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Bibliometric Assessment of Data-Driven Marketing Research Trends in the Last Two Decades

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ABSTRACT

This study presents a bibliometric analysis of data-driven marketing research trends over the last two decades, with a focus on its intersection with innovation, decision-making, and related topics. Using VOSviewer for network visualization, we analyze co-authorship, keyword co-occurrence, publication frequency, and country collaboration to uncover key themes and research developments. The findings indicate a significant rise in data-driven marketing research, particularly from 2015 onwards, driven by advancements in big data, machine learning, and artificial intelligence. Co-authorship networks reveal strong interdisciplinary collaboration, while keyword co-occurrence maps highlight the growing role of innovation, decision-making, and machine learning in data-driven marketing. Additionally, country collaboration networks show the United States, China, the United Kingdom, and India as central contributors to global research. The keyword density heatmap emphasizes the increasing focus on data-driven innovation and product development. These insights offer valuable implications for academics and practitioners seeking to understand and apply data-driven marketing in a rapidly evolving digital landscape.

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1. INTRODUCTION

In the past two decades, marketing has seen substantial shifts driven by breakthroughs in data analytics and technology. Traditional marketing techniques that depended on intuition and experience have been gradually superseded by data-driven approaches that harness massive databases to assess consumer behavior, optimize campaigns, and predict market trends. This transition has been particularly noticeable with the growth of digital marketing, where organizations have access to large amounts of real-time data, enabling new potential for tailored marketing and more efficient allocation of resources. The rise of social media, mobile platforms, and e-commerce has expedited this trend, generating a demand for marketing strategies that are both flexible and evidence-based [1]. These advancements have not only revolutionized the way marketing is conducted but have also inspired a growing

amount of academic study focusing on data-driven marketing.

Bibliometric studies have become a key instrument for analyzing the evolution of scientific research in different domains, including marketing. Bibliometric analysis allows scientists to examine research patterns, identify major topics, and comprehend the trajectory of a discipline. In the context of data-driven marketing, bibliometric studies can provide significant insights into how this area of study has progressed over time, which approaches are most widely utilized, and which themes are gaining interest. For instance, studies have demonstrated an increasing interest in the use of artificial intelligence (AI), machine learning (ML), and big data analytics in marketing operations (Huang et al., 2021). By reviewing the literature via a bibliometric lens, researchers can acquire a better grasp of the fundamental issues that are defining the future of marketing research.

Data-driven marketing has also been recognized for its capacity to achieve commercial outcomes. Companies that effectively deploy data-driven marketing tactics tend to outperform their peers in terms of client acquisition, retention, and total profitability. Research reveals that organizations that base choices on data are 23 times more likely to attract clients, 6 times more likely to keep them, and 19 times more likely to be profitable (McKinsey & Company, 2019). As a result, there has been rising interest among both practitioners and scholars in studying the tools, approaches, and models that might help firms harness the power of data in their marketing operations. This has led to an explosion of study on themes such as customer segmentation, personalized marketing, predictive analytics, and the ethical concerns of collecting consumer data (Zhang et al., 2022).

Despite the rising body of research in data-driven marketing, there is still a need for a complete grasp of the research environment in this sector. Previous assessments have frequently focused on specific parts of data-driven marketing, such as digital marketing or AI applications, but few studies have taken a holistic approach to examine the overall research trends in this sector. A bibliometric review of data-driven marketing research over the last two decades can fill this vacuum by providing an overview view of how this discipline has progressed. Such a study can assist identify the most significant articles, authors, and journals, as well as indicate emerging trends that may affect the future of marketing research. This study attempts to present a bibliometric overview of data-driven marketing research, concentrating on the important themes and trends that have evolved in the past twenty years.

The exponential growth in data availability has dramatically altered the marketing landscape, making it more complex and multifaceted. While data-driven marketing has become an essential tool for businesses, there is still a fragmented understanding of the research in this area. Most existing studies focus on niche aspects, such as digital marketing, predictive analytics, or AI in marketing, rather than providing a comprehensive picture of the entire field. Additionally, there is limited bibliometric analysis that spans a full two decades, which means there is a knowledge gap regarding how research trends have shifted over time. Without a thorough understanding of these trends, researchers and practitioners may miss out on important insights that could guide future studies and business practices. Therefore, there is a pressing need for a bibliometric assessment that maps out the evolution of data-driven marketing research in the last two decades, identifying the key themes, methodologies, and areas of growth.

This study seeks to conduct a bibliometric analysis of data-driven marketing research published in the last twenty years. By doing so, it aims to achieve three main objectives: first, to identify the most influential publications, authors, and journals in the field of data-driven marketing; second, to uncover the key themes and methodologies that have dominated the research landscape; and third, to highlight

emerging trends that may shape the future of data-driven marketing. The findings from this study will provide a comprehensive overview of how data-driven marketing research has evolved, offering valuable insights for scholars and practitioners alike.

2. LITERATURE REVIEW

2.1 Data-Driven Marketing

Data-driven marketing refers to the process of leveraging data to inform and optimize marketing efforts. It entails collecting, analyzing, and interpreting data to make better marketing decisions and forecast future consequences. This technique contrasts with past marketing strategies that typically depended on intuition or broad demographics. Data-driven marketing focuses on accurate targeting and customisation, employing data to personalize ads to particular consumer interests. One of the primary advantages of this method is the ability to measure campaign performance in real-time, allowing marketers to change their plans to better results. According to [2], data-driven marketing has transformed the marketing landscape by enabling organizations to make decisions based on actual evidence rather than assumptions.

The fundamental components of data-driven marketing include customer segmentation, personalization, and predictive analytics. Customer segmentation involves dividing a market into distinct groups of consumers who have different needs, characteristics, or behaviors, and tailoring marketing efforts to each segment. Personalization takes this a step further by customizing marketing messages and offers to individual consumers based on their behaviors and preferences. Predictive analytics uses historical data to predict future behaviors, enabling marketers to anticipate customer needs and optimize campaigns for future success [3]. These strategies are underpinned by advancements in data analytics technologies, such as machine learning, big data, and AI, which allow marketers to analyze vast datasets and generate actionable insights.

2.2 Big Data in Marketing

Big data is a critical component of data-driven marketing. It refers to the large volumes of structured and unstructured data that companies collect from various sources, including social media, website interactions, customer transactions, and more. The rise of big data has provided marketers with unprecedented insights into customer behavior and preferences. This has made it possible to move beyond generalized marketing strategies toward highly targeted and personalized campaigns. The sheer volume, variety, and velocity of big data make it a valuable asset for marketers, but also pose challenges in terms of storage, processing, and analysis [4].

In marketing, big data is used to enhance customer insights, optimize marketing strategies, and drive decision-making. For example, companies like Amazon and Netflix use big data to recommend products and services to their customers based on previous purchases or viewing habits. This creates a more engaging and personalized experience, increasing customer satisfaction and loyalty. Big data also allows companies to test and refine their marketing strategies in real-time. They can measure the effectiveness of campaigns, adjust targeting, and allocate resources more efficiently based on data-driven insights [5].

However, while big data offers immense potential for marketing, it also raises several ethical and privacy concerns. The collection and use of personal data for marketing purposes must comply with regulations like the General Data Protection Regulation (GDPR) in Europe and the California Consumer Privacy Act (CCPA) in the U.S. These laws set strict guidelines on how companies can collect, store, and use personal data, ensuring that consumers' privacy is protected. Marketers must balance the benefits of big data with the ethical responsibility to respect consumer privacy and data security [6].

2.3 Artificial Intelligence and Machine Learning in Marketing

Artificial intelligence (AI) and machine learning (ML) are rapidly becoming integral to data-driven marketing strategies. AI refers to the simulation of human intelligence in machines that can perform tasks that typically require human cognition, such as decision-making, language understanding, and visual perception. In marketing, AI helps automate tasks, analyze customer data, and predict consumer behavior. Machine learning, a subset of AI, involves algorithms that allow computers to learn from data and make predictions or decisions without being explicitly programmed to perform those tasks [7].

One of the most prominent applications of AI in marketing is in customer segmentation and personalization. AI algorithms can analyze large datasets to identify patterns in consumer behavior, preferences, and purchasing habits. These insights allow marketers to create highly targeted marketing campaigns that are tailored to individual consumers. For example, AI-powered recommendation systems, such as those used by e-commerce platforms, suggest products to customers based on their browsing and purchase history, leading to higher conversion rates [8]. AI also plays a critical role in predictive analytics, helping marketers forecast future trends and consumer behaviors, which can inform marketing strategies and resource allocation.

Moreover, AI and ML enable automation in marketing processes, such as programmatic advertising and chatbots. Programmatic advertising uses AI to automate the buying and placement of ads in real-time, ensuring that the right message is delivered to the right audience at the right time. This reduces the need for manual intervention and improves the efficiency of advertising campaigns. Chatbots, powered by AI, provide customer service support by responding to queries in real-time, enhancing the customer experience while freeing up human resources for more complex tasks [9]. The integration of AI and ML in marketing has opened new possibilities for enhancing customer engagement, improving operational efficiency, and driving business outcomes.

2.4 Predictive Analytics in Marketing

Predictive analytics is a key component of data-driven marketing that uses statistical models and machine learning techniques to predict future customer behaviors based on historical data. This allows marketers to anticipate customer needs, optimize their strategies, and make data-informed decisions. Predictive analytics can help businesses identify which customers are most likely to make a purchase, which products are likely to perform well, and which marketing channels are most effective [10].

In marketing, predictive analytics is often used for customer lifetime value (CLV) modeling, churn prediction, and cross-selling or up-selling strategies. CLV modeling helps businesses predict the future value that a customer will bring, allowing them to allocate marketing resources more effectively. Churn prediction models analyze customer behavior patterns to identify customers who are at risk of leaving, enabling companies to take proactive steps to retain them. Cross-selling and up-selling strategies use predictive analytics to recommend products that customers are likely to purchase based on their past behaviors [11].

Predictive analytics has also transformed digital marketing. Marketers can now predict which online ads will perform best, which keywords will generate the most traffic, and which content will resonate with their target audience. These insights enable businesses to optimize their digital marketing strategies and improve return on investment (ROI). However, predictive analytics is not without challenges. It requires high-quality data, advanced analytical tools, and skilled personnel to interpret the results accurately. Moreover, as predictive models are based on historical data, they may not always be accurate in predicting future trends, particularly in rapidly changing markets [12].

2.5 Ethical Considerations in Data-Driven Marketing

While data-driven marketing offers numerous benefits, it also raises significant ethical concerns. The collection, storage, and use of customer data for marketing purposes must adhere to ethical standards and legal regulations to protect consumer privacy. Companies must be transparent about how they collect and use data and must obtain consent from consumers before using their personal information for marketing purposes. The misuse of data, such as unauthorized sharing or sale of personal information, can lead to breaches of trust and damage a company's reputation [13]. Data security is another important consideration in data-driven marketing. Marketers must ensure that the data they collect is stored securely and protected from unauthorized access. With the increasing number of cyberattacks and data breaches, companies face growing pressure to implement robust security measures to safeguard consumer data. Furthermore, marketers must consider the ethical implications of using data for predictive analytics. While predictive models can provide valuable insights, they can also perpetuate biases or make inaccurate predictions, leading to unfair or unethical marketing practices [14].

3. METHODS

This research performs a bibliometric analysis to analyze the changes in data-driven marketing research over the previous two decades. The data was collected from Google Scholar, where papers pertaining to data-driven marketing were found using particular keywords such as "data-driven marketing," "big data in marketing," "AI in marketing," and "predictive analytics in marketing." The search results were refined to include papers published between 1991 and 2023. VOSviewer software was applied to examine the acquired data, focusing on keyword co-occurrence, citation networks, and author collaboration patterns. The methodology also involves identifying the most prominent articles, journals, and authors based on citation count and network centrality.

4. RESULTS AND DISCUSSION

4.1 Bibliometric Overview

Table 1. Citation Metrics

Publication years:	1991-2024
Citation years:	33 (1991-2024)
Papers:	980
Citation:	110905
Cities/year:	3360.76
Cities/paper:	113.17
Cities/author:	47635.59
Papers/author:	503.13
Authors/papers:	2.71
h-index:	189
g-index:	314
hI,norm:	108
hI,annual:	3.27
hA-index:	68
Papert with ACC >= 1,2,3,10,20: 689,616,518,419,287	

Source: Publish or Perish, 2024

The citation metrics in Table 1 offer a comprehensive overview of the impact and productivity of the body of research on data-driven marketing from 1991 to 2024. Over these 33 years, a total of 980 papers were published, collectively receiving 110,905 citations, which translates to an average of 3,360.76 citations per year and 113.17 citations

per paper. The average citation count per author is 47,635.59, with each author contributing to approximately 503.13 papers, and an average of 2.71 authors per paper. The h-index of 189 indicates that 189 papers have been cited at least 189 times, highlighting the influence of key papers in the field. The g-index of 314 reflects the broader citation distribution, and the hI,norm value of 108 adjusts the h-index based on co-authorship. Additionally, the hI,annual value of 3.27 shows consistent yearly citation growth, while the hA-index of 68 underscores the impact of top-cited authors. Papers with at least 1, 2, 3, 10, and 20 citations are represented by 689, 616, 518, 419, and 287 papers respectively, illustrating the spread of influence across different citation thresholds. These metrics demonstrate a robust and steadily growing body of research in data-driven marketing.

4.2 Yearly Publication

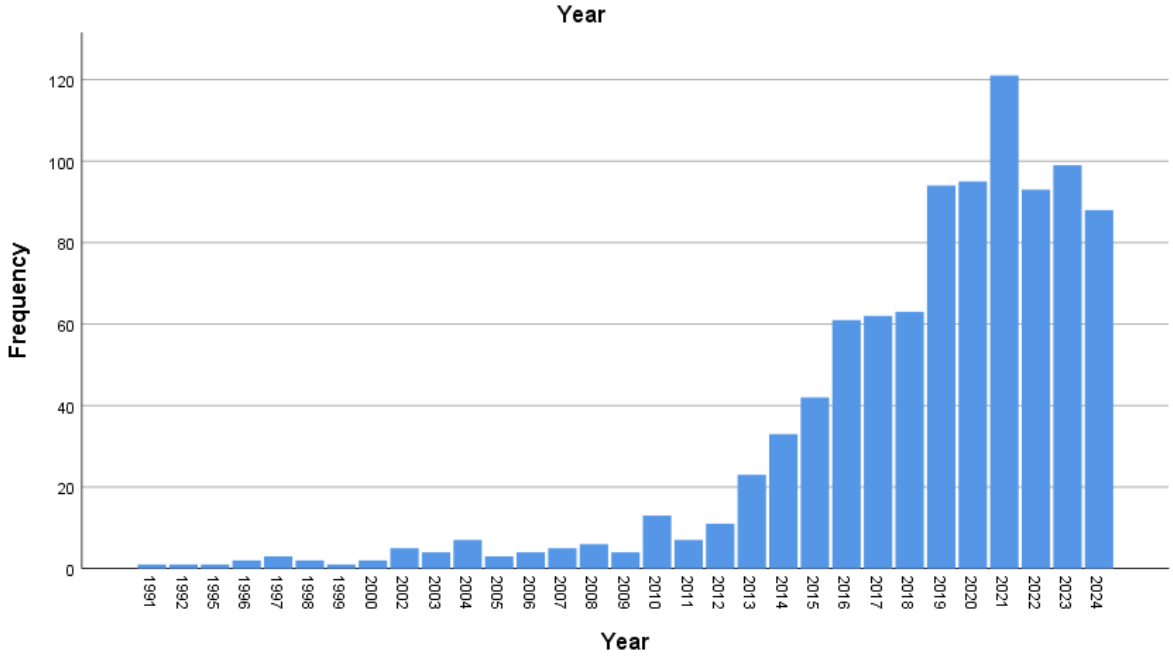

Figure 1. Yearly Publication

Source: Data Analysis, 2024

This bar chart represents the frequency of publications over time, from 1991 to 2024. The chart shows a significant increase in the number of publications, particularly after 2015. From 1991 to around 2010, the number of publications remained relatively low, with a gradual but slow rise. Starting in 2011, there is a noticeable upward trend in the frequency of publications, accelerating from 2015 onwards. The highest peak occurs in 2021, with over 120 publications in that year alone, followed by a slight decrease in 2022 and 2023. The frequency remains high in 2024, although it appears slightly lower than in previous years, likely due to incomplete data for that year. This trend suggests that the research field has experienced significant growth in recent years, with increasing interest and activity, particularly between 2017 and 2021. This surge could be attributed to the growing relevance of emerging technologies and the development of data-driven methodologies in marketing, business, and other related disciplines. The peak in 2021 indicates that this topic has reached widespread recognition, likely driven by advancements in digital transformation, big data, and artificial intelligence.

4.3 Author Collaboration

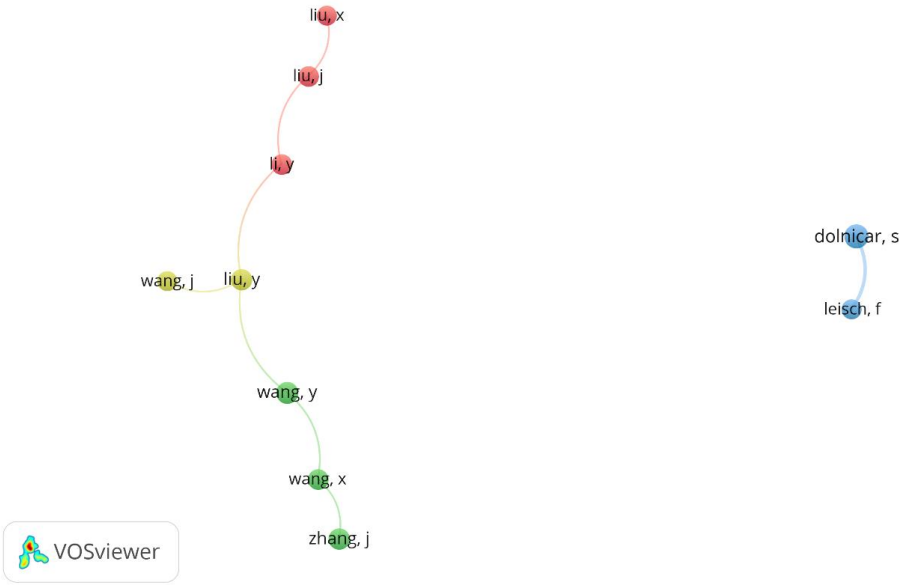

Figure 2. Author Collaboration
Source: Data Analysis, 2024

This figure represents a co-authorship network visualization generated using VOSviewer. The nodes in the network represent authors, and the size of each node correlates with the author's contribution or prominence in the field of study, based on the number of co-authored publications. The links between nodes indicate collaboration between authors, with thicker lines representing stronger collaboration (i.e., multiple co-authored papers). The figure shows two distinct clusters of authors: one larger, interconnected group on the left, featuring authors like Liu, J., Liu, Y., Wang, X., and Zhang, J., and a smaller cluster on the right, showing a strong collaboration between Dolnicar, S. and Leisch, F.

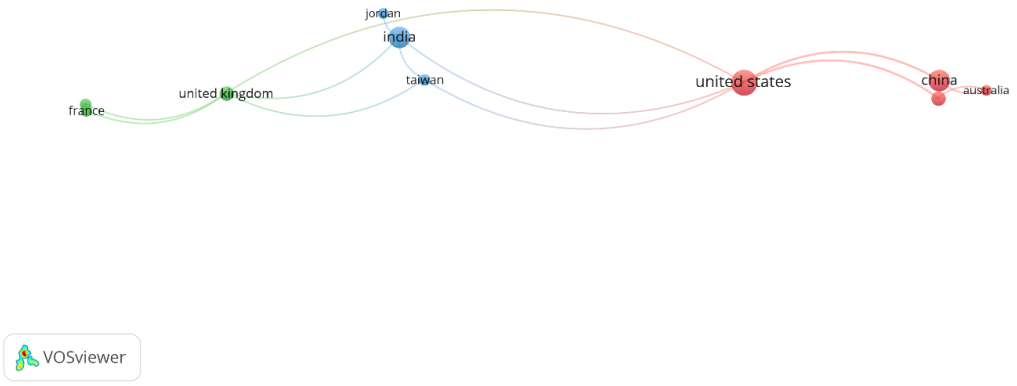

Figure 3. Country Collaboration
Source: Data Analysis, 2024

This figure represents a country collaboration network in academic research, generated using VOSviewer. Each node represents a country, and the size of the nodes indicates the relative contribution of each country to the research field, while the lines between nodes represent collaborative efforts between countries. The thickness of the lines reflects the strength or frequency of these collaborations. United States (US) appears as a central node in the network, showing strong collaborations with China, Australia, and India. This suggests that the US is a key player in fostering international research collaborations. China is closely linked with the US, indicating significant joint research output between these two nations. China also has ties with Australia and India, highlighting its active involvement in global academic partnerships. United Kingdom (UK) forms another important node, collaborating extensively with France and India, and to a lesser extent with other countries like Jordan and Taiwan. The UK's position suggests that it is a major hub in European and cross-regional academic collaboration. France and the United Kingdom have a strong collaborative connection, reflecting significant research partnerships between these European countries. India plays a pivotal role in connecting several regions, with collaborative links to the US, UK, and China, indicating its increasing prominence in global research.

4.4 Citation Analysis

Table 2. Top Cited Literature

Cites	Author	Title	Findings
2612	[15]	Data-driven science and engineering: Machine learning, dynamical systems, and control	Explores how machine learning and dynamical systems can be integrated to model complex physical systems using data-driven approaches.
2321	[16]	Data science and its relationship to big data and data-driven decision making	Provides an overview of how data science and big data are utilized for data-driven decision-making processes in various industries.
2057	[17]	Distributionally robust optimization under moment uncertainty with application to data-driven problems	Provides an overview of how data science and big data are utilized for data-driven decision-making processes in various industries.
1960	[18]	Data-driven soft sensors in the process industry	Reviews the use of soft sensors that are driven by data for monitoring and controlling industrial processes.
1927	[19]	Data-driven intelligent transportation systems: A survey	Surveys the application of data-driven approaches in intelligent transportation systems, highlighting key trends and technologies.
1810	[20]	Should you be persuaded: Two samples of data-driven learning materials	Investigates the effectiveness of data-driven learning materials in improving learning outcomes in educational settings.
1760	[21]	Dynamic mode decomposition: data-driven modeling of complex systems	Introduces dynamic mode decomposition as a data-driven approach for analyzing and modeling complex dynamical systems.
1719	[22]	Data-driven distributionally robust optimization using the Wasserstein metric: Performance guarantees and tractable reformulations	Develops data-driven optimization techniques using the Wasserstein metric to ensure robust performance under uncertainty.

1656	[23]	Data-driven smart manufacturing	Discusses the role of data-driven technologies in advancing smart manufacturing systems and improving production efficiency.
1344	[24]	Strength in numbers: How does data-driven decisionmaking affect firm performance?	Examines the positive impact of data-driven decision-making on firm performance, including productivity and profitability gains.

Source: Publish or Perish, 2024

4.5 Keyword Co-Occurrence Visualization

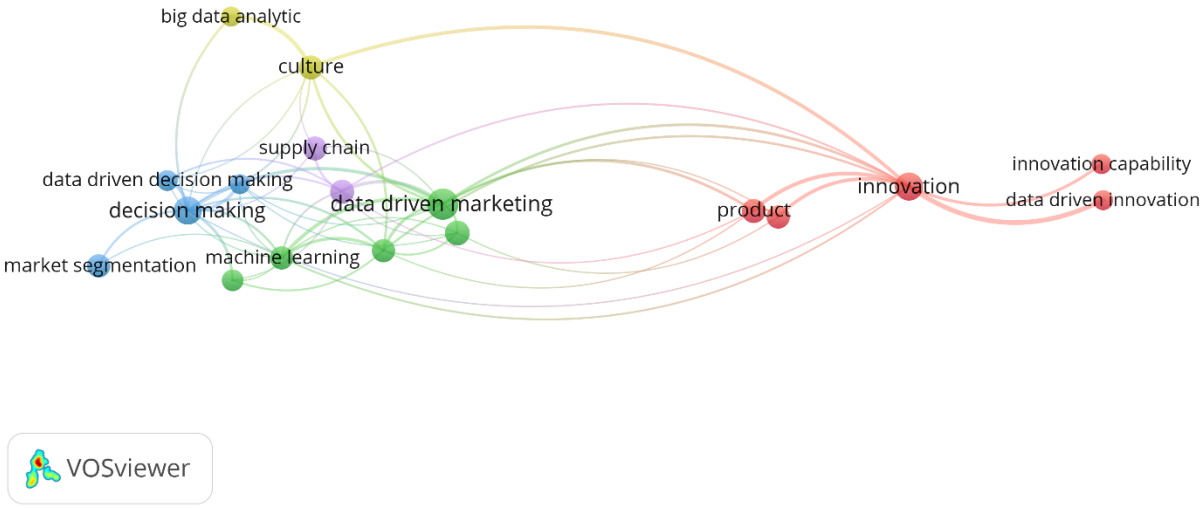

Figure 4. Network Visualization

Source: Data Analysis, 2024

This figure represents a keyword co-occurrence network in the field of data-driven marketing and innovation. Each node in the network represents a keyword, and the size of the node indicates the frequency with which that keyword appears in the analyzed body of literature. The lines between nodes indicate co-occurrences of keywords, meaning that these concepts are often discussed together in academic papers. The colors of the nodes represent different clusters, signifying groups of related keywords that are often found together in the literature. In the center of the network, "**data-driven marketing**" appears as one of the most central and connected nodes, signifying its role as a foundational concept in the body of research. It is closely related to terms like "**decision making,**" "**machine learning,**" and "**market segmentation,**" which are all vital components of how data is used to inform marketing strategies. The strong links between **data-driven marketing** and **decision making** indicate that much of the research focuses on how marketing decisions are improved through data analytics, a central theme in contemporary marketing literature.

Moving to the right side of the network, we observe a separate but connected cluster focused on "**innovation**" and "**product.**" This cluster emphasizes the relationship between data-driven marketing and innovation capabilities. The term "**data-driven innovation**" suggests that a growing body of literature explores how data-driven processes contribute to product development and organizational innovation. The presence of keywords like "**innovation capability**" in close proximity to "**data-driven innovation**" reflects a focus on how data can enhance an organization's ability to innovate, supporting new product development and improving competitive advantage.

Lastly, there are smaller clusters on the left and upper parts of the network, involving terms such as "**big data analytics,**" "**culture,**" and "**supply chain.**" These keywords suggest that research on data-driven marketing extends into related areas,

such as how organizational culture and supply chain processes are influenced by data-driven decision-making. The inclusion of "**big data analytics**" highlights the importance of advanced analytical techniques in extracting insights from vast datasets to optimize marketing and business processes. The integration of these keywords into the broader network demonstrates that data-driven marketing is not only a central concept but also part of a larger, interconnected system of business functions and innovation drivers.

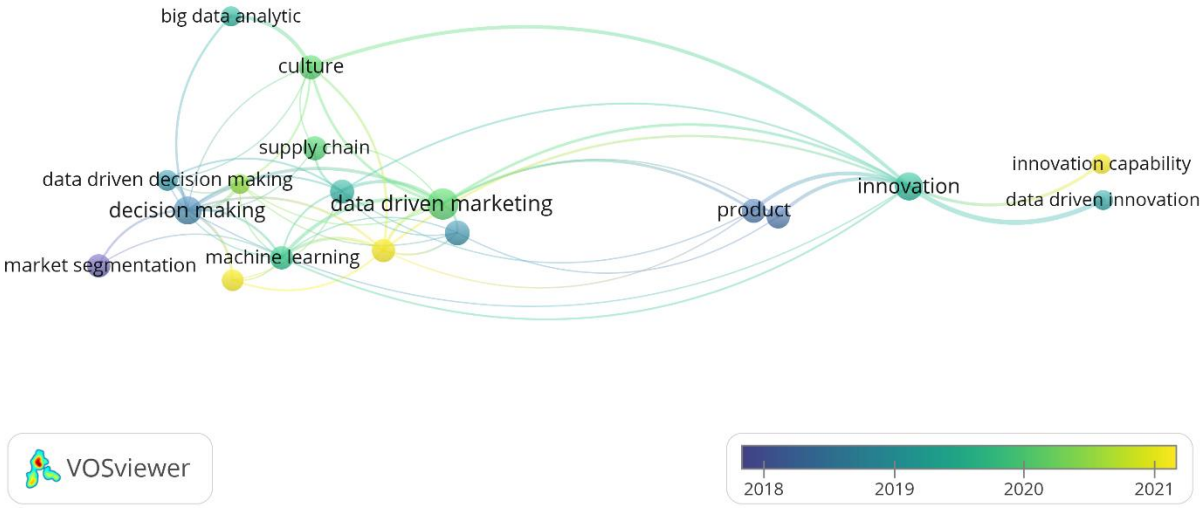

Figure 5. Overlay Visualization

Source: Data Analysis, 2024

This figure represents a keyword co-occurrence network over time in the field of data-driven marketing and innovation, visualized using VOSviewer. The color gradient, ranging from purple (2018) to yellow (2021), indicates when certain keywords gained prominence in academic literature. The nodes represent keywords, and the size of each node corresponds to its frequency in the dataset. The lines between the nodes indicate co-occurrence, meaning the terms are often mentioned together in papers. Thicker lines represent stronger connections. This time-based view provides insights into how research themes have evolved over recent years.

In the center of the figure, "data-driven marketing" appears as a core node that gained significant attention between 2019 and 2020 (as indicated by its green color). It is closely connected with terms like "decision making," "machine learning," and "market segmentation," which began to appear more prominently around 2019. These connections highlight the growing importance of applying data-driven methodologies to enhance marketing decision-making processes. The connection with "machine learning" indicates that automation and advanced analytics are integral components of data-driven marketing research, particularly as the field continues to leverage cutting-edge technologies to optimize marketing strategies.

On the right side of the figure, we see terms like "innovation" and "product" also becoming prominent around 2020, with related terms like "data-driven innovation" and "innovation capability" showing up closer to 2021 (yellow nodes). This indicates that more recent research has increasingly focused on how data-driven approaches contribute to product innovation and organizational innovation capabilities. The link between "data-driven marketing" and "innovation" demonstrates that businesses and researchers are looking at how data can drive new product development and strategic innovation, emphasizing the role of data analytics in fostering competitive advantage through innovation.

In addition, keywords such as "big data analytics," "culture," and "supply chain"

appear to have gained prominence between 2018 and 2019, as indicated by their blue and purple colors. This suggests that earlier research focused on the foundational aspects of big data and its impact on business processes, organizational culture, and supply chain management. Over time, research has shifted toward integrating these insights into more applied areas like innovation and product development, showing a natural progression in the academic focus. This figure provides a clear visualization of how the focus of research in data-driven marketing has evolved over the years, moving from foundational concepts like decision-making and big data analytics to more specific applications like product innovation and innovation capabilities.

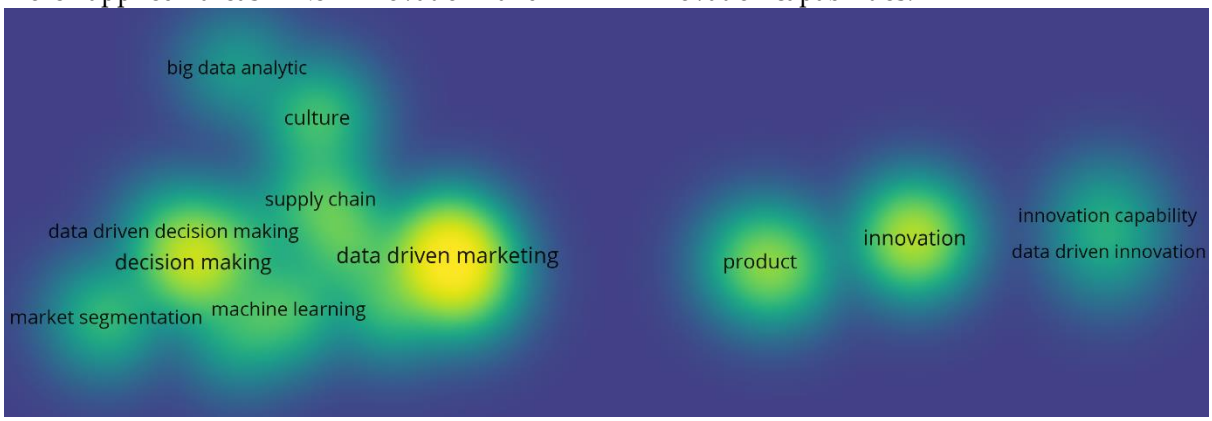

Figure 6. Density Visualization

Source: Data Analysis, 2024

This figure represents a heatmap visualization of keyword density in the field of data-driven marketing, generated using VOSviewer. The intensity of the colors (ranging from green to yellow) indicates the frequency of the occurrence of specific keywords in academic publications. Yellow areas represent keywords that have higher density, meaning they are frequently used, while green areas indicate moderate usage. The blue background represents areas with little to no keyword occurrences in the dataset.

At the center of the map, "data-driven marketing" stands out as a highly frequent keyword, as indicated by the bright yellow coloration around it. This suggests that it is a central theme in the body of research, with strong associations to other frequently used terms such as "decision making," "machine learning," and "market segmentation. These terms, though slightly less frequent, still form key components of the research landscape, as seen in their green-yellow shading. On the right side of the map, "innovation" and "product" are also highlighted, indicating a significant focus on these topics in recent research, especially in relation to data-driven marketing and product development.

Additionally, keywords like "big data analytics," "culture," and "supply chain" are prominent on the left side of the map, suggesting that these areas are important but perhaps less central to the literature than data-driven decision-making and innovation. The spread of keywords and their varying densities provide insights into the thematic focus of research, with a clear emphasis on how data-driven techniques are used to drive marketing decisions and foster innovation. The heatmap effectively visualizes which topics are most widely studied and which areas offer potential for further exploration or emerging interest.

DISCUSSION

Evolution of Data-Driven Marketing Research

The first and most significant observation from the analysis is the exponential growth of research publications in data-driven marketing, particularly from 2015 onward. This surge aligns with the rapid advancements in technology, including big data analytics, machine learning, and artificial

intelligence (AI), which have fundamentally transformed the marketing landscape. In earlier years, data-driven approaches were limited by the availability of data and the tools to analyze it. However, as digital technologies have advanced, data collection has become more accessible, leading to a wealth of consumer data that marketers can use to optimize their strategies. The steep rise in publications from 2017 to 2021, as seen in the yearly publication frequency chart, reflects the increased interest in leveraging data-driven insights to make more informed marketing decisions.

The peak in 2021 can be attributed to the growing maturity of AI and big data technologies and their widespread adoption across industries. This period also coincides with the global digital transformation efforts accelerated by the COVID-19 pandemic, which forced many businesses to shift their operations online. This transition required companies to rely heavily on data analytics to understand changing consumer behaviors, prompting more research in the field of data-driven marketing. As organizations began to recognize the value of data for creating personalized marketing experiences and improving return on investment (ROI), academia responded by producing more research on these topics, explaining the increased frequency of publications during this period.

Co-Authorship Networks and Research Collaboration

The co-authorship networks provide insights into the collaborative dynamics in the field of data-driven marketing. In the visualizations, we can observe two distinct clusters of researchers, each representing a different network of collaboration. One prominent cluster consists of authors such as Liu, J., Liu, Y., and Wang, X., who form a highly interconnected group, reflecting strong collaboration patterns. On the other hand, a smaller but tightly connected cluster features Dolnicar, S., and Leisch, F., indicating focused collaboration between these authors.

The presence of multiple collaboration clusters highlights the diversity of research approaches within the field. The larger, interconnected cluster suggests a broad and interdisciplinary research network where data-driven marketing intersects with other areas such as decision-making, machine learning, and supply chain management. This network likely includes researchers from various discipline working together to explore how data can be applied to solve marketing and business problems. In contrast, the smaller clusters represent more specialized research groups that focus on niche areas, such as the application of data analytics in transportation systems or the ethical considerations of data-driven decision-making. These findings emphasize the importance of collaboration in driving innovation in this field, as researchers pool their expertise to address complex problems.

Keyword Co-Occurrence and Thematic Analysis

The keyword co-occurrence network sheds light on the key themes that have emerged in data-driven marketing research over the years. As illustrated in the visualization, "data-driven marketing" serves as the central theme, connected to a wide array of other keywords, including "decision making," "machine learning," "market segmentation," and "innovation." This cluster of keywords highlights the strong relationship between data-driven marketing and decision-making processes, as businesses increasingly rely on data analytics to guide their strategies.

One of the most interesting trends from the keyword co-occurrence analysis is the growing role of **innovation** in data-driven marketing research. The connection between "innovation" and "product" reflects the increasing focus on how data-driven approaches can fuel product innovation. Companies are using data to identify market gaps, predict consumer preferences, and develop new products that meet evolving customer needs. Furthermore, the terms "innovation capability" and "data-driven innovation" highlight the role of data analytics in enhancing an organization's

ability to innovate, making it a key competitive advantage in the digital age.

The keywords "big data analytics," "machine learning," and "supply chain" also reveal the interdisciplinary nature of data-driven marketing research. As companies collect and process vast amounts of data, the need for advanced analytics techniques such as machine learning becomes critical. Machine learning allows companies to analyze consumer behavior, segment markets, and optimize marketing campaigns in real-time. The inclusion of "supply chain" in this network suggests that data-driven marketing is not limited to consumer-facing activities but also extends to optimizing supply chain processes and improving overall business efficiency. This interdisciplinary approach demonstrates that data-driven marketing is not an isolated practice but is integrated into broader business operations.

Country Collaboration Networks

The country collaboration network visualization reveals the global nature of data-driven marketing research, with significant contributions from countries such as the United States, China, the United Kingdom, and India. The United States serves as a central hub in this network, showing strong collaborations with China, Australia, and India. This reflects the US's dominant position in the field of data-driven marketing, driven by its robust tech industry and academic institutions that are leaders in AI and big data research.

China's prominence in the network can be attributed to its rapid advancements in AI, big data, and e-commerce. Chinese tech giants such as Alibaba and Tencent are pioneers in using data-driven marketing techniques, and their success has sparked academic interest in this area. China's strong collaboration with the US indicates a flow of knowledge and expertise between these two major economies, contributing to advancements in data-driven marketing practices worldwide.

The United Kingdom and India also play important roles in this global collaboration network. The UK's contributions are likely driven by its strong academic institutions and its focus on digital transformation, while India's involvement reflects its growing tech industry and the increasing role of data in driving business growth. The international collaboration patterns underscore the fact that data-driven marketing is a global research endeavor, with countries contributing diverse perspectives and expertise to advance the field.

Heatmap of Keyword Density

The keyword density heatmap provides additional insights into the focus areas within data-driven marketing research. "Data-driven marketing" stands out as the most frequently occurring term, reflecting its central role in the research landscape. The yellow hue around this term indicates that a significant portion of the literature focuses on this concept, particularly in relation to decision-making and machine learning. The dense clustering of these terms suggests that much of the research in this field revolves around how data can be used to improve marketing decisions and optimize business processes.

On the right side of the heatmap, terms like "innovation," "product," and "innovation capability" also show high density, indicating that recent research has increasingly focused on the application of data-driven approaches to innovation. This suggests a shift in academic interest toward exploring how data can be leveraged not just to optimize existing marketing processes but also to drive new product development and foster organizational innovation. This trend reflects the growing recognition that data is a key enabler of innovation, allowing businesses to stay competitive in an increasingly data-driven world.

Implications and Future Directions

The findings from this analysis have several important implications for both academics and practitioners. For researchers, the growing intersection between data-driven marketing and innovation offers a fertile area for further exploration. As data analytics technologies continue to evolve, there are opportunities to explore new methods for

using data to enhance innovation capabilities and create more personalized consumer experiences. Additionally, the increasing importance of ethical considerations in data-driven decision-making presents an area for further research, as companies must balance the benefits of data with the need to protect consumer privacy.

For practitioners, the insights from this analysis highlight the importance of adopting data-driven approaches to stay competitive in the digital age. Companies that can effectively use data to inform their marketing decisions, optimize supply chains, and drive product innovation will be better positioned to meet the needs of modern consumers. Moreover, the global collaboration patterns revealed in this study suggest that businesses can benefit from international partnerships and knowledge-sharing to stay at the forefront of data-driven marketing practices.

5. CONCLUSION

In conclusion, the bibliometric analysis of data-driven marketing research over the past two decades highlights the rapid growth and evolving nature of this field. The increasing focus on innovation, decision-making, and machine learning demonstrates the integral role of data in shaping the future of marketing. As the field continues to evolve, both researchers and practitioners will need to stay agile, leveraging new technologies and insights to drive business success in an increasingly data-driven world.

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