

Artificial Intelligence (AI) Architecture for Integrated Smart Digital Banking System

Bambang Sugiharto^{1*}, Harkim², Rejekia V Simanungkalit², Ilhamsyah Siregar³, Maya Andriani³

¹ Management Study Program, Universitas Pembinaan Masyarakat Indonesia, Medan, Indonesia.

² Management Study Program, Sekolah Tinggi Ilmu Ekonomi Profesional Indonesia Medan (STEKPI), Medan, Indonesia.

³ Accounting Study Program, Sekolah Tinggi Ilmu Ekonomi Profesional Indonesia, Medan, Indonesia.

Received: July 12, 2023

Revised: August 13, 2023

Accepted: October 25, 2023

Published: October 31, 2023

Corresponding Author:

Bambang Sugiharto

bsugiharto@upmi.ac.id

DOI: [10.29303/jppipa.v9i10.4645](https://doi.org/10.29303/jppipa.v9i10.4645)

©2023 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: Using artificial intelligence, physicists have condensed a daunting quantum problem that until recently required 100,000 equations into a task of as few as four equations - all without sacrificing accuracy. Artificial intelligence is becoming the most current achievement of the computing world. The human brain is to some extent represented and spliced with the ability to solve problems. The purpose of this study is to describe in detail how the power of artificial intelligence with its complex system can help the needs of digital technology in the banking sector. The research method used is the elaboration of great thoughts and facts about artificial intelligence. Scientific data is interpreted with analytical power that is as precise as possible, so as to produce a description that meets the logic of structured thinking. The data is taken from relevant and up-to-date literature, the work of scientists who have been disseminated in various weighty scientific publications at the world level. The results of the study found how artificial intelligence has folded the complexity of the problem into a simple solution. Artificial intelligence in the banking world becomes an instrument that integrates consumers, smartphones, databases, security systems, financial services authorities, agencies, law enforcement officers, and various derivative digital systems.

Keywords: Artificial; Banking; Integrated; Intelligence; Smart System

Introduction

Artificial Intelligence (AI) techniques are being increasingly deployed in finance, in areas such as asset management, algorithmic trading, credit underwriting or blockchain-based finance, enabled by the abundance of available data and by affordable computing capacity (Benlala, 2022). Machine learning (ML) models use big data to learn and improve predictability and performance automatically through experience and data without being program to do so by humans (O.E.C.D., 2021).

Since AI can help business leaders automate time-consuming and labor-intensive operations, and it enables businesses to offer innovative services to customers, the application of AI in the fields of finance has attracted much attention and interest. Millar, et al said that a combination of technological innovations,

including AI, is changing business as it responds to volatility, uncertainty, complexity and ambiguity in the financial sector, which has been popularized in the literature as a VUCA world (Ashta & Herrmann, 2021).

Financial technology (FinTech) has been playing an increasingly critical role in driving modern economies, society, technology, and many other areas. Smart FinTech is the new-generation FinTech, largely inspired and empowered by data science and artificial intelligence (DSAI) techniques (Katib et al., 2023). Smart FinTech synthesizes broad DSAI and transforms finance and economies to drive intelligent, automated, whole-of-business and personalized economic and financial businesses, services and systems (Cao et al., 2021).

More fundamentally, artificial intelligence can be understood as cognitive abilities associated with learning, adapting, responding to the environment, and managing a variety of complex human-made

How to Cite:

Sugiharto, B., Harkim, Simanungkalit, R. V., Siregar, I., & Andriani, M. (2023). Artificial Intelligence (AI) Architecture for Integrated Smart Digital Banking System. *Jurnal Penelitian Pendidikan IPA*, 9(10), 876-882. <https://doi.org/10.29303/jppipa.v9i10.4645>

relationships. Intelligence, in this case, can only be ascribed to humans because as a cognitive ability, intelligence measurement tools cannot be used on non-human entities, such as animals and plants, or even the universe (Korteling et al., 2021). Therefore, the opposite of artificial intelligence is "human intelligence", not "natural intelligence". Humans create AI based on the model of human intelligence; in other words, it is an imitation of human intelligence (Nirwana, 2023).

Artificial Intelligence find its applications in different context in to-day's business scenario. Practitioners and academicians believe that Artificial Intelligence is the future of our society (Aggarwal et al., 2021). With the advancement of technology, the world has become a web of interconnected networks. The technology implementation leadto investment in Artificial Intelligence (AI) for big data analytics to generate market intelligence. Artificial Intelligence applications are not limited to only marketing; rather, it is widely used in other sectors such as medical, e-commerce business, education, law, and manufacturing (Verma et al., 2021).

One of the prominent uses of AI for business is the complex systems in banking with various interactions between entities. With the instances above, it's clear that AI is paying off for brands and intelligent marketers by allowing them to create better, more relevant, and tailored dialogues and experiences (Tiago & Verissimo, 2014). According to the Interactive Advertising Bureau (IAB), marketers will continue to use AI in the coming decade to improve their performance, personalize their marketing, make their advertising more creative, target their customers more precisely, and fine-tune their media mix. Overall, marketers must incorporate industry standards in this technology and, eventually, assure the ethical usage of AI to achieve customer trust (Sığırıcı, 2021).

Industry 4.0, also known as the fourth industrial revolution, can be described as the advent of cyber-physical systems involving entirely new capabilities for people and machines (Mhlanga, 2020). At present, automation and AI are changing the nature of work in the industry. Technology has an impact on various aspects, including the economy, business and society (Caruso, 2018). At the same time, technology also has an impact on changes in the demand for future workforce skills and how work is organized within the company, as more people interact with machines in the workplace (Santoso et al., 2020).

Method

The Systematic Literature Review (SLR) method was used to answer this research question. SLR is the

process of compiling, evaluating, and synthesizing all relevant research related to a particular topic, in this case digital visual marketing (Van Dinter et al., 2021) The purpose of SLR is to provide a comprehensive overview of digital visual marketing research and identify gaps that require further research (Xiao & Watson, 2019).

The next step was to assess quality by reviewing the full-text papers and selecting a few articles that were directly related to the topic of using AI in digital marketing. From the articles selected as directly related to the study of AI and digital marketing, content reading was conducted to find themes related to the application of AI in planning, marketing conceptualization, design, implementation and monitoring, and evaluation in digital marketing. Let's see how data is extracted from scientific articles (Nirwana, 2023).

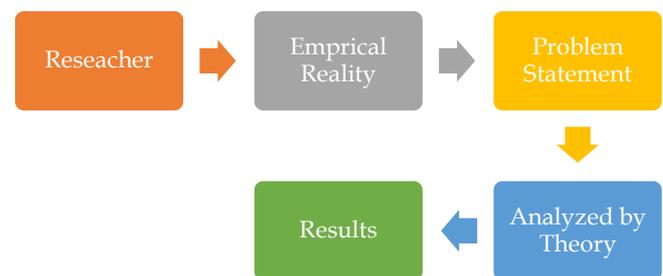


Figure 1. Logic Flow of Research Conduct

The logical flow of this research begins with the researcher's five senses capturing a current phenomenon in connection with the increasingly sophisticated digital equipment, namely artificial intelligence. It then becomes an inseparable part of human life which is also increasingly complex. Of all the joints of life, business becomes sexy when it is inevitable from the uproar of modern human life. Artificial intelligence fulfills its destiny to become a business instrument, which in the discourse of this study is the marketing of various products, both from the government and from the business world, from micro to multinational scale (Umamaheswari et al., 2023). The financial supervision department further clarifies the supervision responsibility, applies artificial intelligence technology to supervision methods and means, and improves the degree of supervision automation and intelligence (Hu, 2020).

Result and Discussion

Artificial Intelligence: The inevitability of the Modern Occult

For now, economic integration and cohesion cannot be avoided and AI contributed in this reality. In this case, something to be prominent is the occurrence of a single market and production base. At least, in that context, there is a movements (outflow-incoming) of materials

and services are guaranteed for freedom (Setiawan, 2016). With above condition, artificial intelligence and learning machines (AI/ML) and big data affect certain financial sector areas that have introduced such technologies early on and how these innovative mechanisms are transforming their business models (Mishra & Tyagi, 2022). Discussing the benefits and associated risks from the deployment of such technologies in finance, can provides an update on regulatory activity and approaches of regulators vis-à-vis AI and ML in financial services in some markets, as well as information on open debates by IOs and other policy makers. Identify areas that remain concerning and merit further discussion by the Committee and its Experts Group; and provides preliminary policy considerations around these areas (O.E.C.D., 2021).

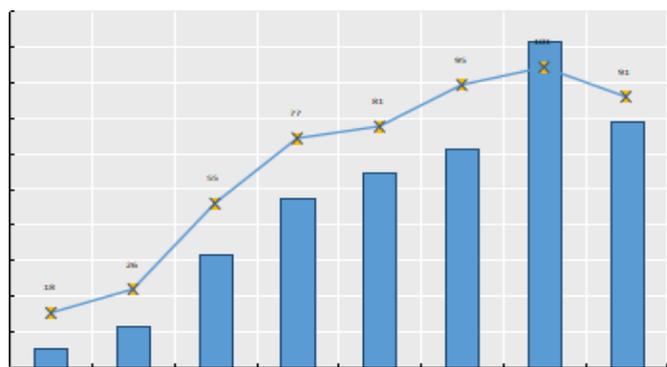


Figure 2. Growth in AI-related research and investment in AI start-ups

Growth in the deployment of AI applications is evidenced by increased global spending on AI in the private sector, coupled with increased research activity on this technology (Soni et al., 2020). Global spending on AI is forecast to double over the next four years, growing from \$50.1 billion in 2020 to more than \$110 billion in 2024. According to IDC forecasts, spending on AI systems will accelerate over the next several years at an expected CAGR of c.20% for the period 2019-24, as organizations deploy AI as part of their digital transformation efforts and to remain competitive in the digital economy. Private equity investment in AI start-ups doubled in 2017 on a year-to-year basis and attracted 12% of worldwide private equity investments in H1 2018 (O.E.C.D., 2021). At the same time, growth in AI-related research is far greater than growth of computer science or overall research publications, providing further evidence of increasing interest around this innovative technolog.

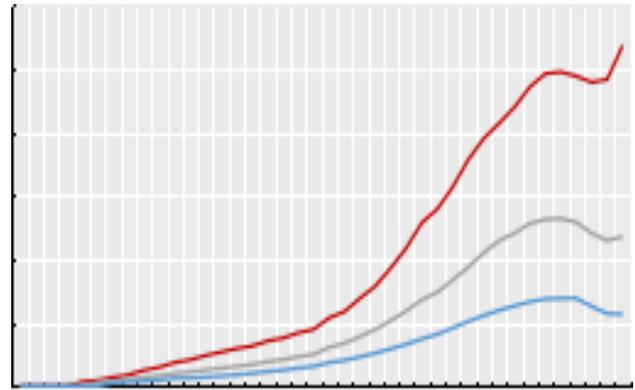


Figure 3. Funding of cyber start-ups that use AI as the core product differentiator.

The figure 4 shows various activities/types of artificial intelligence-based computing. Where in the context of this study artificial intelligence is used in global scale economic practices that require simultaneity, real time, speed, precision level, data security, transaction security in today's global economic association.

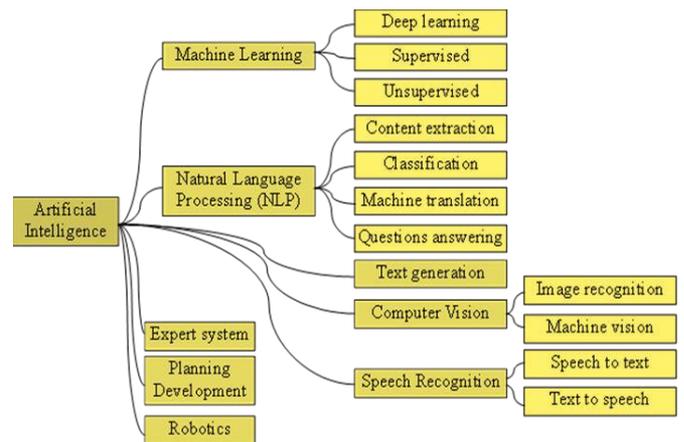


Figure 4. Types of classifier in artificial intelligence. Source : Askarifard, H. (2015).

An AI system, as explained by the OECD's AI Experts Group (AIGO), is a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments (Lane & Williams, 2023). It uses machine and/or human-based inputs to perceive real and/or virtual environments; abstract such perceptions into models (in an automated manner e.g. with ML or manually); and use model inference to formulate options for information or action. AI systems are designed to operate with varying levels of autonomy (O.E.C.D., 2021).

The instinctive reaction to such a long list of complex issues with AI applications in the financial sector could be that of restricting these applications to a per-se fragile environment such as the financial sector.

The study explains that this attitude is wrong provided that the issues are properly understood and well addressed. Since the financial sector is heavily regulated, and for good reasons, the study discusses how AI interacts with existing regulations and how AI-specific, “horizontal” regulations could impact the financial sector (Hoffmann-Riem, 2020).

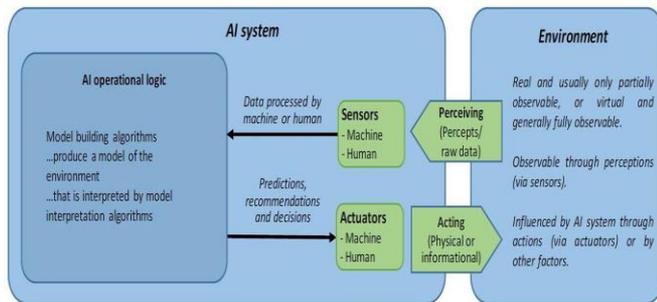


Figure 5. As defined and approved by the OECD AI Experts Group (AIGO) in February 2019

The AI system lifecycle phases are; planning and design, data collection and processing, and model building and interpretation; verification and validation; deployment; and operation and monitoring (De Silva & Alahakoon, 2022). An AI research taxonomy distinguishes AI applications (e.g. NLP); techniques to teach AI systems (e.g. neural networks); optimisation (e.g. one-shot-learning); & research addressing societal considerations (O.E.C.D., 2021).

The study provides specific recommendations that could put in place to fully harness the benefits of AI in the financial sectors while keeping its challenges under control. These recommendations pertain to AI regulations and their impact on the financial sector, together with specific recommendations for financial institutions adopting AI solutions and recommendation about managing risk in financial markets. Recognising that regulators will profoundly influence the adoption of AI in financial markets and its applications, the study proposes some recommendations to support the transformation offered by AI, avoiding stifling its innovations.

The deployment of AI in finance is expected to increasingly drive competitive advantages for financial firms, by improving their efficiency through cost reduction and productivity enhancement, as well as by enhancing the quality of services and products offered to consumers. In turn, these competitive advantages can benefit financial consumers by providing increased quality and personalised products, unlocking insights from data to inform investment strategies and potentially enhancing financial inclusion by allowing for the analysis of creditworthiness of clients with limited credit history (e.g. thin file SMEs) (Dominic et al., 2010).

At the same time, AI applications in finance may create or intensify financial and non-financial risks, and give rise to potential financial consumer and investor protection considerations (e.g. as risks of biased, unfair or discriminatory consumer results, or data management and usage concerns). The lack of explainability of AI model processes could give rise to potential pro-cyclicality and systemic risk in the markets, and could create possible incompatibilities with existing financial supervision and internal governance frameworks, possibly challenging the technology-neutral approach to policymaking (Locatelli et al., 2022). While many of the potential risks associated with AI in finance are not unique to this innovation, the use of such techniques could amplify these vulnerabilities given the extent of complexity of the techniques employed, their dynamic adaptability and their level of autonomy (O.E.C.D., 2021).

Towards an Artificial Intelligence-Based Smart Marketing System

Artificial Intelligence has made leaps and bounds since a long time ago, and it already shapes the future of marketing. It’s up to you to implement this technology in your business. But one thing for sure is that AI is the future. If you plan on running a successful online business in the coming years, using AI-powered marketing and tools is a must (O.E.C.D., 2021). Building on insights from marketing (and more generally business), social sciences (e.g., psychology, sociology), and computer science/robotics, we propose a framework to help customers and firms anticipate how AI is likely to evolve. We consider three AI-related dimensions: levels of intelligence, task type, and whether the AI is embedded in a robot (Davenport et al., 2020).

There’s no better time for marketers to begin testing how Artificial Intelligence strategies can help create highly personalized experiences for their consumers. With AI poised to continue growing across all industries and segments, marketers should dedicate time and resources to experiment with strategies and ensure their marketing organization is set up for continued success, both now and in the future (O.E.C.D., 2021).

The AI-based applications have a promising future and they will create a very positive impact on marketing in terms of efficiency, customer satisfaction, speed, problem-solving and decision making. This in turn will enhance brand loyalty and generate hefty revenues for businesses (Kumari, 2021).

There is a fashion element to discussions about AI, particularly in marketing, where the boundary between advanced analytics and AI is definitely fuzzy. Analytics has evolved to where it can handle problems which are

relatively unstructured and come up with suggestions in a way that would once have been considered “expert” and even defined as AI. One essential characteristic of AI that distinguishes it from classic “advanced analytics” is automation of feedback loops and improvement i.e. learning by the system (machine learning) about how to do things better, and this in turn implies that conclusions are being tested and assessed against certain criteria, as opposed to being reviewed by humans who then make decisions about what to do next. It is no exaggeration to say that there will be no days when you do not see AI and Fin-tech articles in the economic reports in newspapers. This is exactly the AI/Fintech boom. However, this boom seems not a temporary one this time (Kato, 2020).

Where the action being “managed” by AI is precise and contained, implemented quickly and with the results also being measurable and assessable quickly, AI is generally very productive. But where decisions are more wide-ranging, take time to implement and time elapses before the results of the decisions are apparent, let alone measurable and assessable, deployment of AI can be more complicated. It may be hybrid, with parts of the cycle being undertaken by AI, part by human decision-makers. The latter applies to marketing strategy. However, one technique which may be usable to improve applicability is back-casting, in which decisions taken earlier and of which the results are now known are used along with data from the period of analysis to train the system. This approach can also be used to capture the “historic expertise” of strategic marketers, by rule elicitation or case-based reasoning.

AI is able to more quickly analyze results and patterns in data searches from potential consumers. This pattern is very important for marketing to know because it can be used to identify the most appropriate areas that are an important focus for marketing products to certain target markets (Fatimah & Saidah, 2021).

Conclusion

Artificial intelligence or AI is very useful and provides many advantages for humans in various aspects of human life in various aspects of life. In promotional strategies, artificial intelligence or AI can process large amounts of data in the shortest possible time, so that a job can be completed faster without errors. Artificial intelligence has the ability to learn much faster and can present the data needed in large quantities. Advantages of AI in marketing: (1) Artificial intelligence is able to find new channels in marketing that may not be used by other competitors, (2) Able to predict buying patterns using predictive analytics, which is able to

display large amounts of data that can be used in predicting future sales.

Acknowledgments

The author would like to thank the parties who have played a role in this research activity, so that this research can be carried out well. Thank you to the informants, and the other persons for giving permission to researchers to complete this academic task.

Author Contributions

In this study, all researchers contributed actively with the tasks that were carried out together. In other words, this research was supported by equal distribution of roles and contributions of all authors, because each stage was always discussed together.

Funding

This research is an empirical research funded by the researchers themselves or independent research. So on this happy occasion, I as the first author express my highest appreciation and gratitude to my colleagues who are members of this research team for their financial participation.

Conflicts of Interest

In this research, there is no tug of interest and or hidden interests among the researchers. In addition, this research is also not an order from any funder because it is an independent research, or in other words, the research team itself plays a role in preparing proposals, selecting topics, conceptualizing problems, collecting data, analyzing problems, drawing conclusions until the publication stage in this journal.

References

- Aggarwal, A., Mittal, M., & Battineni, G. (2021). Generative adversarial network: An overview of theory and applications. *International Journal of Information Management Data Insights*, 1(1). <https://doi.org/10.1016/j.jjime.2020.100004>
- Ashta, A., & Herrmann, H. (2021). Artificial intelligence and fintech: An overview of opportunities and risks for banking, investments, and microfinance. *Strategic Change*, 30(3), 211-222. <https://doi.org/10.1002/jsc.2404>
- Benlala, M. A. (2022). Artificial intelligence in the modern banking and financial industry (Applications, Risks, Policies and Regulations). *Industrial Economics Journal –Khezartech*, 12(2), 49-66. <http://dspace.univ-batna.dz/xmlui/handle/123456789/3975>
- Cao, L., Yang, Q., & Yu, P. S. (2021). Data science and AI in FinTech: an overview. *International Journal of Data Science and Analytics*, 12(2), 81-99. <https://doi.org/10.1007/s41060-021-00278-w>
- Caruso, L. (2018). Digital innovation and the fourth industrial revolution: epochal social changes? *AI &*

- Society*, 33(3), 379–392. <https://doi.org/10.1007/s00146-017-0736-1>
- Davenport, T., Guha, A., Grewal, D., & Bressgott, T. (2020). How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science*, 48(1), 24–42. <https://doi.org/10.1007/s11747-019-00696-0>
- De Silva, D., & Alahakoon, D. (2022). An artificial intelligence life cycle: From conception to production. *Patterns*, 3(6). <https://doi.org/10.1016/j.patter.2022.100489>
- Dominic, P. D. D., Goh, K. N., Wong, D., & Chen, Y. Y. (2010). The importance of service quality for competitive advantage--with special reference to industrial product. *International Journal of Business Information Systems*, 6(3), 378–397. <https://doi.org/10.1504/IJBIS.2010.035051>
- Fatihah, D. C., & Saidah, I. S. (2021). Model Promosi Marketplace Berbasis Artificial Intelligence (AI) di Indonesia. *JMBI UNSRAT (Jurnal Ilmiah Manajemen Bisnis Dan Inovasi Universitas Sam Ratulangi)*, 8(3), 806–817. <https://doi.org/10.35794/jmbi.v8i3.35908>
- Hoffmann-Riem, W. (2020). Artificial intelligence as a challenge for law and regulation. *Regulating Artificial Intelligence*, 1–29. https://doi.org/10.1007/978-3-030-32361-5_1
- Hu, Z. (2020). Research on fintech methods based on artificial intelligence. *Journal of Physics: Conference Series*, 1684(1). <https://doi.org/10.1088/1742-6596/1684/1/012034>
- Katib, I., Assiri, F. Y., Althaqafi, T., AlKubaisy, Z. M., Hamed, D., & Ragab, M. (2023). Hybrid Hunter-Prey Optimization with Deep Learning-Based Fintech for Predicting Financial Crises in the Economy and Society. *Electronics*, 12(16), 3429. <https://doi.org/10.3390/electronics12163429>
- Kato, Y. (2020). AI/Fintech and Asset Management Businesses. *Public Policy Review*, 16(4), 1–28.
- Korteling, J. E. (Hans), van de Boer-Visschedijk, G. C., Blankendaal, R. A. M., Boonekamp, R. C., & Eikelboom, A. R. (2021). Human-versus artificial intelligence. *Frontiers in Artificial Intelligence*, 4, 622364. <https://doi.org/10.3389/frai.2021.622364>
- Kumari, P. (2021). *Role of Artificial Intelligence (AI) in Marketing*. IEEE Women In Engineering, VII.
- Lane, M., & Williams, M. (2023). Defining and classifying AI in the workplace. *OECD Social, Employment and Migration Working Papers*, 20. <https://doi.org/10.1787/59e89d7f-en>
- Locatelli, R., Pepe, G., & Salis, F. (2022). The Validation of AI Techniques. In *Artificial Intelligence and Credit Risk: The Use of Alternative Data and Methods in Internal Credit Rating*, 65–79. https://doi.org/10.1007/978-3-031-10236-3_4
- Mhlanga, D. (2020). Industry 4.0 in finance: the impact of artificial intelligence (ai) on digital financial inclusion. *International Journal of Financial Studies*, 8(3), 1–14. <https://doi.org/10.3390/ijfs8030045>
- Mishra, S., & Tyagi, A. K. (2022). The role of machine learning techniques in internet of things-based cloud applications. *Artificial Intelligence-Based Internet of Things Systems*, 105–135. https://doi.org/10.1007/978-3-030-87059-1_4
- Nirwana, A. (2023). Implementation of Artificial Intelligence in Digital Marketing Development : a Thematic Review and Practical Exploration. *Jurnal Manajemen Bisnis, Akuntansi dan Keuangan*, 2(1), 85–112. <https://doi.org/10.55927/jambak.v2i1.4034>
- O.E.C.D. (2021). *Artificial Intelligence, Machine Learning and Big Data in Finance: Opportunities, Challenges, and Implications for Policy Makers*. In OECD Business and Finance Outlook 2020 : Sustainable and Resilient Finance. Retrieved from <https://www.oecd.org/finance/financial-markets/Artificial-intelligence-machine-learning-big-data-in-finance.pdf>
- Santoso, W., Sitorus, P. M., Batunanggar, S., Krisanti, F. T., Anggadwita, G., & Alamsyah, A. (2020). Talent mapping: a strategic approach toward digitalization initiatives in the banking and financial technology (FinTech) industry in Indonesia. *Journal of Science and Technology Policy Management*, 12(3), 399–420. <https://doi.org/10.1108/JSTPM-04-2020-0075>
- Setiawan, T. (2016). Indonesia and the Asean Economic Community: a Tussle Between Human and Culture in the Regional Materialism Sublimation. *Addin*, 10(2), 283. <https://doi.org/10.21043/addin.v10i2.1185>
- Sığırıcı, Ö. (2021). *Artificial Intelligence in Marketing: A Review of Consumer-AI Interactions*. Handbook of Research on Applied Data Science and Artificial Intelligence in Business and Industry, 342–365. <https://doi.org/10.4018/978-1-7998-6985-6.ch016>
- Soni, N., Sharma, E. K., Singh, N., & Kapoor, A. (2020). Artificial intelligence in business: from research and innovation to market deployment. *Procedia Computer Science*, 167, 2200–2210. <https://doi.org/10.1016/j.procs.2020.03.272>
- Tiago, M. T. P. M. B., & Veríssimo, J. M. C. (2014). Digital marketing and social media: Why bother? *Business Horizons*, 57(6), 703–708. <https://doi.org/10.1016/j.bushor.2014.07.002>
- Umamaheswari, S., Valarmathi, A., & others. (2023). Role of Artificial Intelligence in The Banking Sector. *Journal of Survey in Fisheries Sciences*, 10(4S), 2841–2849. <https://doi.org/10.17762/sfs.v10i4S.1722>

- Van Dinter, R., Tekinerdogan, B., & Catal, C. (2021). Automation of systematic literature reviews: A systematic literature review. *Information and Software Technology*, 136, 106589. <https://doi.org/10.1016/j.infsof.2021.106589>
- Verma, S., Sharma, R., Deb, S., & Maitra, D. (2021). Artificial intelligence in marketing: Systematic review and future research direction. *International Journal of Information Management Data Insights*, 1(1), 100002. <https://doi.org/10.1016/j.jjime.2020.100002>
- Xiao, Y., & Watson, M. (2019). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, 39(1), 93–112. <https://doi.org/10.1177/0739456X17723971>