An Analytical Framework for Evaluating the Impact of Digital Transformation Technologies on Business Performance: A Natural Language Processing Approach

Iman Raeesi Vanani*

*Corresponding author, Associate Prof., Department of Information Technology and Operations Management, Faculty of Management and Accounting, Allameh Tabataba'i University, Tehran, Iran. E-mail: imanrv@gmail.com

Mohammad Amin Yalpanian

Master of Information Technology Management, Advanced Information Systems, Faculty of Management and Accounting, Allameh Tabataba'i University, Tehran, Iran. E-mail: m_yalpanian@atu.ac.ir

Mohammad Taghi Taghavifard

Prof., Department of Information Technology and Operations Management, Faculty of Management and Accounting, Allameh Tabataba'i University, Tehran, Iran. E-mail: taghavifard@atu.ac.ir

Yasaman Tahmaseby

Master of Information Technology Management, Advanced Information Systems, Faculty of Management and Accounting, Allameh Tabataba'i University, Tehran, Iran. E-mail: yasaman_tahmasbi@atu.ac.ir

Abstract

Extensive technological advancements have highlighted the importance of digital transformation in improving business performance. While prior research on this topic has been done in the information systems and business management domains, it has been limited to specific areas. Therefore, it is crucial to evaluate the impact of digital transformation comprehensively. This research aims to systematically identify critical themes, significant

topics, main concepts, and trend priorities. The study involved the analysis of 474 research papers from 2015 to 2024 from reputable databases such as SCOPUS, Web of Science, and IEEE Xplore. First, thematic analysis identified the main themes and interpreted their relationships. Identified themes refer to technological changes at the operational and strategic levels through data analytics, digitalization, collaborative learning, and digital interaction. Realizing that digital transformation leads to value creation, improved service quality, customer experience, and long-term communication in digital ecosystems. These findings were related to dynamic capability theory concepts and compared with theory constructs like sensing, seizing, and transforming. Next, text mining techniques were used for deeper investigation, including word cloud, topic modeling (Latent Dirichlet Allocation), and text clustering (K-means). Findings were categorized into three perspectives: business, customer, and systemic, highlighting the influential role of digital technologies, particularly artificial intelligence (AI) capabilities. Moreover, trend analysis presented research priorities using VOSviewer. Finally, research innovation involved designing thematic networks and examining the relevance of significant topics as a research artifact with subtle differences compared to the conducted research. This novel approach provides five targeted propositions to audiences for future research.

Introduction

In recent decades, the industrial world has been transforming into the digital world (Schmitt, 2023). Moreover, the threefold increase in research published in recent years shows the interest of academics and industries (Müller et al., 2024). Digital transformation is defined as integrating digital technology into every aspect and operation of businesses, which leads to fundamental and infrastructural changes in performance, service provision, and customer value (Vial, 2019). Digital transformation changes services, products, operations, and processes, which can lead to changes in business models (Chatterjee et al., 2022). Therefore, regardless of their kind and scale, businesses should adapt or replace their current potential and capability to align with the new digital processes (Horváth & Szabó, 2019).

Digital technologies also enable businesses to keep in contact with their customers in offline and online touchpoints and move towards digital interactions (Buhalis & Volchek, 2021). Therefore, it seems crucial to comprehend how effective digital technologies are in improving customer experience and what new values, applications, and benefits they create (Gong & Ribiere, 2021). When digital technology potentials are appropriately recognized, it plays an essential role in customer orientation, which is one of the top priorities of B2C businesses (Terho et al., 2022).

Digital transformation technology development is a strategic action that significantly impacts various units of modern businesses (Heshmatisafa & Seppänen, 2023). This leads to added value and revision in business structures and operations (Peng & Tao, 2022). These changes may not be straightforward, and businesses must use digital technologies, especially artificial intelligence (AI) and machine learning (ML), as a potential opportunity to identify future challenges and provide efficient solutions (Fernández-Rovira et al., 2021). Digital technologies fill the gap between the digital world and the physical one and develop intelligent automation (IA), flexibility, and optimization of processes (Vuchkovski et al., 2023).

Digital transformation involves much more than just implementing new technologies. It is a comprehensive process that affects all business areas. Despite the potential benefits, scientific research has shown that almost 84% of digital transformation efforts fail to meet their expectations. Therefore, businesses must carefully plan and monitor the effects of their digitalization processes (Facchini et al., 2022). This is particularly important given that over 80% of CEOs have reported implementing digital transformation initiatives and predict that digital technologies will account for over 70% of newly added value in the industry economy by 2030 (Gökalp & Martinez, 2021). However, digital transformation is a complex process that requires significant changes across various business sectors and presents a challenge or even a threat to their survival.

Recognizing the advantages of digital technology developments presents a unique opportunity to enhance digital capabilities and bring about effective changes to realize digital transformation in business (Buck et al., 2023). However, due to the ever-growing trend of technological advancements, there is often a gap between the current state of business and the latest digital capabilities (Verhoef et al., 2021). This emphasizes the importance of examining the relationship between digital transformation technologies and business performance, making it a significant research priority in the information systems and business management domain, especially in the era of Industry 4.0 (Oduro et al., 2023).

Despite extensive research highlighting the increasing importance of digital transformation and the recent emphasis from researchers on the necessity for businesses to adapt to digital technologies, there is still an incomplete understanding of how these technologies affect business performance (S. Li et al., 2023). Most studies that employ text mining and ML techniques concentrate on specific domains. Thus, there is a scientific need for a comprehensive and integrated framework to evaluate the effects of digital transformation on business performance (Kraus et al., 2022). Therefore, conducting a systematic literature review is crucial to gaining deep insight for researchers and specialists (Oludapo et al., 2024). This research examines how digital transformation impacts business as a continuous process by effectively utilizing digital technologies (Ding et al., 2024). This approach allows for creating new digital capabilities based on future requirements and is distinguished by digital

technology development, which focuses on adding value through implementing digital technologies (Wan et al., 2023).

Also, digital transformation refers to an organizational shift propelled by digital technologies, enabling businesses to recognize valuable and unique internal and external resources. However, most academic articles primarily focus on the direct relationship between digital transformation and business performance and its broader impacts and structural changes at the macro level. They pay less attention to a detailed evaluation of how digital transformation influences business performance (Y. Zhang et al., 2023). This research represents a significant step toward addressing the gap in understanding digital transformation technologies by utilizing a hybrid approach that combines thematic analysis and advanced text analytics. This method facilitates a comprehensive examination of article content and assesses the increasing impact of digital transformation across various industries. Also, the proposed model extracts insights from hidden patterns within the articles, providing valuable assistance to researchers, managers, and decision-makers in identifying emerging trends and making informed strategic choices because recent articles indicate that digital transformation allows businesses to quickly adapt to market changes, resulting in businesses that effectively utilize these digital technologies becoming more agile and innovative (Songkajorn et al., 2022).

The innovative aspect of this research is that it uses these three methods to automatically extract information and identify patterns and key concepts from a large amount of information. Thematic analysis helps to accurately understand and investigate the relationships between the main themes, providing more in-depth interpretations of the articles' texts (Costa Silva et al., 2022). In addition, text mining helps extract hidden patterns from research literature and review major topics that traditional methods cannot easily identify (Hai et al., 2023). Additionally, trend analysis investigates the relationship between crucial research topics and future trends and highlights this research field for audiences (Yan et al., 2022).

This study employs Scopus and WoS databases as the primary sources for the systematic literature review. These databases provide comprehensive insight into authoritative scientific articles from various research fields and are widely recognized for evaluating scientific literature. Additionally, the inclusion of IEEE Xplore enhances this study by offering high-quality, specialized sources that provide valuable insights into the impact of digital technologies on business performance.

IEEE Xplore is a crucial reference for contemporary research related to digital technologies. It adds depth to existing studies by incorporating technology-based perspectives on how new technologies affect business productivity and efficiency. This multifaceted approach ensures that research from these databases strengthens systematic review, leading to

a deeper understanding and the generation of new knowledge in both technological and practical fields.

The main themes are identified, and their relationships are determined. Findings are interpreted based on the three constructs of dynamic capability theory (sensing, seizing, and transforming). Dynamic capability theory is chosen as it is widely applicable in digital transformation research and helps understand and integrate external and internal competencies to challenge the current business situation. The constructs are compared with the extracted themes to design a model that provides this research artifact. It can be used as a suggested approach in other research for a more detailed understanding of this issue.

Furthermore, the word cloud helps to identify the most frequently used words. Next, the LDA algorithm is used to extract significant topics, one of the most common techniques for topic modeling. After that, tags are assigned to each word group to differentiate the highlighted topics from other findings. Following this, critical components are extracted using abstract clustering to identify the most widely used concepts in this field. Finally, the VOSviewer software analyzes the most critical research trends. These findings address the four questions that were raised.

RQ1: What are the significant themes related to the effectiveness of digital technology development that provide solutions for realizing digital transformation on business performance improvement?

RQ2: What are the significant topics related to the impact of digital technology development that present valuable opportunities to realize digital transformation on business performance improvement?

RQ3: What are the commonly used components related to the impact of digital transformation development to improve business performance?

RQ4: What is the upcoming trend analysis regarding the impact of digital transformation technologies on business performance improvement?

In this research, Section 2 gives an overview of digital transformation concepts and the applications of digital technologies in business transformation. Section 3 explains the design science methodology and the steps to conduct this study. Section 4 analyzes the findings obtained from the three methods mentioned. Section 5 explores the relationship between findings and implications of digital transformation in business by presenting five propositions. Finally, Section 6 provides conclusions and suggestions for future research.

Literature Review

The Role of Digital Transformation in Business Performance

In the fast-changing landscape of businesses, digital transformation is considered a turning point for performance improvement (Meena et al., 2023). Accepting digital transformation is an ongoing and dynamic process, and not limited to a separate operation (Fischer et al., 2020). This transformation is a strategic change based on creating value for the business and the customer (Costa Climent & Haftor, 2021). In other words, digital transformation is an organizational reform based on digital technology capabilities. Digital transformation is defined as the integration of various digital technologies, such as AI, IoT, Industry 4.0, digital platforms, blockchain, robotic process automation (RPA), big data, social media, and cloud computing (Usai et al., 2021). This transformation leads to infrastructural changes (AlNuaimi et al., 2022). Digital technologies accelerate processes, automate tasks, and advance data analytics (Hung et al., 2023), enhance collaborative learning (Zabolotna et al., 2023), and increase digital interaction. Making changes promotes digital capabilities in supply chains, digital servitization, product design, and development (Deepu & Ravi, 2023), human resources, change management, mitigating risk, inventory monitoring, quality control, dynamic pricing, demand forecasting, sales and digital marketing, creating a digital ecosystem, new revenue models, and increased agility (Skare et al., 2023). Published statistics indicate that global investment in digital technology development for manufacturing and service businesses is expected to experience rapid growth from 2021 to 2025, with a projected compound annual growth rate of 16.6% (Tian et al., 2023).

Digital transformation can be divided into operational and strategic levels (Yu et al., 2022). Operational digital transformation involves the impact of digital technologies on various business processes, such as accelerating new product design, improving service quality, increasing efficiency, optimizing production lines, and reducing costs (L. Li et al., 2022). On the other hand, strategic digital transformation focuses on identifying new business opportunities and determining long-term goals by reviewing business structures and models (Höyng & Lau, 2023). However, digital transformation is not a simple project that can be designed and implemented quickly within a planned time frame. It is a continuous and complex process (Otay et al., 2023). This transformation involves identifying emerging digital technologies and evaluating their application (Yuan & Pan, 2023), implementing selected technologies to achieve desired goals, and developing digital capabilities to realize the desired landscape (Saeedikiya et al., 2024).

Proposed concepts based on dynamic capability theory aim to help businesses become more adaptable to technological changes and better utilize strategic resources. This theory consists of three constructs: sensing, seizing, and transforming (Magistretti et al., 2021). Sensing involves identifying new digital opportunities, exploring emerging technologies, and

investigating potential threats. Seizing involves evaluating the digital impact on existing capabilities and determining how businesses effectively utilize digital technologies. Lastly, aligning internal and external resources transforms business performance and enhances digital capabilities (Karadağ et al., 2024).

The Importance of AI in Business Transformation

AI is a widely used digital technology that can analyze large amounts of data from various sources, such as sales, customer information, IoT sensors, production lines, and inventory management (Heimberger et al., 2024). It can automate routine and rule-based operations, leading to faster and more accurate processes (Asatiani et al., 2023). As a result, this allows human resources to focus on more complex and value-adding activities (Thainimit et al., 2022). Intelligent process automation (IPA) is flexible and scalable, providing 24/7 services to meet the demands of businesses. AI in the predictive modeling approach tries to forecast future events (Chaudhuri et al., 2021), leading to data-driven decision-making, potential risk management, preventive maintenance, rapid response to market changes, and identifying hidden patterns (Rodríguez-Espíndola et al., 2022). Recent reports show that 89% of large businesses worldwide use advanced data analytics to improve their supply chain performance, resulting in a 25% reduction in operating costs and a 31% increase in future revenues (Ghafoori et al., 2024).

Data analysis from social media interactions, chatbots, and digital platforms can be used to examine customer demand (Ziaie et al., 2021) and develop more personalized products and services. Furthermore, analyzing historical trends predicts the churn rate or loss of customers and creates appropriate strategies and targeted campaigns to retain customers (Liu et al., 2023). On the other hand, prescriptive modeling provides recommendations and appropriate solutions according to resources, constraints, and variables that lead to achieving the best results to improve operations (Corredera & Ruiz, 2023). Prescriptive modeling is used in various industries, specially manufacturing and logistics, to optimize the supply chain, production planning, and waste reduction. By analyzing different limitations, variables, and objectives, prescriptive modeling examines different scenarios and simulates their potential outcomes, assessing their explicit and implicit effects (Volkmar et al., 2022). This approach helps make optimal decisions across domains such as sales, risk management, inventory control, resource allocation, dynamic pricing, bottleneck resolution, supply chain management, and cost reduction. However, there is a lack of comprehensive insight into digital technology capabilities, particularly AI. It is essential to examine the digital effects of these technologies to provide digital solutions for business performance improvement (Sjödin et al., 2023), which plays a vital role in achieving business success.

Generative AI, as a new generation, has been widely adopted by users and offers new digital capabilities for businesses to optimize processes (T. Wu et al., 2023). It leads to

increased digital interactions with employees. It contributes to idea generation, the design of personalized products, enhanced efficiency and productivity, waste reduction, and the realization of a smart circular economy. This ability to provide unique, innovative, and user-friendly textual, audio, visual, numerical, and video responses tailored to the audience's needs has become an essential milestone in the Industry 5.0 era (Kshetri, 2024). ChatGPT and Large Language Models (LLMS) are widely used generative AI tools based on pre-trained transformer-based networks for advanced text analysis, particularly in text generation, word embedding, document segmentation through semantic similarity (such as clustering and classification), and text summarization.

LLMS analyzes intricate relationships within textual data, allowing for the detection hidden patterns and subtle differences in natural language processing (NLP). Despite the benefits of these models in interpreting texts, retrieving information, and generating new content, there is ambiguity and uncertainty regarding the validity and accuracy of the extracted information (Remadi et al., 2024). This necessitates comprehensive research on the impact of generative AI in business, especially since it is still in its early stages and limited to specific areas (Fosso Wamba et al., 2023).

The Importance of Industry 4.0 in Business Transformation

Industry 4.0, as a technological revolution, integrates advanced digital technologies to digitalize processes, significantly impacting production operations (Heubeck, 2023). By using IA and IoT sensors, Industry 4.0 can spontaneously gather and process data from machines, software, automation, and production lines (Rantala et al., 2023), which happens because of the capabilities of the 6G technology in faster transfer of a large amount of data. Examining data and using the capabilities of simulation and digital twins allows businesses to analyze the behaviors and performance of their physical equipment (Somers et al., 2023). Predicting the breakdown and repair time of systems and machines can solve potential problems and costly failures through preventive repair and maintenance. Additionally, gaining a deep understanding of the system's performance makes it easier to identify bottlenecks and inefficiencies in existing processes and take steps toward resolving them. Simulating different scenarios makes it possible to identify potential changes that could optimize business processes, thus leading to increased efficiency and productivity (Wang et al., 2024).

It has been acknowledged that digital technology's development is vital, but its implementation is often challenging (Qiao & Lv, 2023), and can fail. Businesses that fail to adapt quickly to technological changes lose market share to their competitors (Huang et al., 2023). This review systematically analyzes articles to fill this research gap, understand the implications, identify concepts, and examine their relationships. This is crucial for a better understanding of the digital transformation domain. The goal is to extract the most important

topics using thematic analysis, text mining techniques, and trend analysis to offer practical suggestions for future research in this domain.

In addition to the research conducted in this area, several review articles have been examined to identify existing research gaps and clarify the position of the current study. A systematic review has been carried out to explore the objectives, benefits, and findings related to the impact of digital technologies in business. This review discusses various dimensions and effects comprehensively. A summary of the review can be found in Table 1.

Table 1. Summary of Selected Research Conducted

Row	Research Title	Authors and Year of Publication	Journal	Research Goal or Problem	Finding Analysis
1	Digital transformation as the driving force for sustainable business performance: A moderated mediation model of market-driven business model innovation and digital leadership capabilities	(Chen et al., 2024)	Heliyon	It examines how digital transformation impacts sustainable business performance, emphasizing the importance of digital ambidexterity capabilities. The strategic use of digital technologies allows businesses to adjust their models in response to changing market demands.	An in-depth analysis of digital capabilities (exploitation and exploration) and digitalization strategies, along with their influence on sustainable business performance, will enable the redesign of business processes using new digital technologies to incorporate innovative practices into business models.
2	Digital transformation and firm performance in innovative SMEs: The mediating role of business model innovation	(Merín-rodrig & Alegre, 2024)	Technovation	Examining the positive effects of digital transformation on creating and capturing practical values to drive change in innovative small and medium-sized enterprises.	Digital transformation offers significant advantages but requires careful management. Businesses that effectively integrate new digital tools and adjust their business models will likely see improved performance, while those that fail to adapt may face challenges.
3	Coopetition, strategy, and business performance in the era of digital transformation using a multi-method approach: Some research implications for strategy and operations management	(Meena et al., 2024)	International Journal of Production Economics	Investigating how digital transformation affects collaboration and coopetition in businesses through the utilization of digital technologies to optimize strategic and operational management, which ultimately results in enhanced overall business performance.	Successfully implementing coopetition strategies can provide a sustainable competitive advantage and enhance performance in digital markets from a digital transformation perspective. Coopetition directly affects businesses and significantly influences performance improvement through mediating factors such as knowledge sharing and resource complementarity. In simpler terms, companies that effectively utilize opportunities for

				collaboration and coopetition can achieve better outcomes in their digital transformation efforts.
4	Digital transformation and innovation and business ecosystems: A bibliometric analysis for conceptual insights and collaborative practices for ecosystem innovation	(Liao et al., 2024)	International Journal of Innovation Studies	Developing a framework to analyze the impact of digital transformation on fostering an innovative ecosystem that supports the achievement of sustainable development goals through bibliometric analysis.	Innovation pathways for digital transformation across various ecosystem frameworks—such as business, innovation, digital ecosystems, and the ecosystem economy—provide a comprehensive roadmap for developing strategies that facilitate digital transformation and achieve sustainable development goals. This transformation, seen from both technical and collaborative perspectives, involves various institutions, including academia, industry, and government. It offers practical solutions for managers and policymakers, assisting them in designing digital transformation strategies that align with sustainable development initiatives.
5	Customer-driven value creation in the digital economy: Determining the role of customer firms' digital transformation on supplier performance in China	(C. Zhang et al., 2024)	Omega	Assessing the impact of digital transformation on supplier performance in customer-focused firms within the supply chain using text mining techniques.	Digital transformation can significantly and positively impact supplier performance through mechanisms such as demand push and innovation spillover. Research highlights the importance of several factors, including geographical distance, customer focus, and the type of supplier industry. These elements play a crucial role in determining the intensity and nature of digital transformation's impact. Moreover, enhancing digital infrastructure and improving digital capabilities at the supplier level can lead to a more efficient and competitive supply chain.
6	The effects of digital transformation on innovation and productivity: Firm-level evidence of South African manufacturing micro and small enterprises	(Gaglio et al., 2022a)	Technological Forecasting & Social Change	It examines how digital technologies enhance innovation and increase productivity.	The results indicate that digital technologies, social media, and the Internet foster interaction and knowledge sharing between businesses and customers. This enhanced communication leads to better digital interactions, the development of new products, and the implementation of digitalization.
7	Organizational Strategic Intuition for High Performance: The Role of Knowledge-Based Dynamic Capabilities and Digital Transformation	(Songkajorn et al., 2022)	Journal of Open Innovation: Technology, Market, and Complexity	Examining the impact of dynamic capabilities on digital transformation through knowledge sharing ultimately improves performance.	Enhancing digital capabilities improves knowledge absorption, integration, and storage, improving operational efficiency across various processes. Therefore, businesses must utilize digital technologies to strengthen their knowledge base.

Methodology

Identifying the research domain

This research is classified as qualitative based on its purpose and methodology. It assesses the current situation while referring to existing literature that describes these conditions. The approach used in this research is design science, which has gained significant attention among researchers in information systems and management, particularly in information technology management, in recent years.

A key characteristic of this approach is its practicality and focus on solutions, which distinguishes it from traditional qualitative and quantitative methods. This pragmatic approach describes existing conditions, clarifies problems, and takes steps toward addressing them. The research method emphasizes the presentation of products, processes, and methods, enabling it to go beyond mere description and explanation of issues to provide innovative solutions.

This research, based on design science, investigates the impact of digital transformation technologies on business performance. It uses thematic analysis to identify key themes, applies text mining to reveal hidden patterns, and examines trends over time. This multifaceted design science approach is theoretically and practically flexible, making it well-suited for dynamic environments. The study offers new insights into the complex relationship between digital transformation and business performance. The research provides practical solutions to enhance current practices by analyzing the findings. Consequently, the outcome of this study is a comprehensive framework that assists managers in optimally leveraging key digital transformation technologies.

Gathering sources and selecting related papers

Using IEEE Xplore alongside Scopus and WoS enables researchers to access high-quality scientific and specialized resources. This combination provides valuable insights into how digital technologies enhance business performance. IEEE Xplore is a crucial resource for contemporary research in digital transformation technologies, offering up-to-date and well-documented information on the technological and specialized aspects of this field. Since research in digital transformation often requires a comprehensive and multidisciplinary approach, integrating resources from information systems and management is essential.

Moreover, using IEEE Xplore, Scopus, and WoS together with the logical operator (AND) during the search process allows for extracting targeted and relevant results. This search strategy reduces ambiguity and increases the accuracy of identifying articles related to specific keywords, such as "digital transformation," "digital technologies," and "improving business performance." By effectively combining keywords, this logical operator leads to

precise outcomes. The advanced search feature can also apply various subject filters to titles, abstracts, and keywords.

This study involves a systematic analysis of specialized journals in information systems and management that are recognized for their high scientific quality, credibility in peer review, and significant impact, as indicated by their Q1 ranking (see Table 2). These journals are chosen as primary sources for retrospective articles due to their rigorous review processes, publication of innovative research, and adherence to international standards in research evaluation and validation. Selecting these journal extracts valuable knowledge from the most relevant research trends highlighted in articles of the highest scientific quality.

This includes exploring the challenges and opportunities related to digital transformation and its impact on business performance. Moreover, given the increasing complexity of implementing digital technologies in today's industries, retrospective research can help identify practical solutions and strategies for researchers. Additionally, focusing on emerging topics that may shape the future is essential for advancing knowledge and progress in this field.

It was found that the number of papers published before 2015 was much lower. Since the mentioned field has gained more attention recently, papers from 2015 to July 2024 are selected as references. This approach aims to review the latest published papers to identify the most up-to-date information related to the desired field.

During the research process, 6801 articles were obtained by searching various databases. Several selection criteria were applied to ensure the analysis of the most relevant papers. Firstly, 1147 papers were excluded based on the time frame metric. Next, retrospective English articles from the most relevant journals were selected, leaving 1303 papers after removing 4351 articles. In the third step, papers in management, information systems, and business were chosen while excluding unrelated fields like electrical engineering, computer, electronics, and robotics, further narrowing the search by 678 papers to 645. After removing 97 more papers due to overlapping databases, 528 papers were left for final analysis. Finally, the titles and abstracts of these papers were carefully reviewed, and another 54 were excluded, leaving 474 papers for systematic analysis. Figure 1 shows the paper selection process.
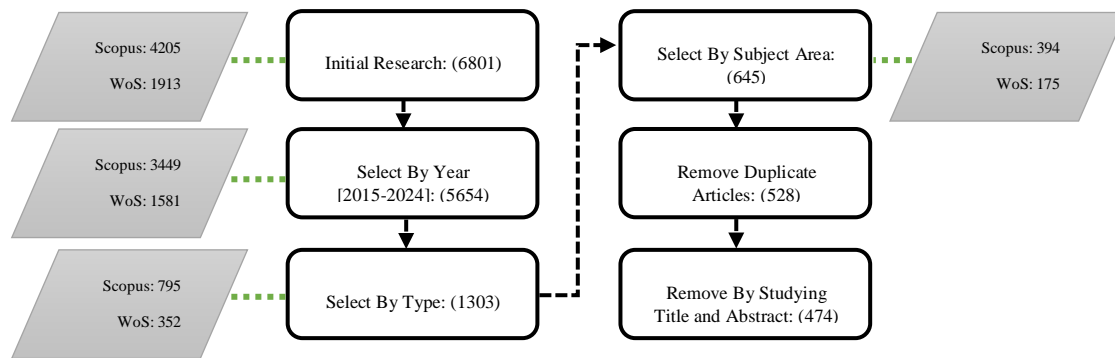
Figure 1. Article Selection Process

The graph in Figure 2 illustrates a consistent upward trend in published papers on digital transformation technologies over the selected period. The findings show that approximately 84% of the reviewed studies were conducted in the last four years, from 2021 to 2024. This trend indicates a growing interest in this topic over time and suggests that this research area is essential for future digital transformation research.
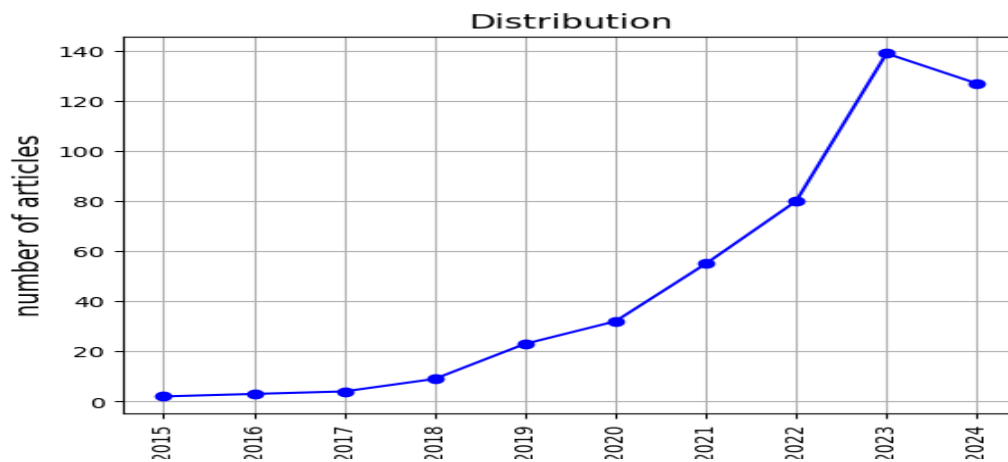

Figure 2. Distribution by the year of publication

Table 2 lists the number of articles and specifications of the top journals, which shows that this research is based on credible research conducted in this field.

Table 2. Details of Selected Articles

Row	Journal Name	Impact Factor	H index	Quality	Number	Percent
1	Journal of Business Research	11.3	236	Q1	52	10.97
2	Technological Forecasting and Social Change	۱۲	155	Q1	49	10.38
3	Heliyon	4	88	Q1	25	5.28
4	Technovation	12.5	150	Q1	23	4.86
5	International Journal of Information Management	21	152	Q1	22	4.64
6	Journal of Innovation & Knowledge	18.1	39	Q1	18	3.80
7	Industrial Marketing Management	10.3	161	Q1	18	3.80
8	IEEE Transactions on Engineering Management	4.5	112	Q1	12	2.53
9	Computers in Industry	10	۱۱۷	Q1	11	2.32
10	Technology in Society	9.2	69	Q1	9	1.90
11	Journal of Cleaner Production	11.1	268	Q1	8	1.69
12	International Journal of Production Economics	9.8	231	Q1	7	1.48
13	Journal of Strategic Information Systems	7	104	Q1	7	1.48
14	Sustainability	3.3	169	Q1	7	1.48
15	Long-range planning	8.5	118	Q1	5	1.06
16	Production Planning & Control	8.3	104	Q1	5	1.06
17	Journal of World Business	8.9	132	Q1	4	0.85
18	European Management Journal	7.5	117	Q1	4	0.85
19	International Journal of Production Research	9.2	186	Q1	3	0.63
20	Transportation Research Part E: Logistics and Transportation Review	8.3	144	Q1	3	0.63
21	Computers & Industrial Engineering	7.9	147	Q1	3	0.63
22	Telecommunications Policy	5.9	86	Q1	3	0.63
23	Robotics and Computer-Integrated Manufacturing	10.4	111	Q1	2	0.43
24	Information & Management	9.9	182	Q1	2	0.43
25	Advanced Engineering Informatics	8.8	99	Q1	2	0.43
26	Review of Managerial Science	7.8	52	Q1	2	0.43
27	Decision Support Systems	7.5	170	Q1	2	0.43
28	Service Business	4.4	45	Q1	2	0.43
29	Expert Systems With Applications	۸/۵	۲۴۹	Q1	1	0.21
30	International Business Review	8.7	114	Q1	1	0.21
31	Other				162	
32	Total				474	

Surveying, Categorizing, and Text Preprocessing

After extracting articles, various parts of the research are analyzed, such as title, abstract, keywords, published year, journal, introduction, literature review, research methodology, findings, discussion, and conclusion. First, thematic analysis involves reading the articles multiple times to understand the content and create initial codes deeply. The next step involves categorizing, selecting, and discarding irrelevant codes to narrow the focus to the main themes. Then, a clearer picture of significant concepts can be developed by drawing a thematic network and analyzing their relationships. Finally, each theme is evaluated, and its characteristics are discussed in detail. Then, various text preprocessing techniques are used to prepare the texts for further analysis. The first step is to normalize the texts and decapitalize the words. The second step is to remove all the redundant punctuation marks, spaces, and stop words, which have a high frequency in the texts but do not contain valuable information. This

enhances the accuracy and speed of the analysis. The third step involves eliminating frequent words with apparent meanings for a more in-depth analysis. The fourth step is to identify abbreviations in the text and expand them to their original forms. This homogenizes the text and makes it more coherent. The fifth step uses lemmatization techniques to return the words to their roots, and the sixth step involves tokenizing and marking the words.

Modeling and Data Analysis

In this phase, thematic analysis, topic modeling, text clustering, and trend analysis are used to identify hidden patterns and their relationships.

Thematic Analysis

Thematic analysis is a qualitative research method to identify, analyze, and report main themes. (Kuoppakangas et al., 2023). This method provides a detailed and comprehensive review of data types, such as voice, text, image, video, and more, to identify meaningful patterns relevant to the desired research. Thematic analysis, through examining codes and searching for patterns, allows researchers to divide complex phenomena into smaller parts and analyze them to gain a deeper understanding of the specific topic (Khanfar et al., 2024). In addition, thematic analysis is highly flexible and can integrate different perspectives, making it an appropriate approach for creating new hypotheses and further research (Madanaguli et al., 2023).

Topic Modeling

Topic modeling is a powerful statistical technique to uncover abstract topics from word groups. It is a crucial method in text mining that helps identify hidden semantic structures and patterns within a corpus, which understands and organizes unstructured data (J. J. Wu & Chang, 2020). This method leads to the revelation of the significant topics in a given domain and investigation based on the assigned subject tags. The most commonly used algorithm for topic modeling is LDA, which identifies each document in a combined set of topics and allocates each word of the document to one of the topics (Gencoglu et al., 2023).

The actions taken include the following steps: 1. Optimal topic numbers were selected based on the coherence score (Farzadnia & Raeesi Vanani, 2022), which is a hyperparameter determined before developing the model. 2. Each word in the documents was randomly assigned to one of the topics. 3. Repetitive allocation and updating were performed, where every word was reassigned based on how common it was in all topics (Savin et al., 2022). This was based on Bayesian inference, where certain words were often placed on the same topic (Rejeb et al., 2024). This step was repeated several times until an optimal allocation of words to each topic was achieved. 4. The Genism library and Corpora module are commonly used to create word dictionaries, which are crucial for achieving optimal results.

Text Clustering

Text clustering is a commonly used method for categorizing documents based on semantic similarity. This technique uses multivariate statistical methods to organize unstructured textual data into distinct clusters. This research aims to identify the most optimal text clustering method by comparing different approaches, including density-based clustering, hierarchical clustering, and partitioning clustering. The process involves several steps. After text preprocessing, the initial step consists of converting the textual data into numerical vectors using the TF-IDF technique. TF-IDF is a well-established method for converting documents into vectors in a high-dimensional space, with each dimension representing a unique word in the text set (Mehta et al., 2021). In the second step, the partitioning clustering method was identified as the optimal approach based on silhouette and elbow evaluations. The K-means algorithm, an unsupervised learning method, places similar data with minimal variance into each cluster. The optimal center of each cluster is determined by repeating this clustering step. At this stage, the data in each cluster should have the smallest distance from the data center and the maximum distance from other clusters (Thirumoorthy & Muneeswaran, 2021). In the last stage, clusters were drawn using principal component analysis (PCA) to reduce dimensions. This method led to an improved interpretation of the clusters.

Trend Analysis

Scientometrics is used to investigate and analyze scientific research across different domains. VOSviewer software creates visual maps that help examine the relationship between the most important research topics and predict future trends (Shashi et al., 2020). By employing clustering algorithms and topic network analysis, VOSviewer generates a conceptual map showing the key topics that each node represents a topic, and its size indicates frequency and importance. Also, the line thickness reflects the connection and correlation between these topics. Additionally, using different colors to draw the communication network helps categorize topics based on content clusters or published years, which aids in gaining a better visual understanding of research trends.

Evaluation

The coherence score determines the optimal number of topics for evaluating topic modeling results. The Silhouette and Elbow criteria are used to cluster abstracts.

Scientific Reports

The research paper has delved deep into the importance of digital transformation in enhancing business performance. The paper has used innovative research techniques such as thematic analysis and text analytics to identify the most attractive research trends. Additionally, the study has compared the main themes with dynamic capability theory constructs to emphasize the significance of enhancing digital capability in the research literature of this domain. The research process is illustrated in Figure 3.
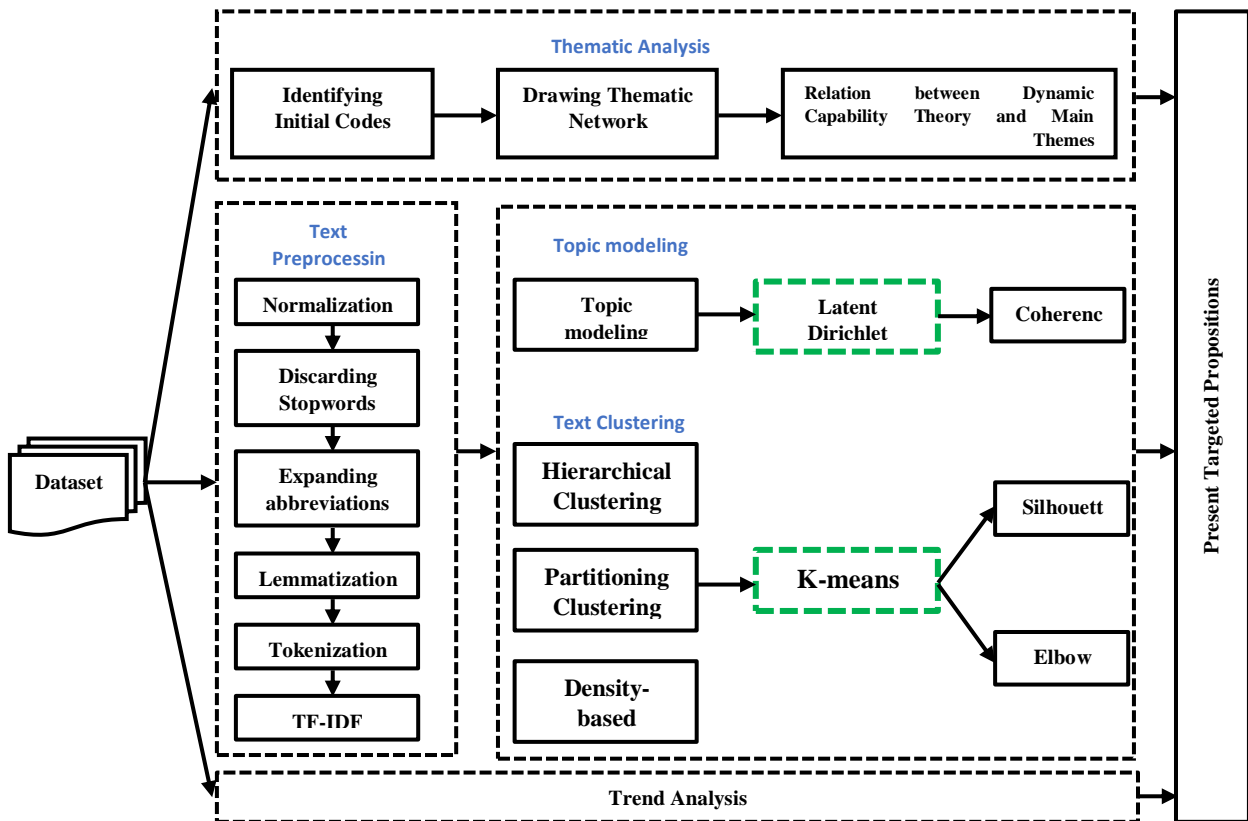
Figure 3. Research Process

Results

Thematic Analysis

The study conducted a thorough thematic analysis, identifying 23 main themes and 863 sub-set codes. Interpreting each theme and analyzing relationships between them leads to a more comprehensive understanding of the impact of digital transformation technologies on business performance. This research used MaxQDA 2020 software (version 20.4.0) to identify significant themes and draw the theme network. Figure 4 shows these findings.
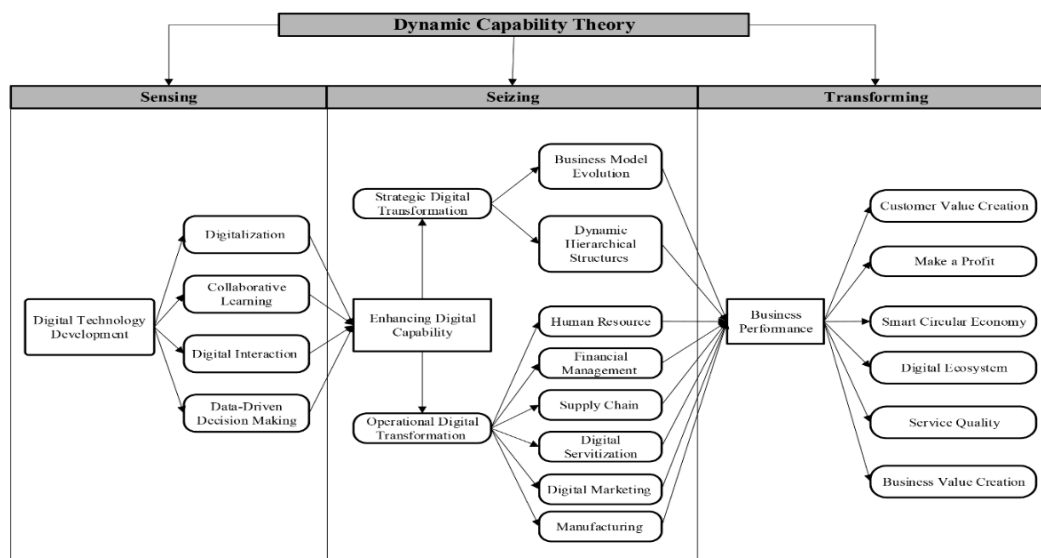
Figure 4. Thematic Network

The development of digital technology has brought about significant changes in various business sectors. It has facilitated digitalization through IA, workflow process management, and minimizing human error (Yang et al., 2024). Moreover, digital technology has led to collaborative learning and improved business absorptive capacity, which has led to increased employee knowledge (Järvelä et al., 2023). In addition, developing communication technologies have also improved digital interactions and increased online communication between businesses, customers, suppliers, employees, and other stakeholders (Raeesi et al., 2025). Furthermore, data-driven decision-making is now possible through real-time data analysis, analytical tools, and monitoring systems.

Digital technology has allowed businesses to improve their digital capabilities (Piccoli et al., 2024), which is crucial for achieving digital transformation at both the strategic (flexible hierarchical structures and business model) and operational (human resources, supply chain, digital marketing, financial management, digital servitization, and manufacturing) levels. Digital transformation is an effective process that can bring value to better business performance. It promotes business value creation through innovation in services or products (Uddin et al., 2023). It increases agility to adapt to change, reduces product life cycle, accelerates activities, improves decision-making accuracy, and minimizes future risks.

The advancement of digital communication channels has led to increased interactions between businesses and customers. This has allowed businesses to predict customer demand better and identify market requirements (Prentice et al., 2020). Consequently, service quality has improved significantly, leading to better customer experience and more value creation. On the other hand, the online monitoring of production line processes, preventive approaches for equipment repairs and maintenance, design of virtual prototypes for comprehensive review, and manufacture of products according to customer demand create this opportunity for businesses to allocate resources optimally and reduce waste as much as possible. This leads to

realizing a smart circular economy and making a profit by reducing operational and fixed costs (Baabdullah, 2024).

Studies reveal that the development of digital technologies fundamentally impacts business department performance. Achieving digital transformation as a strategic action consistently challenges the status quo (Fosso Wamba et al., 2024). Businesses must develop digital technologies to identify emerging opportunities, improve customer experience, create new revenue models, enhance service quality, and improve agility. Furthermore, Dynamic Capability Theory shows that businesses must accurately understand their internal and external resources and competencies to integrate their capabilities according to changing market conditions. Digital transformation is considered a manifestation of dynamic capability (Ghosh et al., 2022). This research will compare the findings in the three constructs of sensing, seizing, and transforming (Funke et al., 2023).

Word Cloud and Frequency

This section, 474 selected papers have been analyzed using various text mining techniques (including word cloud, topic modeling, and text clustering) and trend analysis. This research aimed to identify patterns and hidden relationships between concepts and extract new insights using different bibliographic information. The Word Cloud technique was used to visually represent the textual data using Python (3.10.4) software. In this step, frequent and specific words such as digital, business, transformation, performance, digitalization, company, data, technology, industry 4.0, IoT, AI, RPA, and digitization were removed by adding NLTK's stop words for deeper analysis.

After excluding keywords, words such as value, service, customer, product, analysis, market, medium, and social network were extracted, which indicate a 'customer-centric approach' in providing services, products, and solutions leading to the customer value creation. This was achieved by analyzing customer interactions on social media and other digital communication channels, which has been widely considered in academic literature in recent years (Saura et al., 2021). Additionally, common words such as platform, analysis, and machine show the importance of ML and digital platforms as critical digital transformation technologies. Also, frequent words such as change, system, knowledge, ecosystem, process, and sustainability represent a complex ecosystem for business. It highlights the importance of individuals and businesses adapting to changes and acquiring information in dynamic conditions to succeed in changing markets. Additionally, frequent words such as management, resource support, capability, strategy, supply, and chain demonstrate the impact of digital transformation on the various business parts, such as supply chain management, digital capability, strategy development, and resource management. Figure 5 presents the most frequently used words from the title, abstract, keywords, and an overall word cloud, which includes terms such as "title," "abstract," "keywords," "introduction," "literature review," "research methodology," "data analysis," "discussion," and "conclusion." This method effectively highlights common trends in the field of digital transformation in business

performance. Additionally, analyzing the overall word cloud improves understanding of the conceptual patterns found in various sections of the articles.
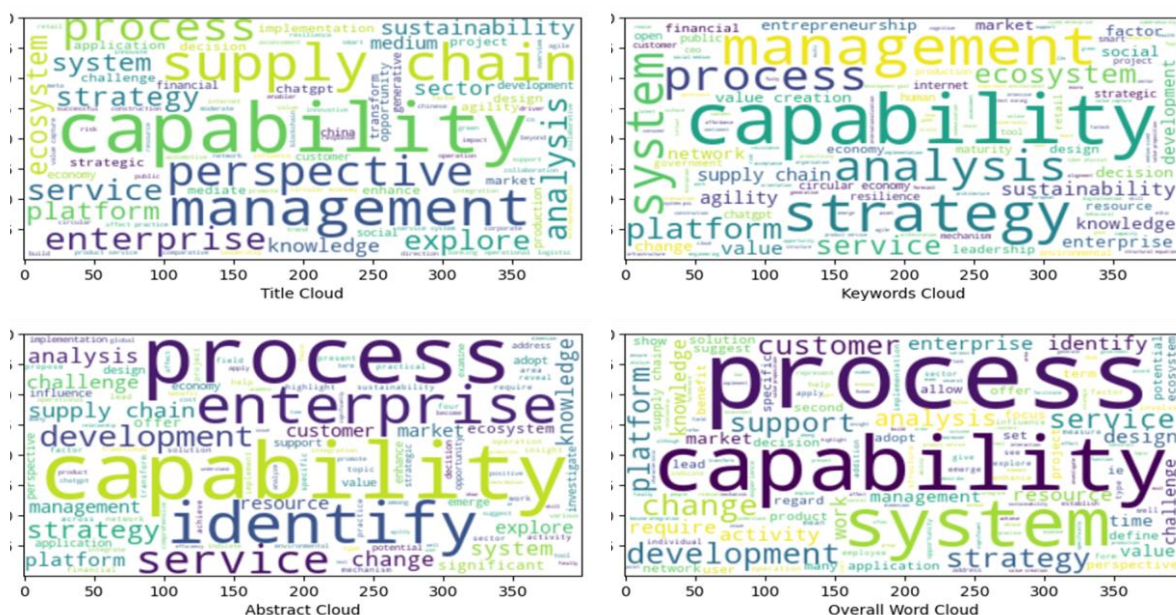

Figure 5. Word Cloud Results

Each word can provide valuable information about the emerging trends related to the research topic. However, word repetition alone cannot provide useful insights. For instance, words like 'process', 'value', 'capability', 'service', 'customer', 'change', 'system', and 'management' have been repeated 9515, 7313, 7190, 6079, 5760, 5347, 4554, and 4297 times. Such high frequencies suggest that value creation for customers and change management are correlated with the approach of offering products and services. However, the reason for using these frequent keywords is often unclear without advanced text analytics. Topic modeling is used to overcome this ambiguity and find goals and applications of these words. In this technique, the occurrence of words and their relations are analyzed based on the possibility (Tavana et al., 2022).

Topic Modeling

Topic modeling is an effective method to evaluate and amplify research results. It provides a broad understanding of significant topics. The Latent Dirichlet Allocation (LDA) algorithm is widely used for topic modeling. This algorithm often achieves better results than the other topic modeling techniques (Rouhani & Mozaffari, 2022). The coherence score for each topic in the range of 3 to 11 is determined as the optimal number. Coherence refers to the degree of relation between closely related words in a topic and how different it is from other topics. It is an essential metric for assessing the quality of selected topics. In the topic modeling of this research, the title was separated into 4, the abstract into 5, the keywords into 5, the introduction into 6, the literature review into 6, the research methodology into 8, the data analysis into 7, the discussion to 6, and the conclusion to 9 topics, based on the coherence results as shown in Figure 6.
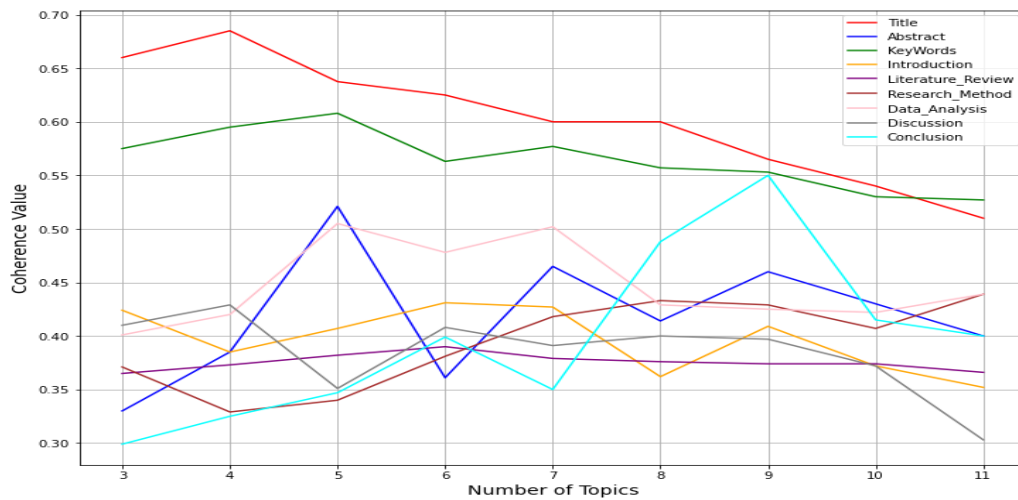
Figure 6. Number of Topics

Perplexity is an important metric for evaluating topic modeling. It measures how well a model fits a given dataset. A lower perplexity demonstrates that the model is more confident in predicting the next words. This metric is crucial for selecting the best model, evaluating model performance, and fine-tuning hyperparameters. This research evaluates topic modeling in various sections of articles to extract relevant topics based on perplexity criteria. Calculating this statistical measure shows that the selected models successfully extract the main topics. Table 3 displays the perplexity results.

Table 3. Perplexity Results

Row	Section	Perplexity	Row	Section	Perplexity
1	Title	-6.7357	6	Research Method	-8.6606
2	Abstract	-7.6913	7	Data Analysis	-8.8186
3	Keywords	-6.2864	8	Discussion	-8.6112
4	Introduction	-8.4922	9	Conclusion	-8.7771
5	Literature Review	-8.6871			

The bar graph on the right side of the topic modeling displays the most frequently occurring expressions in the selected topic. More details for each topic can be viewed by choosing them. This section also indicates the frequency ratio for each chosen topic to the total corpus. In the left graph, each topic is presented by a circle in a two-dimensional plane, and its center is determined by calculating the distance between topics. This provides an overview and reveals its prevalence and relationship with other topics. Their circle area determines each topic's prevalence, and the topics are sorted based on their area. Larger topics have more assigned terms. As a result, sorting topics by circle area helps uncover hidden patterns in the texts. For further clarification, refer to Figure 7, which demonstrates discussion topic modeling as an example.
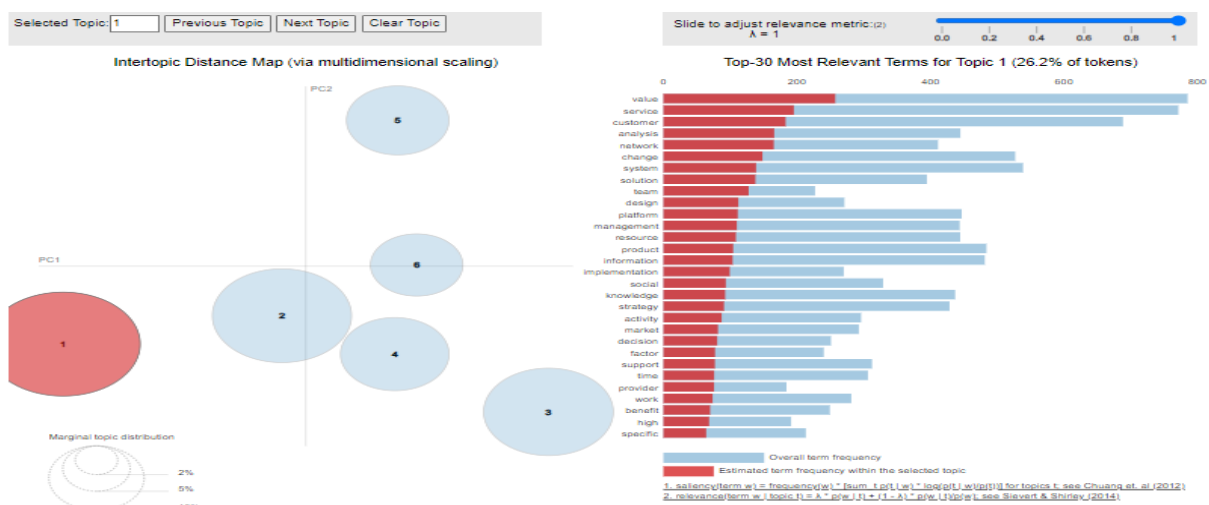
Figure 7. Discussion Topic Modeling

Once the optimal number of topics is determined, the words with the highest semantic similarity are extracted for each topic. Additionally, labels are assigned to each topic to provide a better understanding and distinction from others for a more accurate and comprehensive interpretation. The findings obtained from topic modeling in 3 categories (Business, System, Customer) show the effects of digital technologies, particularly AI, create value for businesses and customers in a digital interactive ecosystem. The findings are presented in Figure 8.
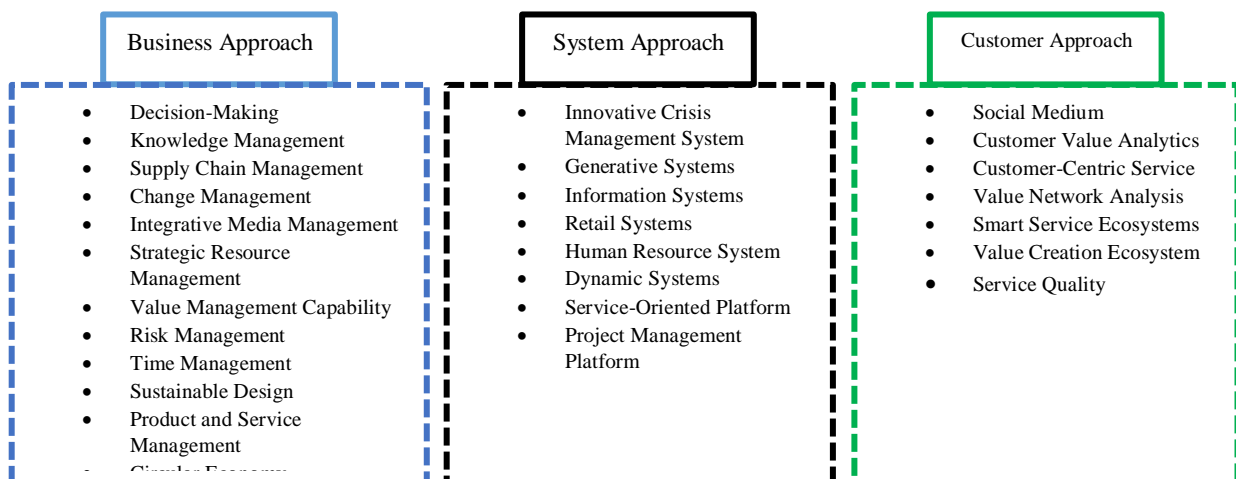

Business Approach	System Approach	Customer Approach
• Decision-Making • Knowledge Management • Supply Chain Management • Change Management • Integrative Media Management • Strategic Resource Management • Value Management Capability • Risk Management • Time Management • Sustainable Design • Product and Service Management • Circular Economy	• Innovative Crisis Management System • Generative Systems • Information Systems • Retail Systems • Human Resource System • Dynamic Systems • Service-Oriented Platform • Project Management Platform	• Social Medium • Customer Value Analytics • Customer-Centric Service • Value Network Analysis • Smart Service Ecosystems • Value Creation Ecosystem • Service Quality

Figure 8. Topic Modeling Results

The business approach highlights several key domains, including decision-making, knowledge management, supply chain dynamics, and agility, to enhance value creation and competitiveness in the digital landscape. These topics are typically examined in the context of business strategies and management. Moreover, the systems approach concentrates on digital technologies and organizational support systems, emphasizing the development of digital transformation technologies crucial for optimizing various business processes. Additionally, the customer approach seeks to increase digital interactions, improve customer experiences,

and analyze customer value within the digital ecosystem. This is achieved by enhancing service quality and creating value for customers.

The diverse findings illustrate the complexity and significance of these issues discussed in the different sections of the articles. To assist in interpreting the extracted topics and improve the analysis's clarity, the appendix of the article includes a table (Table 6) that lists commonly used words associated with each topic before assigning labels to them.

Text Clustering

The next step involved comparing different methods, such as K-means, Agglomerative, and DBSCAN, using the silhouette criteria to identify the best method for extracting the essential components of the abstract. Evaluating the Silhouette and Elbow criteria within the range of 3 to 11 showed that the K-means algorithm is more effective in partitioning the abstract into distinct clusters. This method's speed and accuracy in text clustering help identify the most relevant words in each cluster, making the data in each cluster most similar and as different as possible from other clusters. Based on the results, 5 clusters were selected to extract keywords, as shown in Figures 9 and 10.
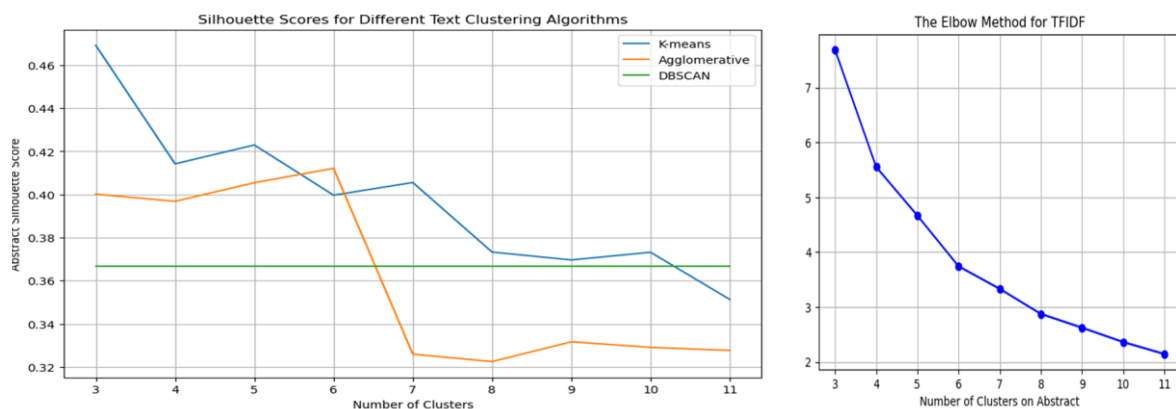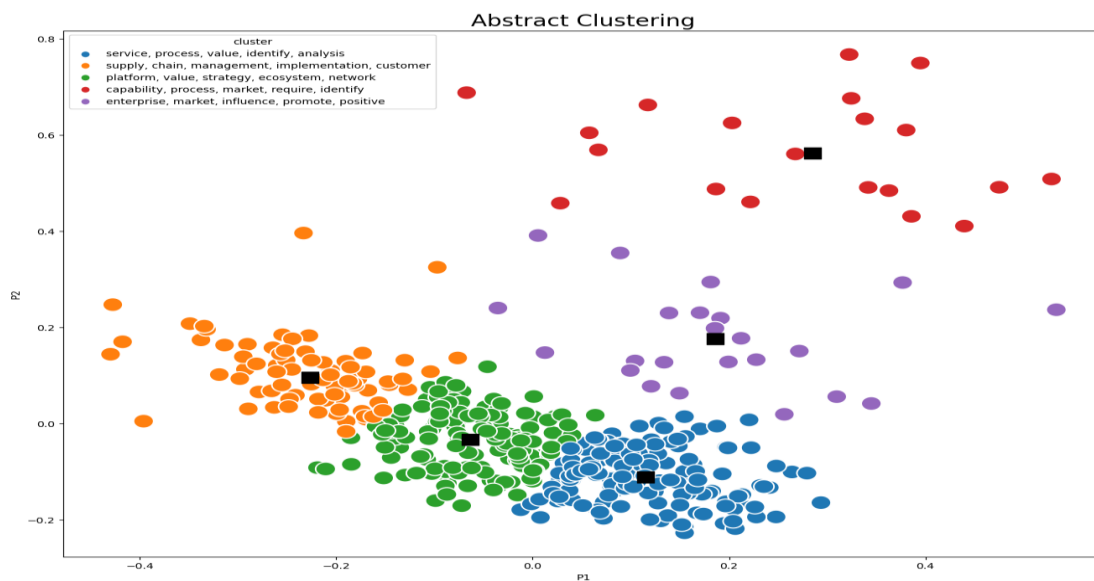

Figure 9. Number of Clusters

Figure 10. Abstract Text Clustering

The research utilized the abstract for text clustering, as it contains the main content of each article. Five key labels were identified to analyze the business domain using the K-Means algorithm, each representing an important aspect of digital transformation management. The first label, "Creating Value in Business Networks", highlights the role of digital technologies in enhancing interactions among business participants and fostering strong ecosystems through digital platforms. The second label, "Increasing Business Process Capabilities", emphasizes the importance of leveraging new technologies, such as AI and big data, to improve operational efficiency and gain a competitive edge. The third label, "Implementing Successful Strategies for Supply Chain Challenges", focuses on strategic solutions for risk management and improving transparency within the supply chain. The fourth label, "Creating Customer Value Through Effective Delivery", emphasizes centered strategies on the customer, improving customer experience, and personalizing services to enhance satisfaction. Moreover, the fifth label, "The Impact of Organizational Market Analysis", addresses identifying emerging trends and innovative opportunities within a competitive landscape. These labels align with academic literature in information systems management and digital technologies, providing an analytical framework that can effectively guide data-driven strategies and address contemporary organizational challenges. These results show the importance of developing digital transformation technologies on business performance by promoting digital capabilities to identify essential internal and external resources and opportunities, enabling rapid responses to changes, and overcoming challenges. Table 4 presents the extracted keywords from each cluster.

Table 4. Text Clustering Results

Component	Cluster Number	Key Words	Labels
Abstract	AC0	platform, value, strategy, ecosystem, network, activity, enterprise, knowledge, challenge, influence, resource, decision, operation, identify, service, analyze, affect, address, examine, capability	Value Creation in Business Networks Through Leveraging Digital Platforms to Develop Strong Ecosystems
	AC1	capability, process, market, require, identify, resource, economy, competitive, change, customer, value, strategy, service, advantage, explore, global, management, adopt, present, influence	Enhancing Business Processes Capabilities to Optimize Resources and Achieve a Competitive Advantage
	AC2	supply, chain, management, implementation, customer, identify, capability, analysis, operation, strategy, application, process, practice, investigate, propose, opportunity, competitive, challenge, support, integration	Implementing Successful Strategies To Overcome Supply Chain Challenges
	AC3	service, process, value, identify, analysis, management, development, challenge, customer, application, design, product, knowledge, topic, sector, ecosystem, work, offer, change, implementation	Creating Customer Value through Effective Product and Service Delivery
	AC4	enterprise, market, influence, promote, positive, economy, analysis, factor, competitive, environmental, mechanism, medium, investigate, development, advantage, resource, indicate, strategy, change, significant	Impact of Enterprise Market Analysis in Investigating Positive Change Factors

After performing text clustering to evaluate the impact of words within each cluster, the average score of each word in all the expressions is calculated using the TF-IDF method and recorded in an array. Next, the average word scores are sorted in descending order based on their uniqueness and frequency in each cluster, resulting in a set of the top words and their scores. Finally, a two-dimensional diagram using seaborn displays the top 20 words on the vertical axis and their influence level on the horizontal axis. This visualization identifies the most critical words in each cluster. The findings are shown in Figure 11.
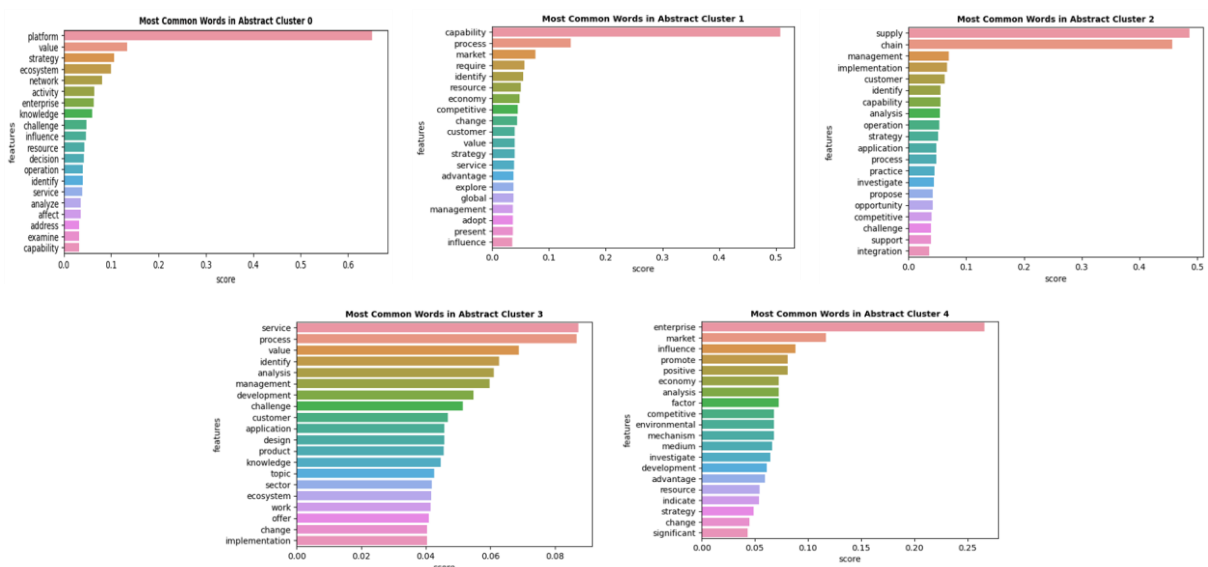

Figure 11. Abstract Clustering Top Words

This research uses two methods, LDA and K-Means, to extract hidden relationships in articles. The purpose of this action depends on the nature of concept extraction in the two methods mentioned. The LDA method, as soft clustering, allows the identification of the main topics and the semantic structure hidden in the data. This model provides a significant concept for understanding the topics by providing possible words. However, it may not accurately separate the key components due to possible overlap between topics, and there may be ambiguities in precisely determining the boundaries of the topics. K-Means, as a form of hard clustering, identifies key components from a geometric perspective (based on data distance) and based on vector similarities to more accurately separate the concepts presented. This feature helps identify each cluster's central and representative components and can reduce the ambiguities caused by overlapping topics in LDA. This hybrid approach increased the accuracy and interpretability of the results and also strengthened the scientific validity of the research.

Comparison of Thematic Analysis with Text Analytics

After examining the thematic analysis and text analytics findings, it is evident that developing digital transformation technologies plays a crucial role in business success. Therefore, businesses must adopt a comprehensive strategy to enhance their digital capabilities and leverage the countless opportunities available in today's digital landscape. Although there were similarities between the findings of both investigated methods, the thematic analysis approach provides a more comprehensive and general picture of the impact of digital transformation in business. This method focuses on abstract concepts derived from subcategory codes related to general concepts such as digital interactions, collaborative learning, data-driven decision-making, digitalization, and business performance. On the other hand, topic modeling and text clustering involve identifying and extracting business, system, and customer topics. These significant topics include managing various business processes, examining intelligent information systems and digital platforms, and analyzing customer perspectives on service quality and communication between parties.

Despite the mentioned cases, the two methods used in the research supplement each other and offer a more precise and all-encompassing perspective of the practical aspects of this domain. Moreover, the findings regarding various dimensions of digital transformation in business align with previous research (Feliciano-cestero et al., 2023), highlighting the significance of adopting a digital technology development approach to improve efficiency and increase productivity in improving business performance (Guo et al., 2023).

Trend Analysis

This study investigated the scientometrics of a specific field using VOSviewer, analyzing data from the mentioned databases. Examining the recent trends leads to identifying the most attractive topics and future research direction. A minimum occurrence of a keyword was set at 5, resulting in a threshold of 75 terms distributed across 10 clusters. Cluster 1 contains 13

items (business model, business model innovation, digital capability, digital strategy, digital transformation, firm performance, fsqca, industry 4.0, ML, manufacturing, open innovation, organizational agility, and SMEs). Cluster 2 contains 11 items (absorptive capacity, bibliometric analysis, circular economy, digital innovation, digital maturity, digital platform, digital servitization, digitalization, innovation performance, performance, and systematic literature review). Cluster 3 contains 11 items (AI, big data, blockchain, digital twins, healthcare, industry 5.0, IoT, resilience, smart manufacturing, supply chain, and sustainability). Cluster 4 contains 10 items (digital divide, digital economy, digital governance, digital government, digital infrastructure, economic growth, financial development, innovation, resource allocation, and sustainable development). Cluster 5 contains 10 items (such as corporate governance, financing constraints, information asymmetry, internal control, investment efficiency, mechanism analysis, resource-based view, technological innovation, textual analysis, and total factor productivity). Cluster 6 contains 8 items (China, digital finance, digital inclusive finance, digitization, energy efficiency, fintech, green finance and moderating effect). Cluster 7 contains 5 items (corporate innovation, digital leadership, dynamic capability, human capability, and organizational resilience). Cluster 8 contains 3 items (digital health, digital technology, and environmental regulation). Cluster 9 contains 3 items (competitive advantage, maturity model, and supply chain management). Cluster 10 contains 1 item (operational efficiency). The result is shown in Figure 12.
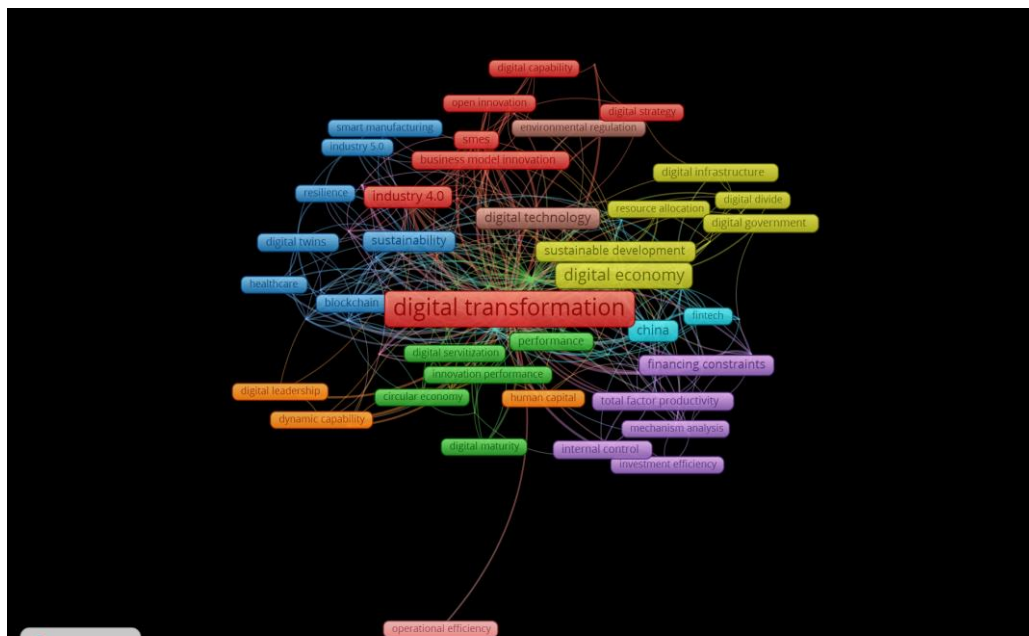

Figure 12. Trend Analysis

The simultaneous use of topic modeling, text clustering, and trend analysis in text analysis provides a complementary and multidimensional approach. From an academic perspective, topic modeling reveals hidden semantic structures and the probability distribution of words within various topics. Text clustering groups documents into homogeneous categories based on content similarities, which facilitates the classification of articles. Additionally, trend analysis using VOSviewer illustrates the relationships and connections between words through correlation networks. This visualization helps in understanding communication patterns and the network structure of concepts. By integrating these three methods, researchers can investigate topics from multiple angles—semantic depth, grouping structure, and network relationships. This comprehensive analysis enhances the validity and accuracy of research findings. Each method offers a unique perspective on textual data, leading to a multifaceted understanding of the semantic structures and connections present in the text.

Discussion

Theoretical Implications

Thematic analysis in this study answers the first research question. It shows that implementing digital transformation technologies at different levels within a business enhances operational efficiency and promotes new strategies to enhance digital capabilities to improve business performance. Furthermore, these findings emphasize the significance of dynamic capability theory as a theoretical framework for explaining digital transformation processes, making it particularly relevant for future research.

In today's highly competitive market, businesses must comprehensively understand the digital landscape to succeed. This requires them to be able to sense the signals of emerging technologies, market trends, customer preferences, and potential threats from digital disruptions. By identifying and responding to these signals across multiple dimensions, businesses can seize opportunities and mitigate threats in the digital era.

To achieve this, businesses must recognize the capabilities of digital technologies, such as AI, digital platforms, IA, IoT, digital twins, and Industry 4.0. These technologies can help automate tasks and develop IPA, which are essential for business success. Simulation capabilities, generative AI, and knowledge sharing can also help improve employees' skills and knowledge. Furthermore, the growth of multi-sided platforms has increased digital interactions among stakeholders, and advanced analytics tools are necessary to extract insights from data and monitor activities online.

Businesses must identify digital opportunities and threats and quickly integrate internal and external resources to create digital capabilities to keep up with rapid technological advancements. This digital capability can enhance strategic and operational digital transformation and lead to significant changes, including improving employee skills, digital servitization, creating new revenue models, and increasing innovation.

Moreover, businesses can leverage digital tools to transform their performance efficiently and create value through increased effectiveness and productivity. Identifying market requirements also significantly enhances customer experience with the service received and affects product acceptance. By online monitoring of the processes, businesses can provide sustainable products and reduce waste, which minimizes product reworking and waste.

Managerial Implications

Compared to previous studies that focused on identifying the factors influencing business performance transformation (Jorzik et al., 2024; Kumar et al., 2021; Singh et al., 2024), this research delves into the practical capabilities of digital transformation technologies. It also examines businesses' expectations for targeted development of digital capabilities from system, business, and customer perspectives. It is critical to explore the opportunities and achievements of this emerging technology at various business levels and to understand the digital perspectives desired by managers to bridge the gap between the current and ideal situations. Therefore, based on the unique topics discussed, these propositions can be presented to audiences in the digital transformation domain.

This study identifies key propositions by applying two advanced text analysis techniques based on the results of topic modeling and text clustering algorithms. First, the major topics related to digital transformation and the practical capabilities of digital transformation technologies are identified using the LDA algorithm, which reveals hidden patterns within the texts. The analysis reveals three main categories of topics, which refer to the importance of using generative AI and IA in digital interactions (Proposition 1), reducing complexity and uncertainty through crisis management systems (Proposition 2), and online monitoring of human and physical resources for strategic resource allocation and optimization (Proposition 3). The results of the topic modeling are presented in Table 6 and Figure 8, which clearly show the distribution and relevance of the extracted topics, which is in line with answering the second research question to identify significant topics related to the impact of digital transformation on improving business performance.

Proposition 1. Leveraging generative AI and IA is essential for knowledge workers during digital interactions.

The findings highlight the importance of "Advanced Data Analytics Technologies", particularly "Generative AI". Generative AI can generate user-friendly and personalized textual, visual, audio, and video content. This has gained significant acceptance among researchers in recent studies. Notable generative AI tools include pre-trained transformer models like ChatGPT and LLMS. These tools can analyze and generate text using semantic similarity, classification, clustering, and word embedding to provide conceptual summaries of documents. The primary aim is to uncover hidden patterns and identify nuanced textual distinctions, enabling more thorough analysis than traditional text mining techniques (Ortakci, 2024). The advancements in generative AI and its widespread acceptance among knowledge

workers present significant opportunities for optimizing processes and boosting flexibility in uncertain business conditions. Projections regarding the impact of this technology on industries suggest a 7% increase in GDP and the replacement of 300 million jobs worldwide through IA, based on a comprehensive evaluation of the current landscape, evolving operational activities, and identifying opportunities (Akhtar et al., 2024).

A comprehensive analysis of digital interactions between businesses, customers, employees, and partners provides valuable insights into stakeholders' needs. This insight leads to targeted development of new products and services and innovative ways to enhance efficiency and effectiveness, creating a competitive advantage, improving targeted interactions, and reducing waste. Despite the many advantages mentioned, the extracted concepts from information retrieval sometimes need clarification. To address this, targeted interactions of users with generative AI and the use of relevant pre-trained models are crucial in leveraging the capabilities of these emerging technologies. Therefore, based on the topics mentioned, the following proposition can be made for change business management:

Proposition 2. Crisis management systems reduce complexity and uncertainty in order to implement dynamic processes successfully.

Advanced analytics allows businesses to identify potential opportunities and challenges in the change process, enabling them to take steps toward successful implementation, decreasing complexity and uncertainty, and enhancing process reliability (Bartosova et al., 2023). Financial managers can also benefit from using various technologies to identify financial risks and investment opportunities (Roeder et al., 2022). These technologies analyze historical trends and examine multiple variables to provide practical insights. Additionally, blockchain technologies enhance the security and transparency of financial transactions, making them more reliable for all parties involved.

In today's fast-paced business environment, it is crucial to have effective crisis management systems to mitigate the impact of unforeseen challenges. Innovative crisis management systems act through proactive planning, strategic decision-making, and innovative actions to control the impact of crises. By adopting such a dynamic system, businesses can develop creative and new solutions to overcome unexpected challenges. Moreover, digital technologies like digital twins and virtual reality can help businesses better understand their systems and processes (García et al., 2022). Through simulation, these technologies can predict the impact of different variables on each other, leading to better recognition of system behavior. By gathering online data from intelligent sensors of machines, software, and automation, these technologies can monitor production lines, predict downtime and repair time of systems, and identify issues before they become costly breakdowns. On the other hand, digital technologies also enable automatic monitoring of defects and anomalies during production, providing feedback on product quality. For instance, machine vision technology can inspect product shape, color, and materials, leading to process

correction, waste reduction, and quality improvement. Therefore, based on the mentioned topics, the following proposition can be made for optimal resource allocation:

Proposition 3. Online supervision allocates and optimizes human and physical resources (financial, infrastructural, and technological assets) to achieve strategic resource management.

AI leads to the ability to plan and budget resources to align with the determined priorities of the business and create a competitive advantage by reviewing limited sources and considering project requirements. Also, AI plays a crucial role in designing sustainable services and products by providing online supervision of the performance of systems, equipment, processes, and individuals (Guandalini, 2022). This approach helps identify the influential factors in optimal resource allocation, leading to decreased environmental impact. Furthermore, sustainable design impacts agile responding to the demands of the changing market and creating an effective supply chain that quickly adapts to the changes and answers the market's growing demands.

The impact of AI on supply chain management has affected all business operations, including design, R&D, production, and marketing (in other words, all activities from supplying raw materials to product delivery or customer services). Advanced data analytics provide valuable insight into supplier relationships, customer preferences, market trends, and production lines (Oliveira-Dias et al., 2022). These insights aid inventory management, demand forecasting, resource allocation, and order points. In addition, online supervision of the flow of materials throughout the supply chain helps to prevent over-accumulation or depletion of inventory levels while reducing human interventions as much as possible. Therefore, based on the mentioned topics, the following proposition can be made for better human resource management:

In the second part of the analysis, the clustering of articles demonstrates how digital technologies can help eliminate process bottlenecks and support dynamic hierarchical structures that enhance employee skills (Proposition 4). It also highlights the significance of data-driven marketing in developing strategies that increase perceived customer value (Proposition 5). Table 4 and Figure 10 display the detailed clustering results, which examine the relationships between similar terms and their groupings. This analysis addresses the third research question and identifies key components related to the impact of digital transformation on improving business performance.

Proposition 4. Utilizing digital capabilities to tackle potential bottlenecks and time-consuming activities by actively monitoring dynamic hierarchical structures.

Project management platforms enable managers and team members to interact and supervise the project's progress. Time management is crucial for any project's success in today's competitive market. AI helps managers forecast requirements and accurately estimate operation time by recognizing patterns and reasons for project failure or success (Elena et al., 2024). It tackles potential bottlenecks and time-wasting activities and proposes solutions for

these problems. In addition, NLP capabilities such as chatbots and virtual assistants have made it easier for businesses to communicate with their teams and answer employee inquiries, providing them access to the latest project information. All these advancements have led to the creation of dynamic hierarchical structures and increasing cooperation between parties. As a result, the vertical workflow has been reduced, and reporting, which was once a time-consuming matter, has become more efficient.

Additionally, the development of intelligent human resources systems has revolutionized the way different human resources processes are carried out. From recruiting and employing to performance evaluation, reward management, salaries, and wages, these systems have significantly simplified and automated these processes. Intelligent systems save human resources specialists time to analyze candidates' resumes during their preliminary interviews and give managers time to focus on the final stages of the employment phase. Moreover, these intelligent systems help managers make informed decisions regarding employee promotion and rewards by examining their performance and participation in the company. They can also analyze historical trends of employees' activities, which can aid in determining the salary amount and job status. Furthermore, with the market conditions and business requirements constantly changing, job responsibilities are also evolving, making it necessary to design training courses to improve employees' skills. Intelligent systems play a crucial role in this regard, as they can help identify skill gaps and design training courses that solve these needs.

Digital Technologies improve collaborative learning by facilitating the gathering, storing, sharing, and using diverse data formats (text, numerical, voice, image, and video). These technologies have made it easier for employees to access information by connecting to the Internet. This has opened up new opportunities for remote teams, as they can collaborate more effectively and efficiently. These technologies strengthen the interaction and cooperation between the employees so that they work together, sharing their ideas and recommendations to solve problems and reach a mutual understanding. Additionally, simulation capabilities allow employees to analyze different aspects of their duties, which is crucial in improving their ability to work together as a team. Therefore, based on the mentioned topics, the following proposition can be made for providing digital servitization:

Proposition 5. The impact of data-driven marketing on formulating appropriate strategies to enhance customer perceived value.

Many businesses harness the transformative power of IA to revolutionize their digital marketing activities, fundamentally altering customer behavior analysis during purchases or when engaging with a communication channel. The insights from data analysis are pivotal in crafting marketing strategies for introducing new services and products to customers (Makkonen et al., 2022). These technologies also play a pivotal role in the marketing campaign to present appropriate content and personalized suggestions based on customer

demands, leading to targeted customer interactions with the business and significantly impacting brand promotion based on customer attitude.

In today's digital marketing landscape, augmented and virtual reality technologies are making it possible to introduce products and services in an exciting and immersive way (Wieland et al., 2024). This has significantly changed how products are marketed, allowing businesses to create more engaging experiences. Additionally, NLP capabilities facilitate the examination of sentiments and opinions in customer engagement, enabling businesses to identify customer concerns and resolve issues promptly.

Moreover, using chatbots and virtual assistants to address customer inquiries promptly is essential for enhancing customer satisfaction during business interactions. Chatbots can minimize the need for support staff, leading to significant business cost savings. According to reports, the targeted use of chatbots is projected to save $11 billion annually by 2023 (Issac & Mohamed, 2023). Digital technologies have proven effective in enhancing digital servitization, which is a shift from a product-centric approach to a service-centric one. By offering services, businesses can create new revenue streams by adding more value to their customers. Digital servitization also enables businesses to offer previously impossible services. These services complement physical products and improve customer perceived value. Ultimately, this enhances customer satisfaction and positively influences their attitudes toward continuing their relationship with the business. The conceptual model effectively illustrates the causal relationship among the five propositions and emphasizes the connections between the presented findings in Figure 13.
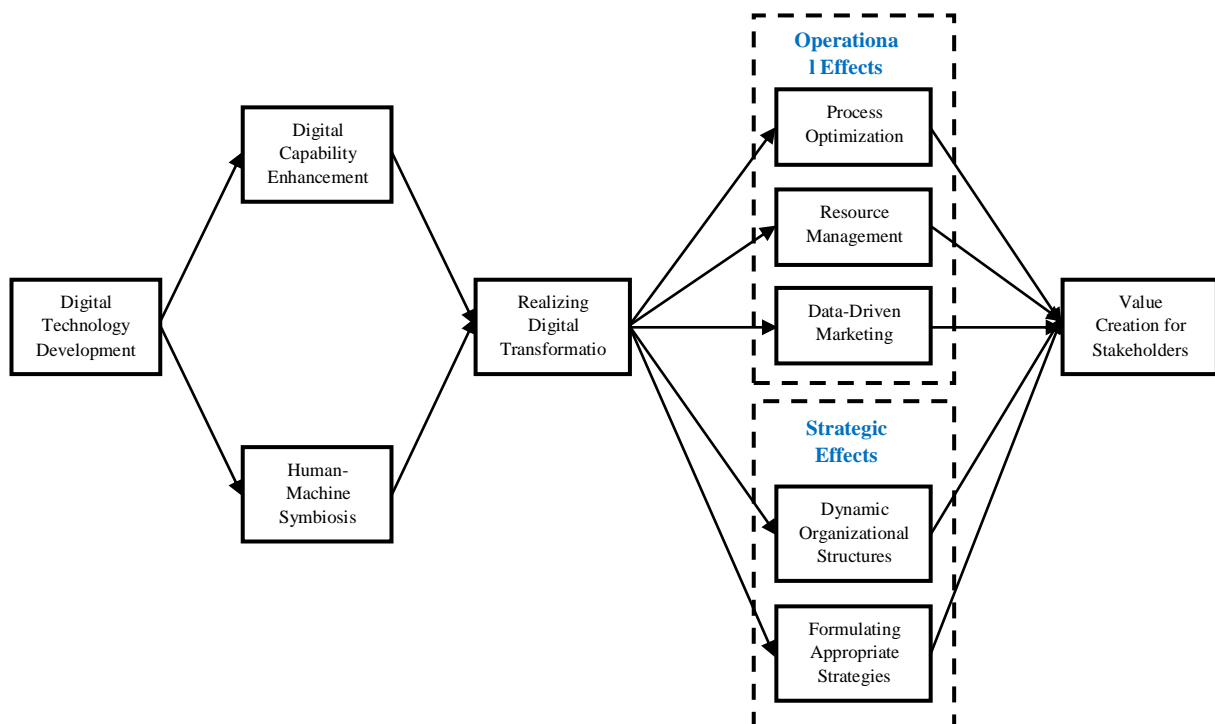

Figure 13. Conceptual Model

The development of digital technologies is the primary driver for enhancing digital capabilities within businesses. These capabilities involve effectively utilizing data, implementing intelligent systems, and building a robust digital infrastructure. This creates opportunities to optimize processes using these technologies. Additionally, human-machine symbiosis has become crucial in the collaborative interaction between technology and human resources. This synergy boosts the productivity of knowledge workers and enhances decision-making quality across various levels. As a result, businesses can leverage digital technologies to automate tasks, increase digital interactions, and improve collaboration between employees and intelligent systems.

Realizing these components drives digital transformation is crucial, as it significantly impacts both operational and strategic levels within a business. At the operational level, digital transformation optimizes processes by reducing complexity and enhancing efficiency. Additionally, effective resource management leads to better allocation of both human and physical resources. Data-driven marketing enables businesses to take targeted actions by analyzing customer data.

On the strategic level, digital transformation enables businesses develop flexible and innovative strategies to adapt to a changing environment. Additionally, creating dynamic organizational structures facilitates quick responses to market developments. Ultimately, these transformations create value for stakeholders so that knowledge workers experience increased productivity and effectiveness through innovative technologies, and customers are satisfied with enhanced digital services and personalized interactions that improve their perceived value.

Technical Implications

The trend analysis offers valuable insights into fourth research question. The results highlight several key trends, each representing a unique aspect of digital transformation. The identified clusters encompass related topics such as digital business models, innovation, digital capabilities, digital transformation strategies, and the application of advanced digital technologies, including ML, Industry 4.0, AI, big data, blockchain, and the IoT. Additionally, digital maturity, absorptive capacity, and circular economy underscore the significance of digital investments in organizations. Moreover, topics related to digital governance, digital leadership, sustainable development, and technological infrastructure emphasize the need for appropriate policies and legal frameworks to bridge the digital divide and promote economic growth.

Furthermore, the trends related to digital finance, fintech, and economic mechanisms indicate a need for research on the impact of new technologies in enhancing energy efficiency, internal control, and operational efficiency. This research would contribute to developing comprehensive and multidimensional frameworks for assessing digital technologies' direct and indirect effects. Finally, this study emphasizes important concepts

such as dynamic capability and the resource-based perspective, highlighting the significance of digital technology capabilities in identifying opportunities, resources, and competencies within the digital landscape. Future research should also investigate the interaction between new technologies and structural transformations in business models and analyze the role of advanced technologies in creating innovative supply chains and improving production processes.

Conclusion

Research in the field of digital transformation has become essential due to the increasing acceptance of emerging digital technology by researchers and industry managers. This research aims to conduct a systematic literature review to identify significant topics in enhancing digital transformation capabilities in business. The research employs thematic analysis, advanced text analytics, and trend analysis with practical business implications to present five propositions. The research artifact creates a conceptual model that compares thematic networks with dynamic capability theory constructs and interprets the most influential themes by examining selected articles in depth.

The study examined previous research findings on business, systemic, and customer perspectives. The results showed that digital transformation technologies significantly impact digitalization, collaborative learning, data-driven decision-making, and digital interaction. Businesses that use digital capabilities can succeed and stay ahead of the curve. Future research should comprehensively investigate the role of new digital transformation technologies in various operational processes to uncover hidden relationships and patterns in business activities. Implementing digital transformation in business leads to optimal resource allocation, profitability, change management, agility, and a smart circular economy. Therefore, evaluating factors that have the most significant impact on improving business performance is recommended.

It is crucial to shift from retrospective to prospective papers when considering this approach. This approach allows researchers to anticipate potential opportunities and challenges that may require further attention. With the advancement of digital technologies across various industries, prospective research is essential for identifying the best solutions and strategies. It is also important to focus on the most recently published papers to ensure that the analysis includes the latest concepts. Additionally, researchers should consider examining papers from a longer time frame to gain a deeper understanding of the historical process. Utilizing other databases, such as Google Scholar, for searching can also be beneficial.

Additionally, it should be noted that LDA was chosen as the most common topic modeling algorithm and partitioning clustering (K-means) was selected as the most optimal text clustering technique. Other topic modeling algorithms (such as Latent Semantic Analysis (LSA) and Nonnegative Matrix Factorization (NFM)) and text clustering (such as hierarchical

clustering and density-based clustering) are recommended to achieve better and improved results. Furthermore, due to the growing advancement of generative AI as one of the most widely used text analytics tools, researchers are advised to utilize LLMS and ChatGPT to extract major topics, influential concepts, and future research trends.

Conflict of interest

All authors declare that they have no conflicts of interest.

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Appendix

Table 6. Topic Modeling Results

Section	Topic	Most Relevant Words	Frequency	Labels
Title	Topic 1	0.031*"sustainable" + 0.025*"high" + 0.023*"intelligence" + 0.023*"dynamic" "+ 0.021*"management" + 0.019*"design" + 0.017*"education" + "0.017*"evaluation" + 0.011*"explore" + 0.011*"production"	30.7%	Sustainable Design
	Topic 2	0.033*"medium" + 0.029*"sector" + 0.025*"value" + 0.023*"social" + "0.021*"psychological" + 0.021*"remote" + 0.020*"retail" + 0.019*"ecosystem" "+ 0.015*"management" + 0.013*"integrative"	30.2%	Integrative Media Management
	Topic 3	0.022*"analysis" + 0.017*"challenge" + 0.016*"resource" + "0.016*"enterprise" + 0.016*"machine" + 0.016*"medium" + 0.016*"agility" + "0.016*"decision" + 0.016*"public" + 0.015*"direction"	20.2%	Enterprise Decision-Making
	Topic 4	0.042*"system" + 0.031*"platform" + 0.023*"management" + "0.016*"information" + 0.012*"crisis" + 0.012*"component" + 0.011*"time" + "0.010*"social" + 0.010*"network" + 0.010*"innovate"	18.9%	Innovative Crisis Management System
Abstract	Topic 1	0.014*"design" + 0.013*"information" + 0.008*"sustainable" + "0.007*"platform" + 0.007*"management" + 0.007*"system" + "0.005*"sustainability" + 0.005*"space" + 0.005*"implement" + "0.005*"address"	29.4%	Design Sustainable Information Systems
	Topic ٢	'0.011*"value" + 0.010*"change" + 0.010*"social" + 0.008*"medium" + "0.006*"share" + 0.006*"analysis" + 0.006*"public" + 0.006*"dynamic" + "0.005*"service" + 0.005*"provider"	26.7%	Analyzing Dynamic Value Changes in Social Media
	Topic ٣	0.010*"platform" + 0.009*"ecosystem" + 0.007*"system" + 0.007*"service" + "0.006*"suggest" + 0.006*"analysis" + 0.006*"make" + 0.005*"decision" + "0.005*"behavioral" + 0.005*"work"	20.1%	Decision Making in Service Platforms
	Topic ٤	0.017*"startup" + 0.010*"value" + 0.008*"retail" + 0.008*"system" + "0.007*"production" + 0.007*"solution" + 0.006*"information" + 0.005*"high" "+ 0.005*"change" + 0.005*"opportunity"	16.2%	Opportunities for Retail Startups
	Topic ٥	0.008*"challenge" + 0.007*"operation" + 0.007*"sector" + 0.007*"agility" + "0.007*"management" + 0.006*"analysis" + 0.006*"enterprise" + 0.006*"market" "+ 0.005*"implementation" + 0.005*"remote"	7.6%	Enterprise Agility
Keywords	Topic 1	0.040*"chain" + 0.034*"supply" + 0.034*"strategy" + 0.029*"system" + "0.028*"value" + 0.023*"management" + 0.016*"agility" +	25.1%	Agile Supply Chain Management

		0.015*"information" "+ 0.012*"public" + 0.012*"social"		
	Topic ۲	0.046*"value" + 0.028*"intelligence" + 0.028*"generative" + "0.022*"enterprise" + 0.018*"creation" + 0.012*"management" + "0.012*"maturity" + 0.012*"strategy" + 0.012*"knowledge" + "0.011*"government"	20.8%	Role of Generative Systems in Knowledge Management
	Topic ۳	0.022*"strategy" + 0.019*"retail" + 0.019*"medium" + 0.016*"social" + "0.016*"resistance" + 0.015*"system" + 0.014*"sustainability" + "0.014*"provider" + 0.012*"intelligence" + 0.012*"artificial"	19%	Sustainable Strategies for Retail Systems
	Topic ۴	0.044*"service" + 0.041*"ecosystem" + 0.027*"platform" + "0.022*"sustainable" + 0.020*"network" + 0.018*"system" + 0.015*"smart" + "0.013*"market" + 0.013*"machine" + 0.013*"analysis"	18.7%	Smart Service Ecosystems
	Topic ۵	0.043*"dynamic" + 0.024*"agility" + 0.023*"information" + "0.021*"management" + 0.014*"design" + 0.013*"market" + 0.013*"artificial" + "0.013*"intelligence" + 0.011*"system" + 0.011*"affordance"	16.3%	Dynamic Systems in Agility Market
Introduction	Topic 1	0.006*"information" + 0.006*"service" + 0.005*"value" + 0.005*"change" + "0.004*"system" + 0.004*"resource" + 0.004*"product" + 0.004*"enterprise" + "0.003*"human" + 0.003*"challenge"	23.6%	Value Change in Human Resource System
	Topic 2	0.007*"dynamic" + 0.006*"change" + 0.006*"value" + 0.005*"service" + "0.005*"information" + 0.005*"product" + 0.004*"market" + 0.004*"knowledge" "+ 0.004*"strategy" + 0.004*"management"	22.7%	Change Management In Dynamic Market
	Topic 3	0.007*"resource" + 0.006*"strategy" + 0.006*"information" + "0.006*"platform" + 0.006*"network" + 0.005*"service" + 0.004*"value" + "0.004*"product" + 0.004*"knowledge" + 0.004*"market"	16.3%	Strategic Resource Management
	Topic 4	0.006*"system" + 0.005*"value" + 0.005*"service" + 0.005*"management" + "0.004*"ecosystem" + 0.004*"customer" + 0.004*"change" + 0.004*"strategy" + "0.003*"risk" + 0.003*"solution"	14.3%	Risk Management in Service Systems
	Topic 5	0.011*"knowledge" + 0.007*"management" + 0.004*"social" + 0.004*"product" + "0.004*"market" + 0.004*"information" + 0.004*"change" + 0.003*"value" + "0.003*"strategy" + 0.003*"chain"	13.7%	Role of Knowledge Management in Market Changes
	Topic 6	0.008*"platform" + 0.005*"service" + 0.005*"knowledge" + "0.005*"information" + 0.005*"social" + 0.005*"product" + 0.005*"customer" + "0.004*"management" + 0.004*"system" + 0.004*"resource	9.4%	Role of Information Systems in Product and Service Management
Literature Review	Topic 1	0.008*"value" + 0.007*"service" + 0.007*"knowledge" + 0.007*"system" + "0.006*"information" + 0.006*"change" + 0.005*"network" + 0.005*"product" + "0.005*"customer" + 0.004*"social"	28.3%	Value Creation for Customer
	Topic 2	0.007*"strategy" + 0.006*"service" + 0.006*"value" + 0.006*"customer" + "0.005*"change" + 0.005*"social" + 0.004*"resource" + 0.004*"product" + "0.004*"information" + 0.004*"system"	23.2%	Strategic Approaches to Enhance Service Value
	Topic 3	0.008*"information" + 0.006*"value" + 0.006*"knowledge" + 0.006*"customer" "+ 0.005*"change" + 0.005*"resource" + 0.004*"service" + 0.004*"product" + "0.004*"system" + 0.004*"dynamic"	14.2%	Resource Management in a Dynamic Systems

	Topic 4	0.008*"value" + 0.007*"change" + 0.005*"customer" + 0.005*"resource" + "0.005*"service" + 0.004*"management" + 0.004*"system" + 0.004*"product" + "0.004*"dynamic" + 0.004*"strategy"	13.7%	Customer value Strategic Management
	Topic 5	0.006*"system" + 0.006*"value" + 0.006*"service" + 0.005*"knowledge" + "0.005*"resource" + 0.005*"change" + 0.004*"customer" + 0.004*"platform" + "0.004*"product" + 0.003*"management"	12.7%	Knowledge-Based Value Systems
	Topic 6	0.008*"value" + 0.008*"product" + 0.007*"information" + 0.007*"service" + "0.006*"resource" + 0.005*"management" + 0.004*"system" + 0.004*"customer" + "0.004*"platform" + 0.004*"market"	8%	Maximizing Value and Product Success through Information Management
Research Method	Topic 1	0.012*"value" + 0.007*"analysis" + 0.005*"network" + 0.005*"customer" + "0.005*"strategy" + 0.005*"service" + 0.005*"application" + 0.004*"resource" "+ 0.004*"platform" + 0.004*"information"	18.2%	Value Network Analysis
	Topic 2	0.007*"information" + 0.005*"analysis" + 0.005*"orientation" + "0.004*"dimension" + 0.004*"knowledge" + 0.004*"scale" + 0.004*"system" + "0.004*"security" + 0.004*"construct" + 0.003*"value"	16.4%	Knowledge Management Orientation
	Topic 3	'0.005*"value" + 0.004*"management" + 0.004*"analysis" + 0.003*"variable" + "0.003*"second" + 0.003*"topic" + 0.003*"step" + 0.003*"database" + "0.003*"service" + 0.002*"phase"	15.2%	Value Management Capability
	Topic 4	0.007*"analysis" + 0.004*"management" + 0.003*"service" + 0.003*"value" + "0.003*"strategy" + 0.003*"information" + 0.003*"quality" + 0.003*"time" + "0.003*"scale" + 0.003*"system"	14.7%	Impact of Data Analysis on Service Quality
	Topic 5	0.006*"service" + 0.005*"information" + 0.004*"system" + 0.004*"platform" + "0.004*"solution" + 0.003*"management" + 0.003*"value" + 0.003*"market" + "0.003*"enterprise" + 0.003*"design"	11.7%	Designing Service-Oriented Platform
	Topic 6	0.006*"information" + 0.005*"service" + 0.005*"analysis" + 0.004*"customer" "+ 0.003*"government" + 0.003*"value" + 0.003*"management" + 0.003*"design" "+ 0.003*"step" + 0.003*"group"	10.3%	Customer Service Analytics
	Topic 7	0.007*"information" + 0.006*"analysis" + 0.005*"resource" + 0.004*"system" "+ 0.004*"customer" + 0.004*"value" + 0.004*"social" + 0.003*"knowledge" + "0.003*"type" + 0.003*"challenge"	7%	Information System Analysis
	Topic 8	0.006*"value" + 0.005*"design" + 0.004*"social" + 0.004*"information" + "0.004*"management" + 0.004*"medium" + 0.003*"respondent" + 0.003*"analysis" "+ 0.003*"solution" + 0.003*"interview"	6.4%	Designing Social Medium
Data Analysis	Topic 1	0.007*"analysis" + 0.007*"value" + 0.006*"customer" + 0.004*"service" + "0.004*"information" + 0.004*"order" + 0.004*"machine" + 0.003*"change" + "0.003*"product" + 0.003*"management"	20.7%	Customer Value Analytics
	Topic 2	0.009*"service" + 0.007*"customer" + 0.006*"value" + 0.005*"analysis" + "0.005*"information" + 0.004*"system" + 0.004*"solution" + 0.004*"product" + "0.004*"change" + 0.003*"network"	20.1%	Optimizing Customer Service
	Topic 3	0.007*"value" + 0.006*"analysis" + 0.004*"management" + 0.003*"service" +	15.8%	Value Creation for Business

		"0.003*"information" + 0.003*"product" + 0.003*"change" + 0.003*"public" + "0.003*"support" + 0.003*"significant"		
	Topic 4	0.008*"value" + 0.008*"analysis" + 0.005*"market" + 0.004*"service" + "0.004*"project" + 0.004*"strategy" + 0.004*"customer" + 0.004*"management" "+ 0.004*"product" + 0.003*"team"	13.9%	Enhancing Business Success through Strategic Value Analysis
	Topic 5	0.006*"service" + 0.006*"value" + 0.005*"analysis" + 0.004*"construct" + "0.004*"management" + 0.004*"topic" + 0.004*"change" + 0.003*"platform" + "0.003*"information" + 0.003*"solution"	12.4%	Evaluating Service Value and Management
	Topic 6	0.006*"social" + 0.005*"information" + 0.005*"value" + 0.004*"knowledge" + "0.004*"analysis" + 0.004*"change" + 0.004*"strategy" + 0.004*"service" + "0.004*"system" + 0.004*"customer"	10.5%	Driving Social Change With Information
	Topic 7	0.006*"analysis" + 0.006*"platform" + 0.004*"project" + 0.004*"value" + "0.004*"strategy" + 0.003*"service" + 0.003*"change" + 0.003*"topic" + "0.003*"product" + 0.003*"design"	6.6%	Project Management Platform
Discussion	Topic 1	'0.007*"customer" + 0.007*"value" + 0.006*"service" + 0.005*"network" + "0.005*"platform" + 0.005*"knowledge" + 0.005*"change" + 0.004*"social" + "0.004*"information" + 0.004*"management"	20.7%	Improve Customer Value
	Topic 2	0.007*"service" + 0.007*"value" + 0.006*"product" + 0.005*"customer" + "0.005*"system" + 0.005*"resource" + 0.005*"information" + 0.005*"strategy" "+ 0.004*"knowledge" + 0.004*"change"	20.1%	Optimizing Service Value
	Topic 3	0.008*"value" + 0.006*"service" + 0.006*"customer" + 0.005*"analysis" + "0.005*"network" + 0.005*"change" + 0.004*"system" + 0.004*"solution" + "0.004*"team" + 0.004*"design"	15.8%	System Change Solution
	Topic 4	'0.008*"service" + 0.007*"customer" + 0.005*"value" + 0.005*"change" + "0.005*"system" + 0.004*"strategy" + 0.004*"product" + 0.004*"information" + "0.004*"management" + 0.004*"project"	13.9%	Optimizing Service Systems
	Topic 5	0.005*"strategy" + 0.005*"information" + 0.004*"value" + 0.004*"system" + "0.004*"product" + 0.004*"customer" + 0.004*"knowledge" + "0.004*"significant" + 0.003*"resource" + 0.003*"management"	12.4%	Strategic Information Systems
	Topic 6	0.008*"service" + 0.005*"system" + 0.005*"value" + 0.004*"information" + "0.004*"strategy" + 0.004*"customer" + 0.003*"platform" + 0.003*"change" + "0.003*"time" + 0.003*"management"	10.5%	Time Management in Service Systems
Conclusion	Topic 1	0.008*"service" + 0.007*"value" + 0.006*"change" + 0.005*"customer" + "0.005*"strategy" + 0.005*"product" + 0.004*"activity" + 0.004*"analysis" + "0.004*"work" + 0.004*"system"	30.1%	Analysis of Service Value Change
	Topic 2	0.011*"value" + 0.005*"customer" + 0.005*"ecosystem" + 0.004*"product" + "0.004*"market" + 0.004*"change" + 0.004*"management" + 0.004*"service" + "0.003*"strategy" + 0.003*"information"	22.4%	Value Creation Ecosystem
	Topic 3	0.007*"change" + 0.005*"information" + 0.005*"platform" + 0.005*"customer" "+ 0.005*"analysis" + 0.005*"work" + 0.004*"product" + 0.004*"value" + "0.004*"management" + 0.004*"strategy"	9.3%	Leveraging Information Platforms

	Topic 4	0.006*"change" + 0.005*"knowledge" + 0.005*"value" + 0.005*"customer" + "0.005*"chain" + 0.005*"resource" + 0.004*"strategy" + 0.004*"design" + "0.004*"management" + 0.004*"information"	7.8%	Optimizing Value Chain
	Topic 5	0.007*"customer" + 0.007*"value" + 0.007*"work" + 0.006*"strategy" + "0.004*"management" + 0.004*"information" + 0.004*"system" + "0.004*"analysis" + 0.004*"service" + 0.003*"change"	7.7%	Customer Value Management
	Topic 6	0.005*"value" + 0.005*"strategy" + 0.004*"service" + 0.004*"knowledge" + "0.004*"work" + 0.004*"change" + 0.004*"management" + 0.003*"dynamic" + "0.003*"time" + 0.003*"customer"	7%	Strategic Value Management
	Topic 7	0.007*"knowledge" + 0.007*"social" + 0.005*"strategy" + 0.005*"value" + "0.005*"management" + 0.005*"analysis" + 0.004*"customer" + 0.004*"service" "+ 0.004*"platform" + 0.004*"change"	6.3%	Social Knowledge Management
	Topic 8	0.005*"knowledge" + 0.005*"strategy" + 0.005*"value" + 0.004*"customer" + "0.004*"work" + 0.004*"information" + 0.004*"chain" + 0.004*"change" + "0.004*"analysis" + 0.004*"supply"	6.1%	Change in Supply Chain
	Topic 9	'0.008*"service" + 0.006*"value" + 0.005*"strategy" + 0.005*"analysis" + "0.004*"customer" + 0.004*"platform" + 0.004*"change" + 0.004*"public" + "0.004*"system" + 0.004*"network"	3.3%	Customer-Centric Service

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