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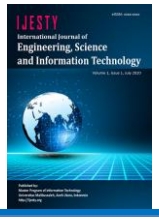

Digital Marketing Data Mapping Using Bibliometric Analysis

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Abstract

This research examines the importance of digital data marketing as a response to technological advances and changes in the macro environment. The main focus of this research is the role of technologies, such as big data, artificial intelligence (AI), and predictive analytics, in driving successful marketing strategies, particularly for small and medium-sized enterprises (SMEs).To achieve this goal, the researcher used a qualitative research method with a historical approach, aiming to identify trends and developments in the relevant literature. In addition, bibliometric analysis was applied with the help of the VOSviewer tool. This analysis observed a significant growth in the study of digital data marketing. From the search using Publish or Perish covering the period of 1951 to 2025, a total of 1. 354 relevant articles were found. A focus on keyword co-occurrence revealed 6,260 keywords related to digital data marketing. After filtering the keywords into those that appeared at least three times and eliminating less relevant terms, 284 were found and divided into 16 clusters. This bibliometric analysis provides valuable insights for developing digital data marketing research through clear visualization of trends.

Keywords: *Data, Digital Marketing, Data Mapping, Bibliometric Analysis.*

1. Introduction

Digital data marketing is an increasingly important area of study to develop in the face of rapid technological developments. Today, business managers, both large corporations and small and medium enterprises (SMEs), are expected to utilize data in their marketing strategies as the macro environment changes. In today's digital era, traditional knowledge and theories in marketing are becoming less relevant for understanding the principles and laws of data-driven marketing. Therefore, developing a scientific understanding of digital data marketing is crucial for businesses, especially SMEs, to utilize data to improve their marketing performance effectively. Changes in the macro environment, including technological, socio-cultural, and government regulatory aspects, have created a higher demand for digital data marketing. In particular, technological advancements have changed how people interact, transact, and conduct business, including marketing activities. Innovations such as big data, artificial intelligence (AI), and predictive analytics have opened up new opportunities for businesses to understand consumer behaviour and make more informed marketing decisions.
Furthermore, the COVID-19 pandemic has accelerated this change, forcing many businesses to turn to digital platforms for survival, so they must also utilize data more efficiently in their marketing strategies. Digital data marketing is a field that needs to be explored more deeply as it can provide significant competitive advantages for companies. Effective data management and analysis can improve the competitiveness and ability of businesses, including small and medium enterprises (SMEs), to adapt to the ever-evolving digital world. Therefore, conducting research that can produce concept formulations and provide systematic insights to encourage the application of digital data marketing among SMEs is essential. Every organization, including SMEs, needs to have the ability to adapt to rapid changes in the digital environment. Without this adaptability, SMEs will struggle to survive and thrive in an increasingly competitive market. The ability of SMEs to utilize digital data marketing is key to their sustainability and growth. Given the strategic role of SMEs in the national economy, implementing digital data marketing can strengthen their position in an increasingly digitized global market. Scientific knowledge about digital data-driven marketing is gained through scientific methods and systematic data analysis. So far, there have been various studies on the acceptance of data-focused marketing technologies, along with the development of multiple theories to explain how organizations and individuals accept and adjust to new technologies in marketing. However, no single theory is universally accepted, given that each organization has a unique context for implementing digital data-driven marketing strategies. Therefore, it is necessary to conduct further research on digital data marketing to map the development of existing knowledge and improve understanding of the acceptance and utilization of digital technology and data in business marketing management. It is hoped that this

research can contribute to enhancing the ability of organizations to explain, predict, and control adaptation to data-driven marketing technologies at the organizational level. In addition, this research is also expected to accelerate the transformation of SMEs towards a more advanced and scalable digital era.

2. Literature Review

Digital marketing strategies that utilize big data analysis can effectively segment advertising on the Internet through remarketing technologies. Since the beginning of the 21st century, both Digital Marketing (DM) and Data Science (DS) have experienced rapid development in terms of usage and profitability. This development has created a digital ecosystem that connects users continuously, forming new habits and behaviours among them [30] [33].

Digital marketing offers a highly satisfying experience for clients thanks to the use of artificial intelligence (AI) in advertising on social media and digital platforms such as Facebook and Instagram. These platforms carefully analyze user information before directing them towards offers that suit their desires. The company is adopting digital technology to transform its digital marketing business. By integrating cutting-edge technologies into non-digital processes, the company is undertaking a complete makeover to develop a more effective and efficient business operating model. With the help of AI, marketers can identify and predict trends using machine learning (ML), a branch of AI that involves computer programs capable of accessing data and learning independently. These programs collect data from various sources, including social media accounts, menus, online reviews, and websites. It then utilizes this information to generate and deliver relevant content to audiences, especially in the context of user retention and conversion of potential customers in digital marketing [16].

AI-based digital marketing has great potential to improve business results, maximize Return on Investment (ROI), and drive more effective actions. By utilizing Big Data analysis, we can precisely segment ads on the Internet through remarketing technologies. For example, text analytics techniques can be applied directly to interactions on apps such as WhatsApp, Messenger, TikTok or Telegram, enabling more efficient ad segmentation on these platforms. Digital marketing also provides an enjoyable experience for clients, thanks to the use of AI that supports advertising on social media and other digital platforms [30] [33].

Table 1. External Stimulus Factors.

Factor	Description	Resources
Artificial intelligence	Changing how we work and interact with the world has led to significant advances in efficiency, decision-making, and prediction of outcomes.	[3], [4], [14]
Digital Marketing	Increasing consumer behaviour in shopping online opens up highly effective marketing opportunities.	[12], [13], [30]
Multiple correspondence analysis	We used analysis of variance and least squares methods to analyze categorical data, reduce many variables, and integrate information.	[23], [25]
Direct Marketing	Managing customer relationships is paramount, with a heavy emphasis on data as the focus.	[16], [28], [37]
Direct Marketing history	Improve efficiency and integrate data to optimize budget allocation across channels.	[8]
Big data	allows companies to personalize messages and facilitate more accurate customer segmentation.	[11], [19], [23], [33]
disruptive technologies	A surprising new look at the tech sector.	[32]
machine learning (ML)	The subfield of artificial intelligence utilizes algorithms and statistical models to analyze patterns in data, make predictions, and apply new patterns to undefined situations.	[2], [10], [15], [31]

External stimuli and cognitive responses are used as keywords in bibliometric analysis. Researchers often use factors to express cognitive responses to Ethics Privacy, Evolution, Business Models, Marketing Profession, Digital Transformation, Marketing, and Information Management, as seen in Table 2.

Table 2. Cognitive Response Factors.

Factor	Description	Resources
Ethics Privacy	Ethical issues relating to manipulation are increasingly complex. A fundamental difference exists between "trustworthy" and "reliable".	[18], [32], [35]
Evolution	Create fundamental changes to the market and economy in the long run.	[5], [9], [20], [21]
business model	To enhance the company's growth, it is essential to transform and adopt new models to maintain competitiveness at the global level.	[12], [21], [5], [29]
marketing profession	Using digital technology and customer data can create significant added value and provide information essential to respond effectively to consumer privacy risks.	[26]
digital transformation	Drive value creation in the industry through tools, especially in digital organizational transformation.	[1], [27]
Marketing	Make a significant contribution by analyzing the value perceived by customers.	[7]
information	Individuals interact with each other and information	[6], [22], [33]

Factor	Description	Resources
management	management companies, where certain factors may influence their willingness to accept social media as a channel of social interaction and participate in its use.	

3. Research Method

This article applies a qualitative research method with a historical approach to identify developments, trends and mappings in research on the role of digital marketing data. This research was conducted in two stages. First, data collection was undertaken systematically by collecting articles published in leading international journals. In the second stage, the collected articles were analyzed using bibliometric analysis, which analyses and organizes data based on keywords or phrases contained in the titles and abstracts of the articles. This analysis process helps in understanding the latest developments and trends in research related to the role of digital marketing data, as well as providing recommendations for research themes or variables for future researchers [36].

3.1. Data Collection Methods

The data collection consisted of research articles taken from a group of leading journal publishers: 1) Elsevier, 2) Emerald, 3) Springer, 4) Taylor & Francis, 5) Sagepub, 6) Wiley Online Library, 7) ieeexplore.ieee.org. Articles were collected from accessible databases from seven groups of journal publishers.

Articles using Publish or Perish (PoP). This software helps find articles with relevant research topics. The data collection stages are as follows:

1. The search is limited to the years 1951-2025.
2. The keyword used as search criteria is "digital data marketing."
3. The combination of keywords used as search criteria consists of three combinations. The first combination ["Artificial intelligence,"; "Digital marketing,"; "Privacy ethics,"; "Multiple correspondence analysis"]. The second combination ["Direct Marketing"; "Direct Marketing history"; "evolution"; "business model"; "marketing profession"]. Third combination ["Big data,"; "digital transformation,"; "marketing,"; "information management,"; "disruptive technologies,"; "machine learning (ML)"].
4. Furthermore, the research collected by this software is reduced based on journals written in English. Source articles from reputable journals.
5. The search was limited to journal articles in the scientific fields of management, business, economics, social, information, and entrepreneurship. This study's data did not include conference proceedings, meeting results, or books.
6. Articles to be analyzed were checked for research completeness regarding the presence of "title," "abstract," and "keywords."
7. The completeness that needs to be considered in selecting articles to be processed is DOI, publishing journal, publisher, article URL, Number of citations, GS Ranking, CitesPerYear, CitesPerAuthor, and AuthorCount.

Articles collected from searches using Publish or Perish from 1951 to 2025 totalled 1354 articles. With a combination of search titles and keywords, as shown in Table 3 [36].

Table 3. Search Combinations and Number of Articles Generated.

Title	Keywords.	journal
Digital Data Marketing	Artificial intelligence, Digital marketing, Ethics Privacy, Multiple correspondence analysis.	347
Digital Data Marketing	Direct Marketing, Direct Marketing history, evolution, business model, marketing profession.	469
Digital Data Marketing	Big data, digital transformation, marketing, information management, disruptive technologies, and machine learning (ML).	538

3.2. Data Analysis Method

Bibliometric analysis was conducted using the VOSviewer application. The results of this analysis show a bibliographic map related to digital data marketing. This analysis produced a bibliographic data map, and text data was extracted from the titles and abstracts of selected articles. These findings are utilized to map and develop the field of reference studies. This scientific mapping aims to analyze trends and patterns in developing research related to digital data marketing.

VOSviewer is a tool used to analyze published scientific articles. With its ability to visualize knowledge development, VOSviewer presents network visualizations complemented by cluster labelling. This means that VOSviewer can provide insights into research updates and the extent to which research in this field has taken place.

The output of VOSviewer includes maps and networks built based on key co-occurrence data and highly detailed keyword relevance. The map and keyword network visualizations are displayed with different colours for each data cluster, making understanding the relationships between concepts easier. In addition, the application displays an overlay network that depicts the development of articles over time. This overlay network visualizes the range of years over which each keyword is linked in a dynamic network.

From the visualization of the overlay network, we can measure the extent of research progress in digital data marketing. VOSviewer also provides a density visualization that shows the high or low frequency of the concept or constructs under study. Thus, this tool presents valuable information for researchers to understand trends and dynamics in scientific research [36].

4. Result and Discussion

4.1. Number of years published

The early 2000s marked a significant evolution in digital data marketing, with the emergence of social media as a promising ecosystem. This progress was further amplified by the arrival of smartphones, which became an essential channel for accessing the Internet. These changes in the world of technology have drastically changed the face of digital marketing. This condition encourages researchers to conduct studies on data-oriented digital marketing strategies, both as the article's main topic and as keywords. The search results showed 1,354 articles published from 1951 to 2025, as listed in Table 4.

Table 4. Number of years published: 1951-2025

Year	Publications	Year	Publications	Year	Publications
1951	2	1987	9	2009	11
1956	1	1988	5	2010	13
1960	1	1989	5	2011	16
1961	1	1990	4	2012	14
1966	1	1991	7	2013	23
1968	1	1992	6	2014	21
1969	1	1993	3	2015	16
1971	1	1994	10	2016	27
1972	2	1995	8	2017	34
1973	1	1996	14	2018	49
1974	1	1997	13	2019	80
1975	1	1998	16	2020	111
1976	1	1999	15	2021	120
1977	2	2000	16	2022	174
1978	1	2001	13	2023	179
1979	4	2002	11	2024	183
1980	2	2003	10	2025	3
1981	1	2004	19	**Total**	**1354**
1982	1	2005	12		
1983	1	2006	15		
1985	6	2007	14		
1986	9	2008	14		

The value continues to increase between 2020 and 2024. The global pandemic has accelerated digital transformation, forcing business managers to make the most of digital technology. This dramatic change has also brought new challenges. Therefore, experts and researchers are now focusing on digital data marketing to analyze consumer behaviour, develop effective marketing strategies, improve customer experience, optimize digital channels, and predict market trends.

This research is beneficial for businesses to adapt and take advantage of various opportunities in the ever-evolving digital era.

4.2. Author's Analysis

The analysis conducted by the authors relies on Google Scholar (GS) rankings. Fundamentally, GS functions similarly to Thomson ISI Web of Knowledge in producing Journal Impact Factors (JIF). These JIFs are used to measure the impact factor of scientific articles. However, GS has the advantage of giving users free access to these articles. This free access allows researchers to use these articles as references without being hampered by the financial limitations of the institutions where they work.

Table 5. Active publications from 1951-2025

Author Name	Title	GS Ranking
Alejandro Barredo Arieta, Natalia Diaz-Rodriguez, Javier del Ser, Adrian Bennetot, Siham Tabik, Alberto Barbado, Salvador Garcia, S Gil-López, D Molina, R Benjamins, R Chatila, Francisco Herrera (2020)	Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI	532
X Wu, X Zhu, GQ Wu, W Ding(2013)	Data mining with big data	853
YK Dwivedi, L Hughes, E Ismagilova, G Aarts, Crispin Coombs, Tom Crick, Yanqing	Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges,	77

Author Name	Title	GS Ranking
Duan, Rohita Dwivedi, J Edwards, A Eilug, V Galanos, P.V Ilavarasan, M Janssen, P Jones, A Kumar K, H Kizgin, B Kronemann, Banita Lal, B Lucini, R Medaglia, M.D Williams (2021)	opportunities, and agenda for research, practice and policy	
YK Dwivedi, E Ismagilova, DL Hughes, J Carlson, R Filieri, J Jacobson, V Jain, H Kaejaluoto, H Kefi, A, S Krishen, V Kumar, M.M Rahman, R Raman, P.A Rauschnabel, J Rowley, J Salow, G.A Tran, Y Wang (2021)	Setting the future of digital and social media marketing research: Perspectives and research propositions	336
YK Dwivedi, N Kshetri, L Hughes, EL Slade, A Jerayaj, A Kumar, A.M Baabdullah, A.Koohang, V Raghavan, M Ahuja, H Albanna, M.A Albashrawi, A.S A-L Busaidi, J Balakrishnan, Y Barlette, S Basu, I Bose, L Brooks, D Buhails, L Carter, R Wirght (2023)	Paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research	93
YK Dwivedi, L Hughes, AM Baabdullah, SR Nvarrete, M Giannakis, MM. Al-Debei, D Dennehy, B Metri, D Buhalis, C M.K Cheung, K Conboy, R Doyle, R Dubey, V Dutot, R Felix, D.P Goyal, A Guftasson, C Hinsch, I Jebabli, M Janssen, SF Wamba. (2022)	Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy	743
CH Noble, RK Sinha, A Kumar (2022)	Market orientation and alternative strategic orientations: A longitudinal assessment of performance implications	502
R Felix, PA Rauschnabel, C Hinsch (2017)	Elements of strategic social media marketing: A holistic framework	395
P Mikalef, IO Pappas, J Krogstie, M Giannakos (2018)	Significant data analytics capabilities: a systematic literature review and research agenda	171
P Zheng, H Wang, Z Sang, RY Zhong, Y Liu, Chao Liu, K Mubarok, Shiqiang Yu&Xun xu (2018)	Intelligent manufacturing systems for Industry 4.0: Conceptual framework, scenarios, and future perspectives	939
D Vrontis, M Christofi, V Pereira, S Tarba, Anna Makrides, E Trichina (2023)	Artificial intelligence, robotics, advanced technologies and human resource management: a systematic review	859
N Syam, A Sharma (2018)	Waiting for a sales renaissance in the fourth industrial revolution: Machine learning and artificial intelligence in sales research and practice	344
C Cath, S Wachter, B Mittelstadt, M Taddeo, L Floridi (2018)	Artificial intelligence and the 'good society': the US, EU, and UK approach	232
TM Choi, SW Wallace, Y Wang (2018)	Big data analytics in operations management	292
Y Liu, X Ma, L Shu, GP Hancke, A.M Abu-Mahfouz (2020)	From industry 4.0 to agriculture 4.0: Current status, enabling technologies, and research challenges	436
Y Wang, M Singgih, J Wang, M Rit (2019)	Making sense of blockchain technology: How will it transform supply chains?	925
IM Enholm, E Papagiannidis, P Mikalef, J Krogstie (2022)	Artificial intelligence and business value: A literature review	538
S Verma, R Sharma, S Deb, D Maitra (2021)	Artificial intelligence in marketing: Systematic review and future research direction	24

The GS ranking illustrates the author's contribution to producing articles each year. From the data collected, 116 authors who actively contributed were identified. Table 5 analyses authors who regularly publish articles yearly by considering their GS rank. Through this table, we can see the authors' contribution to producing scientific papers every year.

4.3. Citation Analysis

Citation analysis provides an overview of how many articles other researchers reference. The importance of research related to digital marketing continues to increase, especially from 2020 to 2024.

Changes in the macro environment bring challenges to business management. For this reason, business people, both large companies and small and medium enterprises (SMEs), must be able to adapt to the dynamics that occur. Efforts to improve this adaptability have encouraged a high commitment among researchers to continue developing scientific knowledge to answer various problems in digital-

based business management. One of the journals that recorded the most publications on digital data marketing is the Journal of Information and Management, as shown in Table 6.

Table 6. Top Authors and Articles Cited in Digital Data Marketing Publications

Author Name	Publisher	Quoted Frequency
KL Keller (1993)	Journal of Marketing	30.700
SL Vargo, RF Lusch (2004)	Journal of Marketing	23.867
FR Dwyer, PH Schurr, S Oh (1987)	Journal of Marketing	16.725
DJ Teece (2010)	Long Range Planning	14.455
GS Day (1994)	Journal of Marketing	12.305
DL Hoffman, TP Novak (1996)	Journal of Marketing	10.587
Alejandro Barredo Arieta, Natalia Diaz-Rodriguez, Javier del Ser, Adrian Bennetot, Siham Tabik, Alberto Barbado, Salvador Garcia, S Gil-López, D Molina, R Benjamins, R Chatila, Francisco Herrera (2020)	Information Fusion	8.647
C Moorman, G Zaltman, R Deshpande (1992)	Journal of Marketing Research	8.574
SF Slater, JC Narver (1995)	Journal of Marketing	8.045
D Buhalis (2000)	Tourism Management	7.998
KN Lemon, PC Verhoef (2016)	Journal of Marketing	7.544
E Anderson, B Weitz (1992)	Journal of Marketing Research	6.392
C Grönroos (1997)	Emerald. insight Discover Journals, Books & Case Studies	6.095
AF Payne, K Storbacka, P Frow (2008)	Journal of the Academy of Marketing Science	5.799

4.4. Bibliometric Analysis

Bibliometric analysis helps researchers map and determine the extent of research development related to digital data marketing. So that the research results can identify relevant and current research themes or variables, thus clarifying the potential impact of the research if it is developed.

4.5. Co-authorship Analysis

In the Co-authorship analysis, there are authors associated with the names of other authors. The results of this analysis show that the authors collaborated in conducting research related to digital data marketing, as shown in Figure 1. S Gupta collaborated with other authors. Six research teams published two articles by S Gupta. Similarly, Chen Y and YK Dwivedi produced two articles published by different author teams.

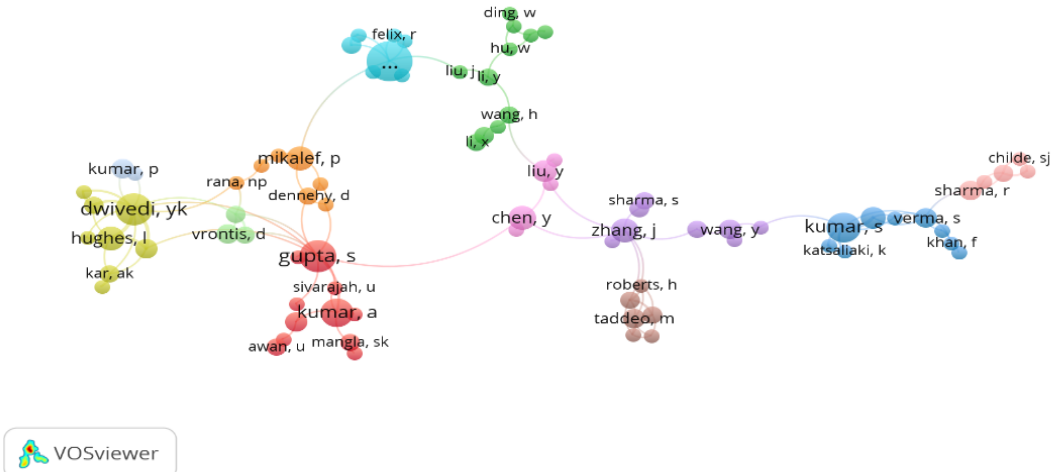

Fig 1. Author's network.

The collaboration conducted by the authors shows a high commitment to continue conducting research related to digital data marketing. Table 7 shows the research titles of the authors who conducted the study.

Table 7. Author Collaboration

Author Name	Title
YK Dwivedi, L Hughes, AK Kar, AM Baabdullah, P Grover, R Abbas, D Andreini, I Abumoghli, Y Barlette, D Bunker, L C Kruse, I Constantiou, R M Davison, R De, R Dubey, H F Taylor, B Gupta, W He, M Kodama, M Mantymaki, M Wade (2022)	Climate change and COP26: Are digital technologies and information management part of the problem or the solution? An editorial reflection and call to action
P Kumar, YK Dwivedi, A Anand (2023	Responsible artificial intelligence (AI) for value formation and market performance in healthcare: The mediating role of patient's cognitive engagement
NP Rana, S Chatterjee, YK Dwivedi, S Akter (2022)	Understanding the dark side of artificial intelligence (AI) integrated business analytics: assessing firm's operational inefficiency and competitiveness.
S Chatterjee, R Chaudhuri, D Vrontis, T Papadopoulos (2024)	Examining the impact of deep learning technology capability on manufacturing firms: moderating roles of technology turbulence and top management support.
S Gupta, VA Drave, YK Dwivedi, AM Baabdullah, E Ismagilova (2020)	Achieving superior organizational performance via big data predictive analytics: A dynamic capability view
S Bag, S Gupta, A Kumar, U Sivarajah (2021)	An integrated artificial intelligence framework for knowledge creation and B2B marketing rational decision-making for improving firm performance
C Trocin, P Mikalef, Z Papamitsiou, K Conboy (2023)	Responsible AI for digital health: a synthesis and a research agenda
Y Chen, S Jensen, LJ Albert, S Gupta, T Lee	Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success
Y Chen, Y Liu, J Zhang	When do third-party product reviews affect firm value, and what can firms do? The case of media critics and professional movie reviews
H Wang, Z Xu, H Fujita, S Liu (2016)	Towards felicitous decision making: An overview on challenges and trends of Big Data
Y Li, B Wu, Y Huang, J Liu, J Wu, S Luan (2024)	Warmth, Competence, and the Determinants of Trust in Artificial Intelligence: A Cross-Sectional Survey from China
M Ghobakhloo, M Iranmanesh, B Foroughi, ML Tseng, D Nikbin, A A.A Khanfar (2023)	Industry 4.0 digital transformation and opportunities for supply chain resilience: a comprehensive review and a strategic roadmap
D Cao, W Hu, J Zhao, G Zhang, B Zhang, Z Liu (2020)	Reinforcement learning and its applications in modern power and energy systems: A review
A Sharma, E Kosasih, J Zhang, A Brintrup, A Calinescu (2022)	Digital twins: State of the art theory and practice, challenges, and open research questions
H Roberts, J Zhang, B Bariach, J Cowls, B Gilburt, P Juneja, A Tsamados, M Ziosi, M Taddeo, L Floridi (2024)	Artificial intelligence in support of the circular economy: ethical considerations and a path forward
Y Wang, N Hajli (2017)	Exploring the path to big data analytics success in healthcare
TM Choi, S Kumar, X Yue, H L Chan (2022)	Disruptive technologies and operations management in the Industry 4.0 era and beyond
P Galetsi, K Katsaliaki, S Kumar (2020)	Big data analytics in health sector: Theoretical framework, techniques and prospects
S Chandra, S Verma, WM Lim, S Kumar, N Donthu (2022)	Personalization in personalized marketing: Trends and ways forward
W Li, Y Chai, F Khan, SRU Jan, S Verma, VG Menon, Kavita&X Li (2021)	A comprehensive survey on machine learning-based big data analytics for IoT-enabled innovative healthcare system.
S Verma, R Sharma, S Deb, D Maitra (2021)	Artificial intelligence in marketing: Systematic review and future research direction
R Sharma, SS Kamble, A Gunasekaran, A Kumaar, V Kumar (2020)	A systematic literature review on machine learning applications for sustainable agriculture supply chain performance

Author Name	Title
R Dubey, A Gunasekaran, SJ Childe, T Papadopoulos, Z Luo, S.F Wamba, D Raubaud (2019)	Can big data and predictive analytics improve social and environmental sustainability?
R Dubey, A Gunasekaran, SJ Childe, DJ Bryde, M Giannakis, C Foropon, D Raubaud, B.T Hazen (2020)	Big data analytics and artificial intelligence pathway to operational performance under the effects of entrepreneurial orientation and environmental dynamism: A study of manufacturing organizations

4.6. Bibliometric Network Visualization Analysis

Analysis using VOSviewer focusing on co-occurrences revealed 6,260 keywords related to digital data marketing. To deepen the study of keywords appearing in titles and abstracts, we limited the number of keyword occurrences to 3. From this restriction, we found 437 keywords grouped into 16 clusters, as shown in Table 8.

Table 8. Keyword Clustering

Cluster	Keyword
Cluster 1	Accoumtability, accuracy, ai ethic, artificial intelligence application, artificial intelligence approach, attitude, business ethic, chatgpt, competence, confidentiality, customer service, data privacy, data security, ethical challenge, ethical issue, ethical principle, ethical problem, ethical standard, ethical use, evaluation, explainability, fairness, governance, information privacy, innovation management, limitation, marketing education, multidisciplinary perspective, principle, privacy risk, reliability, sustainable development, transparency, trust, trustworthy artificial intelligence.
Cluster 2	Activity, artificial intelligence ethic, business development, community, condition, customer loyalty, customer satisfaction, data protection, direct effect, direct impact, direct result, expectation, firm performance, link, market orientation, marketing concept, marketing ethic, marketing management, marketing manager, performance outcome, positive effect, professional service, respect, responsibility, selling, step.
Cluster 3	Adaption, ai application, business relationship, channel, conceptual foundation, direct contact, direct mail, direct marketing, distribution, information systems research, infastructure, new business, place, promotion, regression analysis, relationship marketing, statistic, supplier, telemarketing, web,
Cluster 4	Big data technology, computer science, digital revolution, digital transformation capability, financial service, fintech, fourth industrial revolution, human intelligence, industrial Internet, information systems, internet marketing, leadership, life, new challenge, new opportunity, nlp,psychology, robot, shift, technologies.
Cluster 5	Ai system, artificial intelligence adoption, association, comprehensive review, content, direct marketer, exploratory study, influencer marketing, information management, market research, marketing analytic, marketing model, new trend, online marketing, risk management, supply chain resilience, training, user privacy.
Cluster 6	Business process, conference, direct control, direct response, direct selling event, exchange, function, marketing activity, marketing communication, marketing function, marketing profession, marketing theory, marketing thought, mind, personality, professional marketer, relevance.
Cluster 7	Action, ai technology, big data analysics, business value, digital disruption, digital tranformation initiative, employee, enggagement, ethical approach, higher education, human, internationalization, logistic, new form, rpa, rule, transition, worker.
Cluster 8	Artificial intelligence technique, b2b marketing, cluster, crm, customer experience, customer journey, data collection, digital, entrepreneur, equity, human resource, mca, multiple correspondence analysis, new approach, new era, performance implication, program.
Cluster 9	Behavior, business actifity, business intelligence, circular economy, customer behavior, digital advertising, digital business tranformation, digital innovation, engineering, generative artificial intelligence, globalization, investment, marketing research, marketing strategy, member, software.
Cluster 10	Advantage, ai governance, collaboratioon, conceptual framework, correspondence analysis, digital world, direct relationship, employment, ethical ai, ethical risk, explainable artificial intelligence, new wa, rapid development, respondsible ai, safety, synthesis.
Cluster 11	Balance, choice, competitive advantage, consequence, corporate strategy, figure, location, marketing pratice, arketing scholar, political marketing, price, professional services rims, search, service industry, surveillance.
Cluster 12	B2b, best pratice, business sector, chatbot, country, current study, digital platform, ethical concem, ethical consideration, ethical framework, ethical guideline, international business, perception, privacy protection, sosisal media data.
Cluster 13	Big data era, brand, building, competition, digital twin, direct marketing actifity, good, identily, marketing perspective, marketing professional, new business model, sale, spesial issue.

Cluster 14	Business plan , cost, data managemenet, data privacy issue, digital business, ethical artificial intelligence, ethics, increase, paradigm shift, paraticipant, privacy issue, sosial marketing, tchnological advancement.
Cluster 15	Definition, direct benefit, evolving role, expertise, facebook, money, online advertising, pricing, professional practice, protection, public relation, revenue model, understanding.
Cluster 16	Business analytic, business professional, consumer behaviour, difference, digital marketing strategy, direct observation, effectiveness, interview, market performance, personal selling, respondent.

The results of the Network Visualization Analysis show that many small nodes represent the keywords generated from the analysis, as shown in Figure 2. This visualization shows that there are still many research gaps that exist today. Much research related to digital data marketing is needed to fill these research gaps. For example, the "Ethical Framework" node is not yet connected to the "building" digital model node. More research is needed to explain the causality of each node. Explaining the causal relationships generated by this research will generate scientific knowledge to understand, explain, and control digital data marketing.

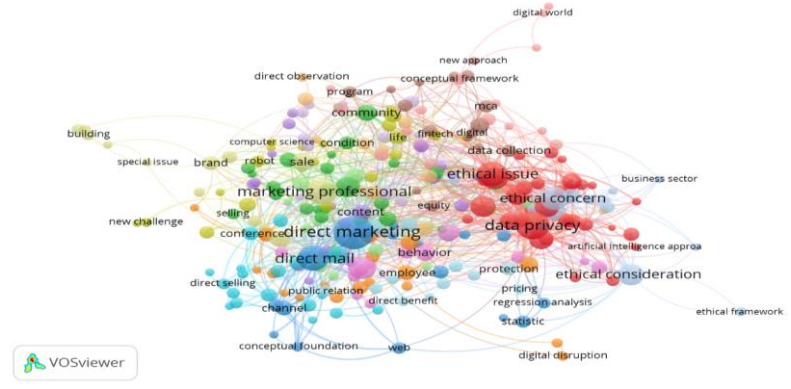

Fig 2. Network Visualization Publication in Digital Data Marketing

4.7. Overlay Visualization Analysis

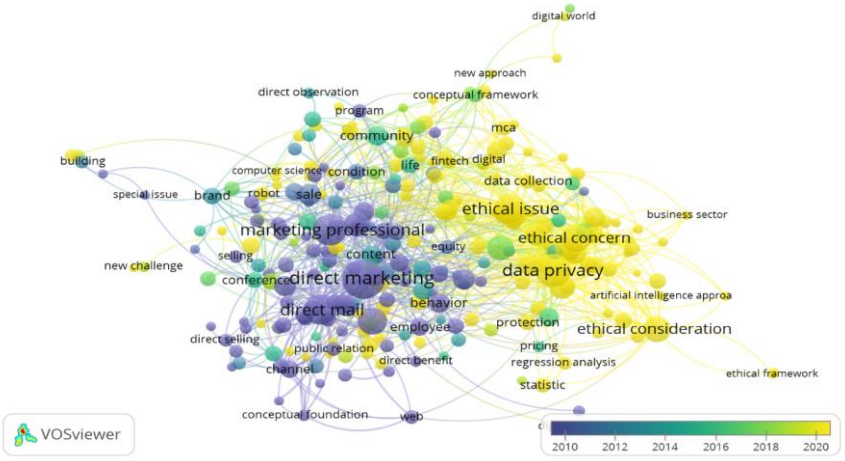

Fig 3. Overlay Visualization in Digital Data Marketing Publication

Figure 3 shows that most of the themes are marked in bright yellow. This colour indicates that most published articles range from 2010 to 2020. The results of this analysis allow us to assume that themes related to digital data marketing are the most up-to-date. Through the overlay visualization, we can see that themes related to digital data marketing are indeed the most recent studies. Following the previous data, research on digital data marketing has generally shown a significant increase since 2019.

4.8. Density Visualization Analysis

Fig 4. Visualization of Density in Digital Data Marketing Publications

Figure 4 shows research on digital data marketing, which is mainly related to direct marketing. This condition can be seen from the yellow focus on the Density visualization output. The colours that emerge from each theme or variable tend to be darker. This means that not too many publications have studied this subtheme. This condition strengthens the analysis results of network visualization and overlay visualization. This visualization shows the importance of conducting research related to digital data marketing. The study conducted will help in the scientific preparation and development of scientific knowledge related to digital data marketing.

5. Conclusion

The bibliometric analysis shows many research gaps in the scholarly mapping of digital data marketing. For small and medium-sized enterprises (SMEs), technological advances such as big data, artificial intelligence (AI) and predictive analytics provide opportunities to improve their competitiveness. This creates room for further research, particularly concerning ethical and privacy issues. In this context, data-driven marketing is key to strengthening SMEs' position in the global market.

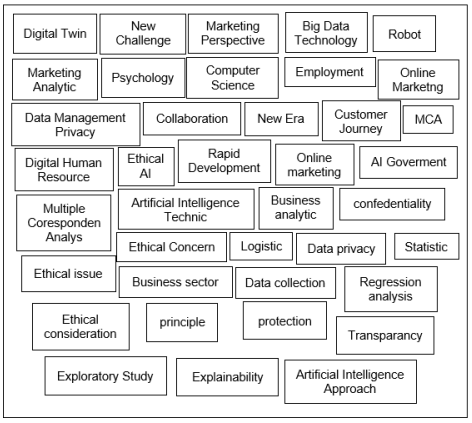

Fig 5. Recommended themes

This topic is drawn from selected articles published between 1951 and 2025. Through bibliometric analysis, it can be seen that there are still many aspects of Digital Data Marketing that have not been widely researched. This research gap is an opportunity for future researchers to dig deeper into Digital Data Marketing. As a first step, some suggested themes include exploring the metaverse in the context of Digital Data Marketing.

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References

[1] Abiodun, Temitayo, Giselle Rampersad, and Russell Brinkworth. 2023. "Driving Industrial Digital Transformation." *Journal of Computer Information Systems* 63(6):1345–61. doi: 10.1080/08874417.2022.2151526.

[2] Albukhitan, Saeed. 2020. "Developing Digital Transformation Strategy for Manufacturing." *Procedia Computer Science* 170:664–71. doi: 10.1016/j.procs.2020.03.173.
[3] Budhwar, Pawan, Ashish Malik, M. T. Thedushik. De Silva, and Praveena Thevisuthan. 2022. "Artificial Intelligence–Challenges and Opportunities for International HRM: A Review and Research Agenda." *International Journal of Human Resource Management* 33(6):1065–97. doi: 10.1080/09585192.2022.2035161.
[4] Chaudhry, Muhammad Ali, and Emre Kazim. 2022. "Artificial Intelligence in Education (AIEd): A High-Level Academic and Industry Note 2021." *AI and Ethics* 2(1):157–65. doi: 10.1007/s43681-021-00074-z.
[5] Chin, Hee Soo, Durga Prasad Marasini, and Don Hee Lee. 2023. "Digital Transformation Trends in Service Industries." *Service Business* 17(1):11–36. doi: 10.1007/s11628-022-00516-6.
[6] Cioppi, Marco, Ilaria Curina, Barbara Francioni, and Elisabetta Savelli. 2023. *Digital Transformation and Marketing: A Systematic and Thematic Literature Review*. Vol. 2023. Springer International Publishing.
[7] Cosma, Simona, and Giuseppe Rimo. 2024. "Redefining Insurance through Technology: Achievements and Perspectives in Insurtech." *Research in International Business and Finance* 70(PA):102301. doi: 10.1016/j.ribaf.2024.102301.
[8] Crié, D., and A. Micheaux. 2006. "From Customer Data to Value: What Is Lacking in the Information Chain? Database Marketing & Customer Strategy Management." *Database Marketing & Customer Strategy Management* 13(4):282–99.
[9] Davenport, Thomas, Abhijit Guha, Dhruv Grewal, and Timna Bressgott. 2020. "How Artificial Intelligence Will Change the Future of Marketing." *Journal of the Academy of Marketing Science* 48(1):24–42. doi: 10.1007/s11747-019-00696-0.
[10] Denton, Emily, Alex Hanna, Razvan Amironesei, Andrew Smart, and Hilary Nicole. 2021. "On the Genealogy of Machine Learning Datasets: A Critical History of ImageNet." *Big Data and Society* 8(2). doi: 10.1177/20539517211035955.
[11] Donnelly, Christina, Geoff Simmons, Gillian Armstrong, and Andrew Fearne. 2015. "Digital Loyalty Card 'Big Data' and Small Business Marketing: Formal versus Informal or Complementary?" *International Small Business Journal: Researching Entrepreneurship* 33(4):422–42. doi: 10.1177/0266242613502691.
[12] Dwivedi, Yogesh K., Laurie Hughes, Abdullah M. Baabdullah, Samuel Ribeiro-Navarrete, Mihalis Giannakis, Mutaz M. Al-Debei, Denis Dennehy, Bhimaraya Metri, Dimitrios Buhalis, Christy M. K. Cheung, Kieran Conboy, Ronan Doyle, Rameshwar Dubey, Vincent Dutot, Reto Felix, D. P. Goyal, Anders Gustafsson, Chris Hinsch, Ikram Jebabli, Marijn Janssen, Young Gab Kim, Jooyoung Kim, Stefan Koos, David Kreps, Nir Kshetri, Vikram Kumar, Keng Boon Ooi, Savvas Papagiannidis, Ilias O. Pappas, Ariana Polyviou, Sang Min Park, Neeraj Pandey, Maciel M. Queiroz, Ramakrishnan Raman, Philipp A. Rauschnabel, Anuragini Shirish, Marianna Sigala, Konstantina Spanaki, Garry Wei-Han Tan, Manoj Kumar Tiwari, Giampaolo Viglia, and Samuel Fosso Wamba. 2022. "Metaverse beyond the Hype: Multidisciplinary Perspectives on Emerging Challenges, Opportunities, and Agenda for Research, Practice and Policy." *International Journal of Information Management* 66(July):102542. doi: 10.1016/j.ijinfomgt.2022.102542.
[13] Dwivedi, Yogesh K., Elvira Ismagilova, D. Laurie Hughes, Jamie Carlson, Raffaele Filieri, Jenna Jacobson, Varsha Jain, Heikki Karjaluoto, Hajer Kefi, Anjala S. Krishen, Vikram Kumar, Mohammad M. Rahman, Ramakrishnan Raman, Philipp A. Rauschnabel, Jennifer Rowley, Jari Salo, Gina A. Tran, and Yichuan Wang. 2021. "Setting the Future of Digital and Social Media Marketing Research: Perspectives and Research Propositions." *International Journal of Information Management* 59(May 2020):102168. doi: 10.1016/j.ijinfomgt.2020.102168.
[14] Gerlick, Joshua A., and Stephan M. Liozu. 2020. "Ethical and Legal Considerations of Artificial Intelligence and Algorithmic Decision-Making in Personalized Pricing." *Journal of Revenue and Pricing Management* 19(2):85–98. doi: 10.1057/s41272-019-00225-2.
[15] Grájeda, Alberto, Johnny Burgos, Pamela Córdova, and Alberto Sanjinés. 2023. "Assessing Student-Perceived Impact of Using Artificial Intelligence Tools: Construction of a Synthetic Index of Application in Higher Education." *Cogent Education* 11(1). doi: 10.1080/2331186X.2023.2287917.
[16] Haleem, Abid, Mohd Javaid, Mohd Asim Qadri, Ravi Pratap Singh, and Rajiv Suman. 2022. "Artificial Intelligence (AI) Applications for Marketing: A Literature-Based Study." *International Journal of Intelligent Networks* 3(September):119–32. doi: 10.1016/j.ijin.2022.08.005.
[17] Harris, Anna, Susan E. Kelly, and Sally Wyatt. 2013. "Counseling Customers: Emerging Roles for Genetic Counselors in the Direct-to-Consumer Genetic Testing Market." *Journal of Genetic Counseling* 22(2):277–88. doi: 10.1007/s10897-012-9548-0.
[18] Ienca, Marcello. 2023. "On Artificial Intelligence and Manipulation." *Topoi* 42(3):833–42. doi: 10.1007/s11245-023-09940-3.
[19] Kong, Cheng. 2022. "Research on Enterprise Digital Precision Marketing Strategy Based on Big Data." *Mathematical Problems in Engineering* 2022. doi: 10.1155/2022/4279983.
[20] Li, Zhi Guang, Yanrui Wu, and Yao Kuang Li. 2023. "Technical Founders, Digital Transformation and Corporate Technological Innovation: Empirical Evidence from Listed Companies in China's STAR Market." *International Entrepreneurship and Management Journal* 3155–80. doi: 10.1007/s11365-023-00852-7.
[21] Martinelli, Elisa Martina, Maria Cristina Farioli, and Annalisa Tunisini. 2021. "New Companies' DNA: The Heritage of the Past Industrial Revolutions in Digital Transformation." *Journal of Management and Governance* 25(4):1079–1106. doi: 10.1007/s10997-020-09539-5.
[22] De Mauro, Andrea, Andrea Sestino, and Andrea Bacconi. 2022. "Machine Learning and Artificial Intelligence Use in Marketing: A General Taxonomy." *Italian Journal of Marketing* 2022(4):439–57. doi: 10.1007/s43039-022-00057-w.
[23] Molina, Reynier Israel Ramírez, Mauricio Junior Santamaria Ruiz, Lady Carolina Monsalve Castro, Nelson David Lay Raby, Sebastian Hinojoza-Montañez, and Martha García Samper. 2024. "Bibliometric Behavior of Big Data and Digital Marketing as Real-Time Multimedia." *Procedia Computer Science* 241:526–32. doi: 10.1016/j.procs.2024.08.075.
[24] Nyagadza, Brighton. 2022. "Sustainable Digital Transformation for Ambidextrous Digital Firms: Systematic Literature Review, Meta-Analysis and Agenda for Future Research Directions." *Sustainable Technology and Entrepreneurship* 1(3). doi: 10.1016/j.stae.2022.100020.
[25] Palos-Sánchez, P. R., P. Baena-Luna, A. Badicu, and J. C. Infante-Moro. 2022. "Artificial Intelligence and Human Resources Management: A Bibliometric Analysis." *Applied Artificial Intelligence* 36(1). doi: 10.1080/08839514.2022.2145631.
[26] Quach, Sara, Park Thaichon, Kelly D. Martin, Scott Weaven, and Robert W. Palmatier. 2022. "Digital Technologies: Tensions in Privacy and Data." *Journal of the Academy of Marketing Science* 50(6):1299–1323. doi: 10.1007/s11747-022-00845-y.
[27] Rashid, Adib Bin, and MD Ashfakul Karim Kausik. 2024. "AI Revolutionizing Industries Worldwide: A Comprehensive Overview

of Its Diverse Applications." *Hybrid Advances* 7(July):100277. doi: 10.1016/j.hybadv.2024.100277.
[28] Reed, David. 2013. "Open Data Institute/Institute of Direct and Digital Marketing Joint Event." *Journal of Direct, Data and Digital Marketing Practice* 15(2):176–79. doi: 10.1057/dddmp.2013.55.
[29] Renz, André, and Romy Hilbig. 2021. "Correction to: Prerequisites for Artificial Intelligence in Further Education: Identification of Drivers, Barriers, and Business Models of Educational Technology Companies (International Journal of Educational Technology in Higher Education, (2020), 17, 1." *International Journal of Educational Technology in Higher Education* 18(1). doi: 10.1186/s41239-021-00245-2.
[30] Ribeiro-Navarrete, Samuel, Jose Ramon Saura, and Daniel Palacios-Marqués. 2021. "Towards a New Era of Mass Data Collection: Assessing Pandemic Surveillance Technologies to Preserve User Privacy." *Technological Forecasting and Social Change* 167(September 2020). doi: 10.1016/j.techfore.2021.120681.
[31] Rowan, Neil J. 2023. "The Role of Digital Technologies in Supporting and Improving Fishery and Aquaculture across the Supply Chain – Quo Vadis?" *Aquaculture and Fisheries* 8(4):365–74. doi: 10.1016/j.aaf.2022.06.003.
[32] Ryan, Mark. 2020. "In AI We Trust: Ethics, Artificial Intelligence, and Reliability." *Science and Engineering Ethics* 26(5):2749–67. doi: 10.1007/s11948-020-00228-y.
[33] Saura, Jose Ramon. 2021. "Using Data Sciences in Digital Marketing: Framework, Methods, and Performance Metrics." *Journal of Innovation and Knowledge* 6(2):92–102. doi: 10.1016/j.jik.2020.08.001.
[34] Saura, Jose Ramon, Vatroslav Škare, and Durdana Ozretic Dosen. 2024. "Is AI-Based Digital Marketing Ethical? Assessing a New Data Privacy Paradox." *Journal of Innovation and Knowledge* 9(4). doi: 10.1016/j.jik.2024.100597.
[35] Schiff, Daniel. 2022. *Education for AI, Not AI for Education: The Role of Education and Ethics in National AI Policy Strategies*. Vol. 32.
[36] Setiawan, Adi, Moh Yudi Mahadianto, M. Alwi Budi, and Agung Prasetya. 2024. "Pemetaan Domain Pengetahuan Transformasi Digital Publikasi : Analisis Bibliometrik." (Gcbme 2023). doi: 10.2991/978-94-6463-443-3.
[37] Webber, Richard. 2013. "The Evolution of Direct, Data and Digital Marketing." *Journal of Direct, Data and Digital Marketing Practice* 14(4):291–309. doi: 10.1057/dddmp.2013.20.