.

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Data Availability Statement

The bibliographic records analysed in this study were retrieved from Scopus using the reported search strategy. The dataset was processed and analysed using R Studio Bibliometrix and Biblioshiny. The methodological details provided in this article support the reproducibility of the analysis.

Conflict of Interest

The authors declare that there are no conflicts of interest related to this research.

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