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PREFACE

Based in Ankara in Turkey, the independent academic publisher, Akademisyen Publishing House, has been publishing books for almost 30 years. As the directors of Akademisyen Publishing House, we are proud to publish more than 3800 books across disciplines so far, especially in Health Sciences. We also publish books in Social Sciences, Educational Sciences, Physical Sciences, and also books on cultural and artistic topics.

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We thank all of the authors with whom we collaborated to publish their books across disciplines.

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CONTENTS

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Chapter 1

THE REVIEW OF DIRAC OPERATORS IN MATHEMATICS: A BIBLIOMETRIC ANALYSIS

Özge AKÇAY[1]

INTRODUCTION

Bibliometric analysis is a methodological approach developed for the quantitative analysis and interpretation of scientific studies. It primarily involves measuring, modeling, and visualizing bibliographic relationships (citations, co-citations, co-authorships, bibliographic duplications, etc.) based on publication (articles, books, conference proceedings, etc.), citation, and keyword data. This interdisciplinary field is intertwined with the literatures of information science, library and information studies, and research evaluation.

We can give the main objectives of bibliometric studies as follows: evaluation of scientific production at the author, institution, country and journal levels, measuring scientific activity and impact areas, citation counts and impact indexes, mapping a research area, revealing collaboration patterns (e.g. between authors, institutions, countries) and information flows through network analysis, literature review and key researcher identification. Recently, bibliometric analysis has been put forward for many scientific studies in different disciplines. The following studies can be given as examples: (Akçay, 2025a, 2025b; Akçay and Can, 2025; Ay et al., 2024; Bekler et al., 2024; Burkut & Dal, 2023; Tuğrul, 2025; Tuğrul & Can, 2025; Tekin, Ay & Dal, 2025).

In this work, bibliometric analysis of Dirac equations, which are equations of quantum mechanics and have an important place in both physics and mathematics, was made, especially in the field of mathematics. Before performing bibliometric analysis, it is necessary to give information about Dirac operators in the mathematics. In particle physics, the Dirac equation is a relativistic wave equation derived by British physicist Paul Dirac in 1928 (Dirac, 1928).

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shape research trends in the field. Furthermore, bibliographical coupling analyses across documents, sources, authors, and countries demonstrate a strong global collaborative network for research on Dirac operators. Journals such as "Journal of Geometry and Physics", "Advances in Applied Clifford Algebras", and "Journal of Functional Analysis" are identified as central publication platforms in the field, while researchers such as "F. Sommen", "D. Eelbode" and "H. De Schepper" are among the most productive authors. Country-based analyses reveal that the "USA", "Germany" and "China" are the countries with the highest publication production.

Overall, it can be concluded that research on Dirac operators has progressed both quantitatively and qualitatively, evolving in strong relationships with fields such as spectral theory, differential geometry, and quantum mechanics. The bibliometric analysis presented in this study provides an important framework for future scientific research by revealing the structure of the existing literature, its development trends, prominent research areas, and collaboration networks. In this respect, this work contributes to a more systematic and strategic development of the literature on Dirac operators in the mathematical context.

REFERENCES

Akçay, Ö. (2025a). Sturm-Liouville Operatörünün Ters Spektral Probleminin Bibliyometrik Analizi. In M. Dal, N.A. Dal & İ. Ay (Eds.), Bibliyometrik Analiz I (pp. 47–60). Ankara: Akademisyen Yayınevi.

Akçay, Ö. (2025b). The Bibliometric Analysis of Scattering Theory in Mathematics. In M. Dal, N.A. Dal & İ. Ay (Eds.), Bibliometric Analysis II (pp. 141–155). Ankara: Akademisyen Yayınevi.

Akçay, Ö., & Can, Ü. (2025). Inverse Scattering Problems in the Theoretical Foundations of Computer Sciences. *16th International İstanbul Scientific Research Congress*, 850–859.

Akcay, O., & Mamedov, K.R. (2017a). Inverse Spectral Problem for Dirac Operators by Spectral Data. *Filomat,* 31(4), 1065–1077.

Akcay, O., & Mamedov, K.R. (2017b). The Main Equation of Inverse Problems for Dirac Operators. *U.P.B. Sci. Bull., Series A*, 79(4), 159–168.

Allahverdiev, B.P., & Tuna, H. (2025). Discrete Dirac Equations. Turkish Journal of Mathematics, 49(3), 287–299.

Allahverdiev, B.P., Tuna, H., & Isayev, H.A. (2024). Titchmarsh-Weyl Theory for Impulsive q-Dirac Equation. International Journal of Geometric Methods in Modern Physics, 21(2), doi. 10.1142/S021988782450049X

Atkins, P.W. (1974). *Quanta: a handbook of concepts.* Oxford University Press.

Ay, İ., Bekler, B., Bekler, S., & Dal, M. (2024). Bibliometric Analysis of Academic Studies on BREEAM with VOSviewer Software Program. *Engineering Applications*, *3*(3), 185–202.

Bekler, S., Ay, İ., Dal, M., & Bekler, B. (2024). Bilimsel Bir Bakış: Küresel İklim Değişikliği ve Sürdürülebilirlik Alanındaki Araştırma Trendleri (1992-2024). In M. Dal (Ed.), *Mimarlıkta Güncel Araştırma, Tasarım ve Yöntem-2024* (pp. 1–24). Livre de Lyon.

Branson, T.P. (1995). Sharp Inequalities, the Functional Determinant, and Complementary Series. *Transactions of the American Mathematical Society,* 347(10), 3671–3742.

Burkut, E. B., & Dal, M. (2023). Systematic Literature Review and Scientific Maps on Ecological Architecture and Eco-Architecture. *International Journal of Pure and Applied Sciences*, *9*(2), 369–380. https://doi.org/10.29132/ijpas.1365407.

Camporesi, R., & Higuchi, A. (1996). On the Eigenfunctions of the Dirac Operator on Spheres and Real Hyperbolic Spaces. *Journal of Geometry and Physics*, 20(1), 1–18.

Dirac, P.A.M. (1928). The Quantum Theory of the Electron. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences,* 117 (778), 610–624.

Friedrich, T. (1980). The 1st Eigenvalue of the Dirac Operator on a Compact Riemannian Manifold with Nonnegative Scaler-Curvature. *Mathematische Nachrichten*, 97, 117–146.

Göktaş, S., Kemaloğlu, H., & Yılmaz, E. (2022). Multiplicative Conformable Fractional Dirac System. *Turkish Journal of Mathematics,* 46(3), 973–990.

Gromov, M., & Lawson, H.B. (1983). Positive Scalar Curvature and the Dirac Operator on Complete Riemannian-Manifolds. *Publications Mathematiques*, 58, 295–408.

Kutzelnigg, W. (1984). Basis Set Expansion of the Dirac Operator Without Variational Collapse. *International Journal of Quantum Chemistry*, 25(1), 107–129.

Levitan, B.M., & Sargsjan, I.S. (1991). *Sturm-Liouville and Dirac operators*. Dordrecht/Boston/London: Kluwer Academic Publisher.

Mamedov, K.R., & Akcay, O. (2014). Inverse Eigenvalue Problem for a Class of Dirac Operators with Discontinuous Coefficient. *Boundary Value Problems*, 110(2014). https://doi.org/10.1186/1687-2770-2014-110.

Mamedov, K.R., & Akçay, Ö. (2014). Inverse Problem for a Class of Dirac Operator. *Taiwanese Journal of Mathematics*, 18(3), 753–772.

Mamedov, K.R., & Akcay, O. (2015). Necessary and Sufficient Conditions for the Solvability of Inverse Problem for a Class of Dirac Operators. *Miskolc Mathematical Notes*, 16(1), 257–275.

Mamedov, K.R., & Akcay, O. (2017). Inverse problem for a class of Dirac operators by the Weyl function. *Dyn. Syst. Appl.,* 26(1), 183–196.

Mosazadeh, S., & Koyunbakan, H. (2020). On the Stability of the Solution of the Inverse Problem for Dirac Operator. *Applied Mathematics Letters,* 102, https://doi.org/10.1016/j.aml.2019.106118

Tuğrul, F. (2025). Bibliometric Analysis on the Concept of "Intuitionistic Fuzzy Set." In M. Dal, N.A. Dal & İ. Ay (Eds.), Bibliometric Analysis I (pp. 47–60). Ankara: Akademisyen Yayınevi.

Tuğrul, F., & Can, Ü. (2025). Bibliometric Analysis of Machine Learning and Fuzzy Concepts: Web of Science-Based Study. In M. Dal, N.A. Dal & İ. Ay (Eds.), Bibliometric Analysis II (pp. 55–68). Ankara: Akademisyen Yayınevi.

Tekin, S., Ay, İ., & Dal, M. (2025). Intersection of Cultural Memory: Bibliometric Analysis of Museum and Music Studies: Web of Science Database. *II. International Perge Scientific Studies Congress*, 165–173.

VOSviewer 1.6.20. (2025). Welcome to VOSviewer. https://www.vosviewer.com/

Web of Science. (2025). Web of Science Core Collection. (27.11.2025 tarihinde https://www.webofscience.com/wos/woscc/citation-report/725bbed5-e6a7-4f50-9798-6e1bff8e7999-018c98218e adresinden ulaşılmıştır).

Yalçınkaya, Y., Allahverdiev, B.P. & Tuna, H. (2025). One Dimensional beta Dirac System. Filomat, 39(22), 7603–7618.

Yang, C.F., & Pivovarchik, V.N. (2013). Inverse Nodal Problem for Dirac System with Spectral Parameter in Boundary Conditions. *Complex Anal. Oper. Theory*, 7, 1211–1230.

Bölüm 2

CONVERSATIONAL MARKETING WITH AI-POWERED CHATBOTS: A COMPREHENSIVE BIBLIOMETRIC ANALYSIS

İbrahim Halil EFENDİOĞLU[1]

INTRODUCTION

A chatbot is an artificial intelligence software that can conduct natural language conversation via voice or text. Businesses use conversational marketing, a strategy that involves engaging customers in personalized, one-on-one conversations, to save time, personnel, and financial expenses, while also enhancing customer experiences. The global chatbot market, which reached $137 million in 2023, is expected to grow to $455 million by the end of 2027. As the fastest-growing communication channel for brands, chatbots can reduce routine response times by up to 80%, helping businesses save approximately 30% on customer support costs. These practical benefits underscore the potential of conversational marketing in the business world, providing a reliable and efficient solution for customer engagement. Furthermore, in 2023, around 67% of consumers used a chatbot, indicating a growing preference for this technology (Connell, 2024). Approximately 71% of consumers favor real-time and swift communication with businesses. 52% of consumers state that if a company provides support with chatbots, they are more likely to shop from that business again. On the other hand, businesses can save up to 30% on the cost spent on customer support thanks to chatbots. Additionally, 79% of companies report that the conversational marketing bot yields positive results in terms of customer loyalty, sales, and revenue (Sendpulse, 2024). Therefore, conversational marketing, with its focus on one-on-one conversations with customers throughout their purchasing

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psychological effects of AI-powered chatbots in marketing could provide valuable insights into consumer satisfaction and loyalty.

Lastly, the study could benefit from a deeper exploration of the effects of emerging technologies and AI trends. There is a growing need for more research on how technologies like natural language processing (NLP) and affective AI influence marketing strategies and how these technologies can be implemented. Additionally, the study could delve into the increasingly crucial topics of data privacy and ethical concerns in consumer-business interactions.

REFERENCES

Adam, M., Wessel, M., & Benlian, A. (2021). AI-based chatbots in customer service and their effects on user compliance. *Electronic Markets*, *31*(2), 427-445. https://doi.org/10.1007/s12525-020-00414-7

Araujo, T. (2018). Living up to the chatbot hype: The influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions. *Computers in Human Behavior*, pp. 85, 183–189. https://doi.org/10.1016/j.chb.2018.03.051

Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959-975. https://doi.org/10.1016/j.joi.2017.08.007

Arsenijevic, U., & Jovic, M. (2019, September 30). *Artificial intelligence marketing: Chatbots*. In 2019 International Conference on Artificial İntelligence: Applications and Innovations (IC-AIAI) IEEE. Vrdnik Banja, Serbia. https://doi.org/10.1109/IC-AIAI48757.2019.00010

Bhagyalakshmi, R., & Begam, M. G. S. (2023). Exploring The Effects of Conversational Marketing and Artificial Intelligence on Customer Engagement Comprehensive Literature Review. *Tuijin Jishu/Journal of Propulsion Technology*, *44*(4), 4509-4517. https://doi.org/10.52783/tjjpt.v44.i4.1735

Broadus, R. N. (1987). Toward a definition of "bibliometrics". *Scientometrics*, pp. 12, 373–379. https://doi.org/10.1007/BF02016680

Cheng, Y., & Jiang, H. (2022). Customer–brand relationship in the era of artificial intelligence: understanding the role of chatbot marketing efforts. *Journal of Product & Brand Management*, *31*(2), 252-264. https://doi.org/10.1108/JPBM-05-2020-2907

Chung, M., Ko, E., Joung, H., & Kim, S. J. (2020). Chatbot e-service and customer satisfaction regarding luxury brands. *Journal of Business Research*, 117, 587-595.https://doi.org/10.1016/j.jbusres.2018.10.004

Clarivate (2024). Scientific & Academic Research. Web of Science platform https://clarivate.com/products/scientific-and-academic-research/research-discovery-and-workflow-solutions/webofscience-platform/ (Access Date: March 15, 2024).

Connell, A. (2024). 50 Critical Chatbot Statistics You Need To Know For 2024. https://adamconnell.me/chatbot-statistics/ (Access Date: August 15, 2024).

Davis, F. D. (1989). Technology acceptance model: TAM. Al-Suqri, MN, Al-Aufi, AS: *Information Seeking Behavior and Technology Adoption*, pp. 205, 219.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, pp. 133, 285–296.

El Bakkouri, B., Raki, S., & Belgnaoui, T. (2022). The role of chatbots in enhancing customer experience: Literature review. *Procedia Computer Science*, 203, 432-437. https://doi.org/10.1016/j.procs.2022.07.057

Fornell, C. (1981). Increasing the organizational influence of corporate consumer affairs departments. *Journal of Consumer Affairs, 15*(2), 191–213. https://doi.org/10.1111/j.1745-6606.1981.tb00709.x

Hu, P., Gong, Y., Lu, Y., & Ding, A. W. (2023). Speaking vs. listening? Balance conversation attributes of voice assistants for better voice marketing. *International Journal of Research in Marketing, 40*(1), 109-127.https://doi.org/10.1016/j.ijresmar.2022.04.006

Ikumoro, A. O., & Jawad, M. S. (2019). Assessing intelligence conversation agent trends-chatbots-ai technology application for personalized marketing. *Test Engineering and Management*, 81, 4779-4785.

Israfilzade, K. (2021). Conversational marketing as a framework for interaction with the customer: Development & validation of the conversational agent's usage scale. *Journal of Life Economics*, 8(4), 533-546. https://doi.org/10.15637/jlecon.8.4.12

Israfilzade, K. (2023). *Beyond Automation: The Impact of Anthropomorphic Generative AI on Conversational Marketing.* In 8th International European Conference On Interdisciplinary Scientific Research 5(2), 757-766

Lin, X., Shao, B., & Wang, X. (2022). Employees' perceptions of chatbots in B2B marketing: Affordances vs. disaffordances. *Industrial Marketing Management*, 101, 45-56.

Linnenluecke MK, Marrone M, Singh AK (2020). Conducting systematic literature reviews and bibliometric analyses. *Aust J Manag 45*(2):175–194. https:// doi. org/ 10. 1177/ 03128 96219 877678

Meller, L., Jagadeesh, V., Gali, H., Oca, M., Wilson, K., & Scott, N. (2023). Characterizing core journals in ophthalmology literature using Bradford's Law: a bibliometric analysis. *Investigative Ophthalmology & Visual Science, 64*(8), 5381-5381.

Mirosavljević, M., & Milovanovic, M. (2022, June 02-05). Conversatıonal Marketıng-New Roles of Consumers. X Internatıonal Conference of Socıal and Technologıcal Development. Trebinje, Serbia

Mogaji, E., Balakrishnan, J., Nwoba, A. C., & Nguyen, N. P. (2021). Emerging-market consumers' interactions with banking chatbots. *Telematics and Informatics*, p. 65, 101711. https://doi.org/10.1016/j.tele.2021.101711

Moguluwa, S. C. (2022). A Review of Conversational Marketing. *Journal of Positive School Psychology, 6*(5), 4452-4461.

Moral-Muñoz, J. A., Herrera-Viedma, E., Santisteban-Espejo, A., Cobo, M. J. (2020). Software tools for conducting bibliometric analysis in science: An up-to-date review, *El Profesional de La Información, 29*(1), 4.1–20. https://doi.org/10.3145/epi.2020.ene.03

Pritchard, A. (1969). Statistical Bibliography or Bibliometrics? *Journal of Documentation*, pp. 25, 348–349.

Sheehan, B., Jin, H. S., & Gottlieb, U. (2020). Customer service chatbots: Anthropomorphism and adoption. *Journal of Business Research*, 115,14-24. https://doi.org/10.1016/j.jbusres.2020.04.030

Sendpulse (2024). Conversational Marketing Statistics. (Access Date: August 15, 2024). https://sendpulse.com/support/glossary/conversational-marketing

Sidlauskiene, J., Joye, Y., & Auruskeviciene, V. (2023). AI-based chatbots in conversational commerce and their effects on product and price perceptions. *Electronic Markets, 33*(1), 24. https://doi.org/10.1007/s12525-023-00633-8

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425-478. https://doi.org/10.2307/30036540

Bölüm 3

GLOBAL RESEARCH TRENDS IN MARBLE DETERIORATION: A WEB OF SCIENCE-BASED BIBLIOMETRIC ANALYSIS

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INTRODUCTION

Natural stones, especially marble, have been one of the primary building materials for architectural structures, sculptures, and cultural heritage elements for thousands of years due to their aesthetic appearance, high polishability, and homogeneous mineralogical structure. However, marble is exposed to physical, chemical, and biological degradation processes operating at different scales throughout its service life, and as a result of these processes, both its surface properties and mechanical strength change significantly over time. The multidimensional nature of marble degradation is frequently emphasized in the literature; it is stated that parameters such as temperature changes, moisture cycles, and mineralogical preferred orientation are decisive for the physical behavior of marble. For example, the highly anisotropic thermal expansion properties of calcite lead to stress accumulation at grain boundaries and microcrack formation, reducing the long-term strength of the material. This situation reveals that thermal effects and microcrack development are critical degradation mechanisms in the use of marble in both historical structures and modern architecture (Siegesmund, Ullemeyer, Weiss and Tschegg, 2000).

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REFERENCES

Ague, J. J. and Nicolescu, S. (2014). Carbon dioxide released from subduction zones by fluid-mediated reactions. *Nature Geoscience*, *7*(5), 355–360. doi:10.1038/ngeo2143

Ay, İ. (2024a). Akıllı Ev Sistemleri Üzerine Bibliyometrik Bir Analiz: Web Of Science Tabanlı Bir Çalışma. *III. International Fırat Scientific Research Congress* in (pp. 114–121). Elazığ: Ases Publications.

Ay, İ. (2024b). Sürdürülebilir Kentsel Planlamada Bilimsel Yayınların Eğilimleri: Bibliyometrik Bir İnceleme. *III. International Fırat Scientific Research Congress* in (pp. 91–99). Elazığ: Ases Publications.

Ay, İ. and Dal, M. (2024). 1989'dan Günümüze Dijital Mimarlık: Akademik Yayınların Bibliyometrik Analizi. *International Science and Art Congress* in (pp. 190–198). Kahramanmaraş: Ases Publications.

Burkut, E. B. and Dal, M. (2023). Systematic Literature Review and Scientific Maps on Ecological Architecture and Eco-Architecture. *International Journal of Pure and Applied Sciences*, *9*(2), 369–380. doi:10.29132/ijpas.1365407

Burkut, E. B. and Dal, M. (2024). Analysis of Articles on Occupational Health and Safety with Scientific Mapping Techniques in WoS & Scopus Database (2000-2023). *Digital international journal of Architecture Art Heritage*, *3*(1), 1–13.

Cao, P., Liu, T., Pu, C. and Lin, H. (2015). Crack propagation and coalescence of brittle rock-like specimens with pre-existing cracks in compression. *Engineering Geology*, *187*, 113–121. doi:10.1016/j.enggeo.2014.12.010

Chen, C. (2017). Science Mapping: A Systematic Review of the Literature. *Journal of Data and Information Science*, *2*(2), 1–40. doi:10.1515/jdis-2017-0006

Del Monte, M., Sabbioni, C. and Vittori, O. (1981). Airborne carbon particles and marble deterioration. *Atmospheric Environment (1967)*, *15*(5), 645–652. doi:10.1016/0004-6981(81)90269-9

Dennis, K. J. and Schrag, D. P. (2010). Clumped isotope thermometry of carbonatites as an indicator of diagenetic alteration. *Geochimica et Cosmochimica Acta*, *74*(14), 4110–4122. doi:10.1016/j.gca.2010.04.005

Lee, H. ., Park, Y. ., Cho, T. . and You, K. . (2001). Influence of asperity degradation on the mechanical behavior of rough rock joints under cyclic shear loading. *International Journal of Rock Mechanics and Mining Sciences*, *38*(7), 967–980. doi:10.1016/S1365-1609(01)00060-0

Macedo, M. F., Miller, A. Z., Dionísio, A. and Saiz-Jimenez, C. (2009). Biodiversity of cyanobacteria and green algae on monuments in the Mediterranean Basin: an overview. *Microbiology*, *155*(11), 3476–3490. doi:10.1099/mic.0.032508-0

Martínez-Martínez, J., Benavente, D., Gomez-Heras, M., Marco-Castaño, L. and García-del-Cura, M. Á. (2013). Non-linear decay of building stones during freeze–thaw weathering processes. *Construction and Building Materials*, *38*, 443–454. doi:10.1016/j.conbuildmat.2012.07.059

Mata, J., Curado, S., Ephrussi, A. and Rørth, P. (2000). Tribbles Coordinates Mitosis and Morphogenesis in Drosophila by Regulating String/CDC25 Proteolysis. *Cell*, *101*(5), 511–522. doi:10.1016/S0092-8674(00)80861-2

Mayr, P. and Scharnhorst, A. (2015). Scientometrics and information retrieval: weak-links revitalized. *Scientometrics*, *102*(3), 2193–2199. doi:10.1007/s11192-014-1484-3

Nasdala, L., Hofmeister, W., Norberg, N., Martinson, J. M., Corfu, F., Dörr, W., … Valley, J. W. (2008). Zircon M257 - a Homogeneous Natural Reference Material for the Ion Microprobe U-Pb Analysis of Zircon. *Geostandards and Geoanalytical Research*, *32*(3), 247–265. doi:10.1111/j.1751-908X.2008.00914.x

Scheerer, S., Ortega-Morales, O. and Gaylarde, C. (2009). Microbial Deterioration of Stone Monuments—An Updated Overview. *Advances in Applied Microbiology* in (pp. 97–139). doi:10.1016/S0065-2164(08)00805-8

Siegesmund, S., Ullemeyer, K., Weiss, T. and Tschegg, E. K. (2000). Physical weathering of marbles caused by anisotropic thermal expansion. *International Journal of Earth Sciences*, *89*(1), 170–182. doi:10.1007/s005310050324

van Eck, N. J. and Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. doi:10.1007/s11192-009-0146-3

Chapter 4

METAVERSE MARKETING AND CONSUMER DYNAMICS: A NEW ERA OF VIRTUAL INTERACTION

İbrahim Halil EFENDİOĞLU[1]

INTRODUCTION

The rapid convergence of physical and digital realities has given rise to the metaverse, a three-dimensional, immersive virtual space where individuals engage and interact through avatars using extended reality (XR) technologies such as virtual reality (VR) and augmented reality (AR) (Mystakidis, 2022). Within this context, the metaverse is increasingly recognized as a socio-technological ecosystem that transforms how users communicate, consume, and experience brands. This transformation has opened new frontiers for marketers, enabling the creation of interactive and immersive brand experiences that blend physical and virtual touchpoints (Dwivedi et al., 2023). As a result, metaverse marketing has emerged as a critical domain where companies experiment with novel ways to engage consumers through digital embodiment, gamification, and virtual co-creation.

Despite its growing commercial and academic relevance, the field of metaverse marketing remains in its formative stage. The research output on this topic has expanded rapidly in recent years, reflecting growing scholarly interest in understanding how consumers behave, interact, and form attachments in virtual spaces (Gao, Chong, & Bao, 2024). However, given the multidimensional and interdisciplinary nature of the metaverse, spanning marketing, technology, psychology, and human-computer interaction, there is a pressing need to map and synthesize the existing body of research systematically. Bibliometric analysis serves this purpose effectively by quantifying publication trends, identifying

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Strategy and economics. Model ROI of metaverse initiatives (cost of content, creator economies, pricing, tokenomics), multi-sided platform dynamics, and interoperability strategies; examine complements/substitutes with social media, mobile, and GenAI-enhanced channels.

Governance, ethics, and risk. Advance frameworks for privacy, safety, IP/consumer protection, dark-pattern mitigation, and accessibility; study bias in AI agents/avatars, identity portability, and community moderation at scale; quantify environmental impacts of computing/ledger choices.

Creator and community ecosystems. Investigate co-creation, user-generated assets, and social influence (parasocial ties with avatars, social proof in virtual venues); map roles of influencers, guilds, and DAOs in brand meaning and value capture.

Open science and reproducibility. Release cleaned bibliographic/keyword networks and synthetic XR datasets; encourage replication across platforms (e.g., Roblox, Fortnite, Horizon, Spatial) and verticals (retail, tourism, health, education).

Methodological transparency. Report clustering parameters, disambiguation rules, and inclusion criteria; triangulate bibliometrics with qualitative synthesis (scoping/systematic reviews) to enrich theory building.

Pursuing these directions will move the field from rapid descriptive growth to cumulative, theory-driven knowledge about how immersive technologies reshape consumer psychology, brand strategy, and market design while ensuring ethical, inclusive, and durable value creation in the metaverse.

REFERENCES

Alsharif, A. H., Salleh, N. Z. M., & Baharun, R. (2020). Research trends of neuromarketing: A bibliometric analysis. *Journal of Theoretical and Applied Information Technology, 98*(15), 2948–2962.

Arya, V., Sambyal, R., Sharma, A., & Dwivedi, Y. K. (2024). Brands are calling your AVATAR in Metaverse – A study to explore XR-based gamification marketing activities & consumer-based brand equity in virtual world. Journal of Consumer Behaviour, 23(2), 556–585.

Azmi, A., Ibrahim, R., Ghafar, M. A., & Rashidi, A. (2023). Metaverse for real estate marketing: The impact of virtual reality on satisfaction, perceived enjoyment, and purchase intention. Preprint, https://doi.org/10.21203/rs.3.rs-2584882/v1

Bilgihan, A., Leong, A. M. W., Okumus, F., & Bai, J. (2024). Proposing a metaverse engagement model for brand development. *Journal of Retailing and Consumer Services*, 78, 103781.

Catherine, S., Kiruthiga, V., & Gabriel, R. (2024). Effective brand building in metaverse platform: consumer-based brand equity in a virtual world (CBBE). In *Omnichannel Approach to Co-Creating Customer Experiences Through Metaverse Platforms* (pp. 39-48). IGI Global Scientific Publishing.

Cheah, I., & Shimul, A. S. (2023). Marketing in the metaverse: Moving forward – What's next? *Journal of Global Scholars of Marketing Science, 33*(1), 1–10.

Cheung, C. M., Lee, M. K., & Rabjohn, N. (2008). The impact of electronic word-of-mouth: The adoption of online opinions in online customer communities. *Internet Research, 18*(3), 229-247.

Davis, F. D. (1989). Technology acceptance model: TAM. Al-Suqri, MN, Al-Aufi, AS: *Information Seeking Behavior and Technology Adoption, 205*(219), 5.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285–296.

Dwivedi, Y. K., Hughes, L., Wang, Y., Alalwan, A. A., Ahn, S. J., Balakrishnan, J., ... & Wirtz, J. (2023). Metaverse marketing: How the metaverse will shape the future of consumer research and practice. *Psychology & Marketing, 40*(4), 750–776.

Efendioğlu, İ. H. (2023). The effect of information about metaverse on the consumers' purchase intention. *Journal of Global Business and Technology, 19*(1), 63–77.

Erkan, I., & Evans, C. (2016). The influence of eWOM in social media on consumers' purchase intentions: An extended approach to information adoption. *Computers in Human Behavior*, 61, 47-55.

Gao, H., Chong, A. Y. L., & Bao, H. (2024). Metaverse: Literature review, synthesis and future research agenda. *Journal of Computer Information Systems, 64*(4), 533–553.

Hollensen, S., Kotler, P., & Opresnik, M. O. (2022). Metaverse – the new marketing universe. *Journal of Business Strategy. 44*(3), 119-125. https://doi.org/10.1108/JBS-01-2022-0014

Linnenluecke, M. K., Marrone, M., & Singh, A. K. (2020). Conducting systematic literature reviews and bibliometric analyses. *Australian Journal of Management, 45*(2), 175-194.

Mystakidis, S. (2022). Metaverse. *Encyclopedia, 2*(1), 486–497.

Passas, I. (2024). Bibliometric Analysis: The Main Steps. *Encyclopedia*, *4*(2),1014-1025. https://doi.org/10.3390/encyclopedia4020065

Periyasami, S., & Periyasamy, A. P. (2022). Metaverse as future promising platform business model: Case study on fashion value chain. *Businesses, 2*(4), 527–545.

Patil, K., Bharathi, V. S., & Pramod, D. (2022). Can metaverse retail lead to purchase intentions among youth? ICETSIS 2022, *Bahrain*, 314–320.

Petty, R. E., & Cacioppo, J. T. (1986). Message elaboration versus peripheral cues. In *Communication and persuasion: Central and peripheral routes to attitude change* (pp. 141-172). New York, NY: Springer New York.

Rane, N., Choudhary, S., & Rane, J. (2023). Metaverse for enhancing customer loyalty: Effective strategies to improve customer relationship, service, engagement, satisfaction, and experience. http://dx.doi.org/10.2139/ssrn.4624197

Rather, R. A. (2025). Metaverse marketing and consumer research: Theoretical framework and future research agenda in tourism and hospitality industry. *Tourism Recreation Research, 50*(1), 189-197.

Rauschnabel, P. A., Felix, R., Hinsch, C., Shahab, H., & Alt, F. (2022). What is XR? Towards a framework for augmented and virtual reality. *Computers in Human Behavior*, 107289.

Shen, B., Tan, W., Guo, J., Zhao, L., & Qin, P. (2021). How to promote user purchase in metaverse? A systematic literature review on consumer behavior research and virtual commerce application design. *Applied Sciences, 11*(23), 11087.

Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. *Journal of the American Society for information Science, 24*(4), 265-269.

Sung, E., Kwon, O., & Sohn, K. (2023). NFT luxury brand marketing in the metaverse: Leveraging blockchain-certified NFTs to drive consumer behavior. *Psychology & Marketing, 40*(11), 2306–2325.

Sussman, S. W., & W. S. Siegal (2003). Informational influence in organizations: an integrated approach to knowledge adoption. *Information Systems Research, 14*(1), 47–65. https://doi.org/10.1287/isre.14.1.47.14767

Vidal-Tomás, D. (2022). The new crypto niche: NFTs, play-to-earn, and metaverse tokens. *Finance Research Letters*, 47, 102742.

Zhang, L., Anjum, M. A., & Wang, Y. (2024). The impact of trust-building mechanisms on purchase intention towards metaverse shopping: the moderating role of age. *International Journal of Human–Computer Interaction, 40*(12), 3185-3203.

Zhao, Y., Jiang, J., Chen, Y., Liu, R., Yang, Y., Xue, X., & Chen, S. (2022). Metaverse: Perspectives from graphics, interactions, and visualization. *Visual Informatics, 6*(1), 56–67.

Chapter 5

ANALYSIS OF ALGORITHMIC TRADING IN A BIBLIOMETRIC CONTEXT: A COMPREHENSIVE REVIEW OF THE 2000-2025 PERIOD

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INTRODUCTION

The concept of trade has been at the heart of every structure involving humans throughout history, including individuals, societies, cities, nations, and states. Trade has guided the development of humanity and civilization, shaping our world from the past to the present by leading to the formation of societies, the establishment of states, wars, the development of languages, geographical discoveries, and the production of new technologies. The Sumerian civilization, one of the oldest known civilizations with a polytheistic belief system, considered its chief god, Enlil, to be the god of trade (Smith, 2008). Similarly, they attributed similar roles to gods named Hermes in Greek mythology and Veles in Slavic mythology. This shows that trade has been vital to societies since civilization began, and more examples can be added. Evolving from the instinct for survival to the accumulation of wealth and the goal of enrichment, trade has appeared in various forms and functions throughout history. Trade was first carried out through a barter system (Oliver & Mpinganjira, 2011). Barter is a system of exchange that allows goods and services to be traded directly for other goods and services without using a medium of exchange like money (O'Sullivan & Sheffrin, 2007). In the barter system, exchange occurred not only with useful products like metals and grains but also between ceremonial, symbolic, or prestige items. Whatever is exchanged through the barter system, the exchanged items must have a function, social benefit, and reciprocity (Smith, 2008). The needs of communities and tribes, arising from natural resources in their habitats, prompted inter-tribal interaction and exchange as demand grew for resources not available in those habitats.

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The increasingly sophisticated, data-intensive, and multi-dimensional nature of this thematic structure over time can be read as a modern reflection of the institutional, technological, and epistemological transformation that trade has undergone throughout history..

In conclusion, the long historical evolution of trade from barter-based social practices to digital markets governed by algorithmic models is directly related to the current scientific dynamics of the algorithmic trading literature. This study elucidates the components of the literature and its historical context through bibliometric analysis, yielding significant insights into the future of algorithmic trading. The findings indicate that the field will deepen further in subtopics such as reinforcement learning, behavioral-data hybrid models, high-frequency data analytics, and the crypto asset ecosystem in the coming period, strengthening its decisive role in financial decision-making processes. The point where these two axes converge is where trade ceases to be a form of social interaction and becomes a completely data-driven optimization problem. This situation represents the most advanced stage in the transformation of trade throughout history. This study comprehensively reveals the historical and scientific shaping of the field of algorithmic trading. The long journey of trade, from barter to today's automated decision-making systems, has produced new tools and forms of relationships in every era. However, today, it has evolved into an ecosystem that effectively utilizes financial models, data algorithms, and machine learning. In the future of algorithmic trading literature, more data sources, more complex learning algorithms, and the emergence of hybrid approaches at the intersection of behavioral finance and artificial intelligence are expected.

REFERENCES

Aria, M., & Cuccurullo, C. (2017). *bibliometrix*: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959-975. https://doi.org/10.1016/j.joi.2017.08.007

Bowers, B. (2002). Inventors of the Telegraph. *Proceedings of the IEEE*, *90*(3), 436-439. https://doi.org/10.1109/5.993407

Davies, G. (2013). *A history of money* (Third edition, with revisions). University of Wales Press.

Delegation of Turkey to UNESCO. (2012). *Aizanoi Antique City*. UNESCO World Heritage Centre. https://whc.unesco.org/en/tentativelists/5724/

FXCM Research, T. (2016, Ağustos 15). Evolution Of The Marketplace: From Open Outcry To Electronic Trading. *FXCM Markets*. https://www.fxcm.com/markets/insights/evolution-of-the-marketplace-from-open-outcry-to-electronic-trading/

Garbade, K. D., & Silber, W. L. (1978). Technology, Communication and the Performance of Financial Markets: 1840-1975. *Journal of Finance*, *33*(3), 819-832.

Gomber, P., & Zimmermann, K. (2018). Algorithmic trading in practice. İçinde *The Oxford Handbook of Computational Economics and Finance* (ss. 311-332). https://doi.org/10.1093/oxfordhb/9780199844371.013.12

Grody, A. D., & Levecq, H. (1993). *Past, Present and Future: The Evolution and Development of Electronic Financial Markets* (SSRN Scholarly Paper 1284845). Social Science Research Network. https://papers.ssrn.com/abstract=1284845

Khristianto, W. (2013). *OPEN OUTCRY AND ELECTRONIC FINANCIAL TRADING SYSTEMS (A Comparison Study)-Jurnal Perspektif Bisnis, Vo.1,No.1, Juli-Desember 2013*. https://www.academia.edu/2313528/OPEN_OUTCRY_AND_ELECTRONIC_FINANCIAL_TRADING_SYSTEMS_A_Comparison_Study_Jurnal_Perspektif_Bisnis_Vo_1_No_1_Juli_Desember_2013

Melloy, J. (2015, Şubat 5). *Why the CME shutting down floor trading matters*. CNBC. https://www.cnbc.com/2015/02/05/why-the-cme-shutting-down-floor-trading-matters.html

Oliver, P., & Mpinganjira, M. (2011). Barter trading: An empirical investigation of management practices. *AFRICAN JOURNAL OF BUSINESS MANAGEMENT*, *5*. https://doi.org/10.5897/AJBM11.273

O'Sullivan, A., & Sheffrin, S. M. (2007). *Prentice Hall Economics: Principles in Action*. Pearson/Prentice Hall.

Pao, M. L. (1985). Lotka's law: A testing procedure. *Information Processing & Management*, *21*(4), 305-320. https://doi.org/10.1016/0306-4573(85)90055-X

Smith, R. L. (2008). The first link. İçinde *Premodern Trade in World History*. Routledge.

Türk Dil Kurumu. (n.d.). *Ticaret*. Güncel Türkçe Sözlük. Geliş tarihi 28 Kasım 2025, gönderen https://sozluk.gov.tr/?kelime=ticaret

Wright, D. J. (1989). Technology and performance: The evolution of market mechanisms. *Business Horizons*, *32*(6), 65-70.

Chapter 6

NEURO-ARCHITECTURE: DESIGN PRINCIPLES AND SCIENTIFIC VISUALIZATION

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INTRODUCTION

Neuroarchitecture is an architectural principle that combines neuroscience and architecture. Neuroarchitecture examines the physical and psychological responses of users to space and the environment (Eberhard, 2009; Ritchie, 2020). Neuroarchitecture aims to produce spatial designs in response to these responses and to enhance individual psychological processes. Space design and environmental factors significantly influence human perception, mood, and behavior. Individuals interact with their environment, exhibiting responses based on sensory, physical, and past experiences. A person's past memories and traumas influence their perception of space. This research examines neuro-architecture conceptually and theoretically. The study utilizes the scientific mapping method, a quantitative research method. This method reveals the conceptual, theoretical, and evolutionary development of the relevant literature through numerical data and frequencies. The findings of the research facilitate the emergence of influential publications on neuro-architecture in the current literature.

Moreover, concepts such as neuro-architecture, memory, architecture, built environment, direction, spatial orientation, sensation, interior space, neuro-aesthetics (Pearce et al., 2016; Vittorio, 2009), neuroscience (Eberhard, 2009;

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REFERENCES

ANFA, (2025). Academy of Neuroscience for Architecture. https://anfarch.org/

Assem, H. M., Khodeir, L. M., & Fathy, F. (2023). Designing for human wellbeing: The integration of neuroarchitecture in design–A systematic review. *Ain Shams Engineering Journal*, *14*(6), 102102. https://doi.org/10.1016/j.asej.2022.102102

Chatterjee, A., Coburn, A., & Weinberger, A. (2021). The neuroaesthetics of architectural spaces. *Cognitive Processing*, *22*(Suppl 1), 115-120.

Coburn, A., Vartanian, O., & Chatterjee, A. (2017). Buildings, beauty, and the brain: A neuroscience of architectural experience. *Journal of Cognitive Neuroscience*, *29*(9), 1521-1531. doi: 10.1162/jocn_a_01146

Eberhard, J. P. (2009). Applying neuroscience to architecture. Neuron, 62(6), 753–756. https://doi.org/10.1016/j.neuron.2009.06.001

Eltaweel, A., & Yuehong, S. U. (2017). Parametric design and daylighting: A literature review. *Renewable and Sustainable Energy Reviews*, 73, 1086-1103. https://doi.org/10.1016/j.rser.2017.02.011

Erkan, I. (2023). A neuro-cognitive perspective on urban behavior of people with different moods. *Open House International*, 48(4), 822-839. https://doi.org/10.1108/OHI-10-2022-0252

Ghamari, H., Golshany, N., Naghibi Rad, P., & Behzadi, F. (2021). Neuroarchitecture Assessment: An Overview and Bibliometric Analysis. *European Journal of Investigation in Health, Psychology and Education*, *11*(4), 1362-1387. https://doi.org/10.3390/ejihpe11040099

Higuera-Trujillo, J. L., Llinares, C., & Macagno, E. (2021). The Cognitive-Emotional Design and Study of Architectural Space: A Scoping Review of Neuroarchitecture and Its Precursor Approaches. *Sensors*, *21*(6), 2193. https://doi.org/10.3390/s21062193

Hudson, R. (2010). Strategies for parametric design in architecture. Civ. Eng, 274, 77-81.

Hosseini Nasab, S., Mehdizadeh Saraj, F., & Khanmohammadi, M. A. (2023). Analysis of Iranian Scientific Productions in Neuro-Architecture: A Scoping Review. *Scientometrics Research Journal*, 9(1), 231-258. https://doi.org/10.22070/rsci.2021.13910.1479

Karakas, T., & Yildiz, D. (2020). Exploring the influence of the built environment on human experience through a neuroscience approach: A systematic review. *Frontiers of Architectural Research*, *9*(1), 236-247. https://doi.org/10.1016/j.foar.2019.10.005

Kandel, Eric, 2013, "From Nerve Cells to Cognition: The Internal Representations of Space and Action", Principles of Neural Science, 5. baskı, McGraw Hill, New York, ABD, ss.421-443.

Khaleghimoghaddam, N. (2022). Objective Exploration of the Effects of Architectural Components on Users' Spatial Evaluation: A Neuroimaging Approach. *ICONARP International Journal of Architecture and Planning*, 10(2), 428–443. https://doi.org/10.15320/ICONARP.2022.209

Krauze, W., & Motak, M. (2022). Neurosciences in Architecture: Applied Research and its Potential in Architectural Design. *Teka Komisji Urbanistyki i Architektury Oddziału Polskiej Akademii Nauk w Krakowie*, 331-356. https://doi.org/10.24425/tkuia.2022.144856

Lee, S., Shin, W., & Park, E. J. (2022). Implications of neuroarchitecture for the experience of the built environment: a scoping review. *Archnet-IJAR: International Journal of Architectural Research*, 16(2), 225-244. https://doi.org/10.1108/arch-09-2021-0249

Llorens-Gámez, M., Higuera-Trujillo, J. L., Omarrementeria, C. S., & Llinares, C. (2022). The impact of the design of learning spaces on attention and memory from a neuroarchitectural approach: A systematic review. *Frontiers of Architectural Research*, 11(3), 542-560.

Papale, P., Chiesi, L., Rampinini, A. C., Pietrini, P., & Ricciardi, E. (2016). When neuroscience 'touches' architecture: From hapticity to a supramodal functioning of the human brain. *Frontiers in Psychology*, 7, 866. https://doi.org/10.3389/fpsyg.2016.00866

Pearce, M. T., Zaidel, D. W., Vartanian, O., Skov, M., Leder, H., Chatterjee, A., & Nadal, M. (2016). Neuroaesthetics: The cognitive neuroscience of aesthetic experience. *Perspectives on Psychological Science*, 11(2), 265-279. https://doi.org/10.1177/1745691615621274

Pektaş, Ş. T. (2021). A scientometric analysis and review of spatial cognition studies within the framework of neuroscience and architecture. *Architectural Science Review,* 64(4), 374–382. https://doi.org/10.1080/00038628.2021.1910480

Rad, P. N., Behzadi, F., Yazdanfar, S. A., Ghamari, H., Zabeh, E., & Lashgari, R. (2023). Exploring methodological approaches of experimental studies in the field of neuroarchitecture: A systematic review. *HERD: Health Environments Research & Design Journal*, *16*(2), 284-309. https://doi.org/10.1177/19375867221133135

Raisi, R., Fattahi, K., Zakeri, S. M. H., & Daneshmand, S. (2025). Exploring neuro-architecture's influence on indoor learning space design: a comprehensive systematic review. *Intelligent Buildings International*, 1–22. https://doi.org/10.1080/17508975.2025.2502009

Raisi, R., Faizi, M., & Khakzand, M. (2025b). A Systematic Review Framework for Environmental Security Indicators in Neuro-Urbanism and Neuro-Landscape Contexts. *Building and Environment*, 113428. https://doi.org/10.1016/j.buildenv.2025.113428

Ritchie, I. (Ed.). (2020). Neuroarchitecture: Designing with the mind in mind. John Wiley & Sons.

Shemesh, A., Leisman, G., Bar, M., & Grobman, Y. J. (2021). A neurocognitive study of the emotional impact of geometrical criteria of architectural space. *Architectural Science Review*, 64(4), 394–407. https://doi.org/10.1080/00038628.2021.1940827

Şekerci, Y. (2024). Neuroscience and Spatial Design Bibliometric Analysis in Web of Science Database. *Journal of Computational Design*, 5(2), 279-300. https://doi.org/10.53710/jcode.1519629

Vittorio, G. (2009). Neuroaesthetics: a review. Current opinion in neurobiology, 19(6), 682-687.

Vizioli-Libório, F. H., Araújo-Bortoleto, L., Inglesis-Barcellos, E. E., & Botura Jr, G. (2023). Neuroarquitectura y Diseño en la oficina en casa: pautas para proyectos y adaptaciones del espacio de trabajo. *Revista de Arquitectura (Bogotá)*, 25(2), 110-122.

Wang, S., Sanches de Oliveira, G., Djebbara, Z., & Gramann, K. (2022). The embodiment of architectural experience: A methodological perspective on neuro-architecture. *Frontiers in Human Neuroscience*, 16, 833528. https://doi.org/10.3389/fnhum.2022.833528

Chapter 7

A BIBLIOMETRIC STUDY ON ARTIFICIAL INTELLIGENCE APPLICATIONS IN BANKING

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INTRODUCTION

Industry 4.0 is an advancement in industrialization where service and production processes are optimized by using digital technologies, relatively reducing manual labor. Artificial intelligence (AI), a key element of this development, was introduced to the literature by John McCarthy at a conference in 1956. The concept of artificial intelligence refers to machines that possess human-like thinking abilities. AI is defined as a system that can mimic humans in reasoning, learning, and decision-making through computer software. Its ability to solve complex problems that humans struggle with and process large datasets is particularly prominent. These capabilities have had a significant impact on expanding the application areas of Industry 4.0 (Bahoo et al., 2024; Akbaba & Gündoğdu, 2021).

AI applications have found their place in all sectors. The banking sector is at the forefront of these sectors. This is largely due to the banking sector's extensive use of data and the highly efficient use of AI in prediction, analysis, and automation. Thanks to AI, it has become possible to improve service quality, increase operational efficiency, and strengthen risk management capacity rapidly and on a large scale. Accordingly, service structures based on human resources, especially customer service representatives, have largely begun to be replaced by artificial intelligencebased digital solutions such as chatbots, online platforms, and automated service systems. In this way, customer experience is improved; operational processes are accelerated; and risk management capacity is increased. With all these developments, the use of AI in the banking sector increases corporate performance and competitiveness. This also increases the ability of institutions to become a more strategic element (Sarı, 2021).

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organized models as we approach the present day.

Country and journal analyses were conducted to analyze studies from every region of the world. These analyses show an increase in internationally interactive publications in countries with high publication frequency. Considering the number of publications, China, the USA, and European countries rank highest. The factors determining the rankings are the number of publications and the impact values created by these publications through citations. Countries with high publication frequency have also seen a parallel increase in international publication relations. This demonstrates that AI in banking has both an interdisciplinary and intradisciplinary collaborative research atmosphere.

The study revealed that the research examined both the technical data and the quantitative data of AI as predictive analysis. These studies also demonstrate that they examine dimensions such as ethical implications, digital transformation, and transparency. Based on these findings, the study analyzes past approaches to AI in banking research and examines its evolutionary development to the present day. In this context, it provides a resource that will guide future research.

REFERENCES

Akalın, B., & Veranyurt, Ü. (2020). Sağlık Hizmetleri ve Yönetiminde Yapay Zekâ. *Acta Infologica*, 5(1), 5-6.

Akbaba, A. İ., & Gündoğdu, Ç. (2021). Bankacılık Hizmetlerinde Yapay Zekâ Kullanımı. *Journal of Academic Value Studies*, 7(3), 298-315.

Akgün, A. (2023). Otel Faaliyetleri İçin Yapay Zekâ Destekli Uygulamalar. *Selçuk Turizm ve Bilişim Araştırmaları Dergisi*, (3), 1-21.

Artar, O., & Türkay, U. İ. (2021). Havacılık Sektöründe Havalimanlarının Dijital Dönüşümü. *Working Paper Series*, 2(1), 86-97.

Artık, K., Yiğit, A., & Şahin, M. (2025). İnşaat Mühendisliğinde Makine Öğrenmesi Üzerine Bibliyometrik Analiz: Web of Science Tabanlı Bir İnceleme. *Bibliyometrik Analiz I* (pp. 77–98). Akademisyen Kitabevi.

Aksoy, A. D., & Aykaç, B. (2024). Bankacılıkta Dijital Pazarlama Çalışmalarının Bibliyometrik Profili. *Journal of Academic Social Science Studies*, *17*(101).

Arslan, Z., & Atay, Ö. (2025). Türkiye'de Ulaştırma Sektöründe Kamu İşletmelerinde Yapay Zekâ Uygulamaları. *Kastamonu İnsan ve Toplum Dergisi*, 3(5), 1-16.

Artık, M. B., & Kula, V. (2025). İşletmelerin Dijitalleşmeye Yönelik Yatırımlarını Etkileyen Faktörlerin Gri İlişkisel Analiz Yöntemiyle Değerlendirilmesi. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi*, 27(3), 1052-1070.

Aria, M., & Cuccurullo, C. (2017*). Bibliometrix: An R-Tool For Comprehensive Science Mapping Analysis. Journal of Informetrics*, 11(4), 959–975.

Bahoo, S., Cucculelli, M., Goga, X., & Mondolo, J. (2024). Artificial intelligence in Finance: a comprehensive review through bibliometric and content analysis. *SN Business & Economics*, 4(2), 23.

Balstad, M. T., & Berg, T. (2020). A Long-Term Bibliometric Analysis Of Journals İnfluencing Management Accounting And Control Research. *Journal of Management Control*, *30*(4), 357-380.

Başer, M. Y., & Olcay, A. (2022). Akıllı Turizmde Yapay Zekâ Teknolojisi. *Gaziantep University Journal of Social Sciences*, 21(3), 1795-1817.

Cengiz, E. K., & Oduncu, F. (2023). Fintek Kavramı ile İlgili Yapılan Uluslararası Çalışmaların Bibliyometrik Analizi. *Topkapı Sosyal Bilimler Dergisi*, *2*(2), 75-92.

Çelik, S. B., & Mangır, F. (2020). Bankacılık Sektörünün Dijitalleşmesi: Dünyada ve Türkiye›de Durum Analizi. *Cyberpolitik Journal*, 5(10), 260-282.

Ceran, M. (2019). Bankacılıkta dijitalleşme kapsamında öğrenen yapay zekâ desteğiyle sorunlu kredilerin belirlenmesi (Yayımlanmamış doktora tezi). Marmara Üniversitesi.

Çilhoroz, Y., & Işık, O. (2021). Yapay zekâ: Sağlık hizmetlerinden uygulamalar. *Ankara Hacı Bayram Veli Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *23*(2), 573-588.

Demirel, E., & Yaralı, C. (2023). İmalat İşletmelerinin Dijitalleşme Süreçleri Üzerine Nitel Bir Çalışma. *Yönetim ve Ekonomi Dergisi*, 21-41.

Demirkol, F. (2020). Ulusal Güvenlikte Yapay Zekâ Kullanımı: ABD ve Çin Örnekleri. *İstanbul Gelişim Üniversitesi Sosyal Bilimler Dergisi*, 7(2), 421-423.

Dhanabalan, T., Subha, K., Shanthi, R. & Sathish, A. (2018). Factors İnfluencing Consumers' Car Purchasing Decision İn Indian Automobile İndustry. *International Journal of Mechanical Engineering and Technology*, 9(10), 53-63.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to Conduct A Bibliometric Analysis: An Overview and Guidelines. *Journal of business research*, *133*, 285-296.

Dülgaroğlu, O. (2024). Turizmde Teknolojileri ve Robotlaşma Yapay Zekâ: Oğuzhan DÜLGAROĞLU. *Uluslararası Turizm, Ekonomi ve İşletme Bilimleri Dergisi* (IJTEBS) E-ISSN: 2602-4411, 8(2), 82-95.

Ekinci, G. (2022). Dijital Teknolojiler, Yapay Zekâ, Girişimcilik ve İnovasyon Yayınları Bibliyometrik Analizi. *Yüzüncü Yıl Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, (55), 163-188.

Ercan, F. (2020). Turizm Pazarlamasında Yapay Zekâ Teknolojilerinin Kullanımı Ve Uygulama Örnekleri. *Ankara Hacı Bayram Veli Üniversitesi Turizm Fakültesi Dergisi*, 23(2), 394-410.

Ever, D., & Demircioğlu, E. N. (2022). Yapay Zekâ Teknolojilerinin Kalite Maliyetleri Üzerine Etkisi. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 31(1), 59-72.

Gedik, Y. (2025). Finans Sektöründe Yapay Zekâ Avantajları, Zorlukları Ve Stratejileri Üzerine Kavramsal Bir Değerlendirme. *Journal of Economics and Research*, 6(1), 59-78.

Güçlüay, S. (2001). Orta Çağda Ticari Müesseseler (Bankalar, Birlikler, Şirketler). *Fırat Üniversitesi Sosyal Bilimler Dergisi*, 11(2), 295-304.

Gümüş, E., Medetoğlu, B., & Tutar, S. (2020). Finans ve Bankacılık Sisteminde Yapay Zekâ Kullanımı: Kullanıcılar Üzerine Bir Uygulama. *Bucak İşletme Fakültesi Dergisi*, 3(1), 28-53.

İşcan, H. & Dursun Kaygısız A. (2024). Yapay Zekâ: Alt Dalları ve Uygulama Alanları. *Aksaray Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 16(4), 201-23

Karakuş, C., & Katman, F. (2019). Male Sınıfı İnsansız Hava Aracı (İha) Teknolojisi ve Konvansiyonel (Geleneksel) Savaştaki Yeri. *Akademik Tarih ve Düşünce Dergisi*, 6(2), 882-897.

Kapusuz, Y. E. (2025). Gayrimenkul Pazarlama Faaliyetlerinin ve Yapay Zeka Uygulamalarının Değerlendirmesi. *İstanbul Ticaret Üniversitesi Teknoloji ve Uygulamalı Bilimler Dergisi*, *8*(1), 185-200.

Karaboğa, T., & Karaboğa, H. A. (2021). Covid-19 Pandemisinin İşletmelerin Dijital Dönüşümüne Etkisinin Bibliyometrik Bir İncelemesi. *Ekonomi İşletme Ve Maliye Araştırmaları Dergisi*, *3*(2), 100-114.

Kazu, İ. Y., & Özdemir, O. (2009). Öğrencilerin Bireysel Özelliklerinin Yapay Zekâ İie Belirlenmesi (Bulanık Mantık Örneği). *Akademik Bilişim*, 11-13.4

Khan, A., Goodell, J. W., Hassan, M. K., & Paltrinieri, A. (2022). A bibliometric review of finance bibliometric papers. *Finance Research Letters*, *47*, 102520.

Kırbaşlı, M., & Hüseyin, A. (2025). Mevduat Sigortacılığı Kavramının Bibliyometrik Analizi. *Financial Analysis/Mali Cozum Dergisi*, *35*(192).

Konak, F., & Demir, Y. (2023). İslami Sigortacılık (Tekafül) Üzerine Bibliyometrik Bir Analiz. *Hitit İlahiyat Dergisi*, *22*(1), 11-46.

Korkmaz, Ö. F., & Korkmaz, S. S. (2025). Bankacılıkta Siber Güvenlik Üzerine Bibliyometrik Analiz. *Fiscaoeconomia*, *9*(2), 1112-1127.

Kurçer, D., & Civelek, M. (2023). Yapay Zekâ ve Turizm: Akıllı Sistemler. Editör) Dalgın, T. ve Civelek, M.: *Yapay Zekâ Kapsamında Turizm İşletmelerinde Akıllı Sistemler*, 191-208.

Kurutkan, M. N., & Terzi, M. (2022). Sağlık Hizmetlerinde Dış Kaynak Kullanımının Bibliyometrik Analizi. *Sağlık Bilimlerinde Değer*, *12*(3), 417-431.

Özcan, H. Z., (2025). Scopus Veritabanında Yapay Zekâ ve Eğitim: Bibliyometrik Bir Analiz. *Bibliyometrik Analiz I,* pp. 99–118. Akademisyen Kitabevi.

Özbek, A. (2025). Finansal Okuryazarlık Temelinin Oluşturulmasında Finansal Sosyalizasyon: Bibliometrik ve Sistematik Bir Analiz. *Bibliyometrik Analiz II* (pp. 135–152). Akademisyen Kitabevi.

Özüdoğru, H., & Sönmez, S. S. (2021). Yapay Zekâ ve Makine Öğreniminin Sigorta Sektörüne Etkisi. *Bankacılık ve Finansal Araştırmalar Dergisi*, *11*(1), 45-53.

Ünal, A., & Kılınç, İ. (2020). Yapay Zekâ İşletme Yönetimi İlişkisi Üzerine Bir Değerlendirme. *Yönetim Bilişim Sistemleri Dergisi*, 6(1), 51-78.

Malali, A. B. & Gopalakrishnan, S. (2020). Application of Artificial İntelligence And İts Powered Technologies İn The İndian Banking And Financial İndustry: An Overview. *IOSR Journal Of Humanities And Social Science*, 25(4), 55-60.

Sarı, S. (2024). Bankacılıkta Yapay Zeka Uygulamaları. *JOEEP: Journal of Emerging Economies and Policy*, 9(Special Issue), 246-263.

Singh, A. K., Sathvik, S. C., Krishnaraj, L., Irfan, M., Kumar, V. R. P., & Işik, C. (2023). Assessing Thermo-Physical Products' Efficiency in The Building and Construction İndustry: A Bibliometric Analysis Approach. *Environmental Science and Pollution Research*, *30*(7), 16867-16877.

Şeker, E. (2020). Yapay Zekâ Tekniklerinin/Uygulamalarının Siber Savunmada Kullanımı. *Uluslararası Bilgi Güvenliği Mühendisliği Dergisi*, 6(2), 108-115.

Van Eck, N. & Waltman, L. (2010). Software Survey: Vosviewer, a Computer Program for Bibliometricmapping. Scientometrics, 84, 523–538.

Zang, Y., Zhang, F., Di, C. A., & Zhu, D. (2015). Advances of Flexible Pressure Sensors Toward Artificial İntelligence and Health Care Applications. *Materials Horizons*, 2(2), 140-156.

Zeng, R., & Chini, A. (2017). A Review Of Research On Embodied Energy of Buildings Using Bibliometric Analysis. *Energy and Buildings*, *155*, 172-184.

Chapter 8

A BIBLIOMETRIC ANALYSIS OF HEALTH TOURISM LITERATURE: ECONOMIC IMPACTS AND POLICY IMPLICATIONS

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INTRODUCTION

Medical tourism is the practice of individuals traveling to tourist facilities outside their own countries to receive healthcare services, improve or maintain their health, and meet their accommodation, nutrition, and entertainment needs. This mobility encompasses both travel purposes and medical interventions. It also includes supportive health services such as well-being, spa treatments, stress reduction, and rehabilitation. In this context, it is clear that individuals consider not only doctors or prices in their own countries but also the best solutions and best price options when seeking solutions to their health problems. Therefore, all mobility arising from intercity or international travel for treatment and vacation purposes is called "medical tourism" (Aydın, 2012). At the same time, medical tourism is a sector that enables the growth of healthcare services by benefiting from international "health-related" mobility. Here, individuals travel abroad to access healthcare services. In a globalized world, increased cooperation between countries, greater freedom and opportunities for travel, improved transportation, and enhanced quality of healthcare services are making it possible to achieve improvements in different parts of the world (Tontus, 2019).

Thus, the concept of health tourism, which can be explained within the context of health economics, becomes clearer. Because from the perspective of health economics, health tourism is defined as a multi-dimensional economic activity that directly affects not only the healthcare sector but also the tourism, transportation, accommodation, and service sectors. In this context, health

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CONCLUSION

In conclusion, health tourism continues to be an important strategic area in terms of both economic and policy dimensions. Bibliometric analysis findings show that this field is being studied with increasing interest in the literature, and that research is concentrated around specific authors, countries, and sources. Examining the most cited studies reveals the economic contributions of health tourism, such as generating foreign exchange, supporting regional development, optimizing the capacity utilization of health systems, and encouraging infrastructure investments. In terms of policy recommendations, it emphasizes the need for developing national strategies, implementing financial incentives, ensuring the provision of services at international standards, and adopting sustainable tourism practices. This study goes beyond classical bibliometric analyses by thoroughly examining the most influential studies in the literature and offering concrete conclusions about the economic and policy impacts of health tourism. The findings provide a roadmap for academic research and shed light on strategic decision-making processes for policymakers and sectoral investors.

REFERENCES

Alfasoft. (n.d.). *Exploring bibliometric methods: Citation analysis in research*. Alfasoft. https://alfasoft.com/blog/products/scientific-writing-and-publishing/exploring-bibliometric-methods-citation-analysis-in-research/?utm_source=

Aydın, Ö. (2012). Türkiye'de Alternatif Bir Turizm; Sağlık Turizmi. *KMÜ Sosyal ve Ekonomik Araştırmalar Dergisi,* 14 (23), 91-96.

Bayram, H. S. & Akkülah, A. U. (2020). *Kayseri sağlık turizminin geliştirilmesi mevcut durum analizi ve 2021–2030 eylem planı* (Haziran 2020). Orta Anadolu Kalkınma Ajansı.

Dirik, D., Eryılmaz, İ. & Erhan, T. (2023). Post-truth kavramı üzerine yapılan çalışmaların VOSviewer ile bibliyometrik analizi. *Sosyal Mucit Academic Review, 4*(2), 164–188. https://doi.org/10.54733/smar.1271369

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N. & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research,* 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Karakoç, S. (2017). Küresel dünyada sağlık turizminin önemi ve Türkiye'nin durumu. Nuh Naci Yazgan Üniversitesi, Yüksek Lisans Tezi, Kayseri.

McGroarty, B. (2024, March 25). *A decade of wellness tourism: First-ever compilation of 10+ years of market data*. Global Wellness Institute.

Özkurt, H. (2007). Sağlık Turizmi Tahvilleri. Maliye Dergisi, 152, 121-142.

Passas, I. (2024). *Bibliometric analysis: The main steps*. *Encyclopedia*, *4*(2), 1014–1025. https://doi.org/10.3390/encyclopedia4020065

Tontuş, H. Ö. (2019). *Sağlık turizmi nedir* (Tüm Yönleriyle Sağlık Turizmi, s. 38). SATURK.

Wisdom Library. (2025, December 20). *Significance of co-authorship analysis*. Wisdom Library. https://www.wisdomlib.org/concept/co-authorship-analysis?utm_source=