

Banks 4.0 in the Context of sustainable development: a literature review and research framework

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Abstract. The digitalization of banking services requires a focus on sustainable development as well as the utilization of new technologies. Understanding and predicting evolving customer needs and expectations is a vital objective for banks. This approach enables achieving and sustaining optimal customer satisfaction, leading to the establishment of customer loyalty. It is crucial to examine how Industry 4.0 affects the transformation of the banking industry. It is necessary to prioritize finding a balance between competition, innovation, security, and customer satisfaction to ensure sustainable development. This paper aims to explore the implementation of Industry 4.0 technologies in the banking system and increase awareness among researchers and bank managers about these new technologies and the concept of sustainability. Through an analysis of relevant literature, we hope to provide valuable insights. In this regard, it presents a framework studying the critical components for achieving banking 4.0

Index Terms— Bank 4.0, Industry 4.0, Banking digitalization, new technologies, Sustainable development, Risk management, Performance.

1. INTRODUCTION

Despite the growing importance of digitalization, it is essential. In recent decades, the advent of Industry 4.0 technologies has greatly enhanced the efficiency of organizations.[1]. Indeed, technological advances have resulted in massive changes in how people perform their jobs since the dawn of industrialization [2]. Looking back, it's clear that these changes qualify as industrial revolutions. Specifically, the fourth industrial revolution (Industry 4.0) is gaining traction in various developed nations. Germany, through a collaborative effort between the public and private sectors, is an example of a country taking the lead in developing smart factories that merge physical objects with digital technologies.[3]. As we enter the fourth era of the industrial revolution, companies across all sectors are attempting to implement digital technology into their business models [4], which is an attempt to increase efficiency and make banking faster and easier for customers.

The objective of numerical and artificial intelligence technologies is to enhance manufacturing efficiency while promoting sustainability.[5]. The use of Internet of

Things (IoT), cyber-physical systems (CPS), big data analytics, cloud computing and cognitive computing in manufacturing technology has led to data automation and an intelligent world. [6]. For this reason, the banking sector should implement its new technologies to take advantage of their benefits and ensure sustainable development in the banking sector.

Digitalization offers several benefits, including enhancing customer loyalty, minimizing human errors, and keeping up with competitors.[7]. As a result, the banking industry incorporates Industry 4.0 concepts into its operations to better respond to new needs through new products and strategies on the one hand and to offer higher productivity by putting innovations into action on the other [8]. In this context, the banking industry wants to respond to their customer's needs while also gathering helpful information for themselves that can be used for innovation [9]. The evolution of technology has not only transformed banking operations, but also created avenues for achieving financial stability and long-term success, leading to economic sustainability. More specifically, technological advances in the 4.0 era have prompted banks to improve their services, including implementing online banking services. This will simplify management and operations, benefit customers, increase flexibility, reduce significant technical errors [10], and develop appropriate environmental strategies to meet challenges and achieve environmental sustainability [11].

Technological innovation is critical to a company's sustainability development, and many focus heavily on technology management (TM) to maintain their competitive edge [12]. Since 1987, the World Commission on Environment and Development (WCED) has brought attention to the impact of business operations on the environment and society. This has led to a growing interest in the concept of corporate sustainability, which has captured the attention of businesses, academia, and policymakers alike.

In contrast, the service sector, particularly the banking industry, which is critical to a country's economic development, may need more attention in terms of sustainability [13]. Banks must engage in sustainable development practices to increase their value and improve their image.

As a result of digitalization, Banking 4.0 is being implemented [14]. Bank 4.0 leverages Industry 4.0 technologies to assign unique numbers to assets, establish digital identities, offer customized deals to customers, and personalize services. Bank 4.0 offers a client-centric and service-oriented approach with an open and flexible integration architecture to enhance the overall experience[15]. The implementation of Bank 4.0 will give rise to fresh commercial models that depend on factors such as the level of investment in digital banking services, flexibility, control, access to data sources, and the ability of technology to minimize the risks associated with digitalization.

Research into Bank 4.0 is still in its early stages and is only available in specific bibliographic databases. Additionally, the banking industry currently lacks a sufficient amount of academic research to establish a comprehensive framework for the successful and sustainable integration of Bank 4.0, resulting in improved performance. The purpose of this article is to address gaps in previous research by creating a thorough conceptual framework for the implementation of Industry 4.0 in the banking industry. The goal of this research is to provide clarity on sustainable banking innovation in relation to environmental, social, and economic concerns. It aims to give readers a different

perspective on banking 4.0 and to show how various technologies affect bank performance and how the use of new technology is assisting the bank in achieving sustainable development

The structure of this article is as follows: Section 2 presents the methodology chosen for the study. Section 3 presents the Implementation of Industry 4.0 in the banking sector with sustainable development. Section 4 presents a discussion. Finally, section 5 offers the conclusion.

2. METHODOLOGY

Analysing literature helps authors evaluate and identify relevant content in their field, contributing to the development of theories and concepts.[16]. The associated publications are still in the works because the Bank 4.0 domain has only been around for a few years. In order to find relevant information on Bank 4.0, new technology, and sustainability, we thoroughly reviewed academic and industrial articles, examining their titles, abstracts, and manuscripts through both traditional and online library systems. We focused on identifying specific keywords for our research. In order to search for relevant publications in the widest range of intelligent productions, we used the following databases:

- (1) Scopus (www.scopus.com),
- (2) Elsevier (www.sciencedirect.com),
- (3) Web Of Science (www.webofscience.com)
- (4) Springer (<https://www.springer.com/gp>)
- (5) Google Scholar

The database searches primarily utilized keywords and terms to describe and identify the utilization of technologies in the banking industry for sustainable development. The following table displays the authors' chosen keywords.

I reviewed the literature using various research sources, such as articles from credible scientific journals and indexed conference proceedings. To begin the investigation process, I first located relevant information sources. The research covered literature from 1998 to 2023. Table 1 summarizes the method used.

Table1: Methodology Summary

The type of analysis	Qualitative
Period	1998-2023
Keywords	Bank 4.0, the banking industry and digitalization, bankingintelligence, bank and Industry 4.0, Sustainability, Sustainable Development bank and (artificial intelligence OR Blockchain OR Cloud OR Internet of Things OR BigData)
Number of articles	103

3. Discussion

In particular, technological advancements in the 4.0 era have led banks to upgrade their services, including deploying online banking services. This will simplify administration and operations, add customer value, boost flexibility, and decrease major technical faults. The focus on sustainable development has led to numerous advancements in the banking industry. There have been improvements in customer relations, with a greater emphasis on the values it represents. Additionally, the industry has expanded its offerings and integrated new technologies.

Rebai, Azaiez, and Saidane [17] noted that sustainable banking is a dependable system considering financial and non-financial issues. According to their statement, sustainable banking involves implementing commercial practices that prioritize social, environmental, and ethical considerations, ultimately contributing to a stable and well-rounded financial system. The activities of banks have been transformed by innovations and technological advancements, which have also opened up opportunities for them to achieve greater financial stability and competitiveness.[18].

In the banking sector, key Industry 4.0 technologies include Artificial Intelligence, Big Data, Blockchain, Cloud, and the Internet of Things (IoT).[16]. The implementation of these technologies not only aids in managing customer relationships but also enhances cyber security, facilitates fraud detection, and optimizes decision-making processes[10] while respecting the sustainable development of the banking system[11].

Artificial intelligence (AI) is causing a dramatic change in the banking industry. For AI, banking is more than simply physical branches; it is an entirely new universe of modern banking. Modern banks' provision of new banking services aids their growth, expansion, and respect for the environment by reducing environmental pollution, resource consumption, and ecological footprints[11]. The use of technology in banking facilitates the penetration of banking services and enhances profitability. It enables low-value transactions and helps attract more clients, leading to further expansion of the banking industry. Additionally, technology reduces loan losses, enhances payment-processing security, automates compliance tasks, and improves client targeting, all of which can contribute to the financial performance and sustainability of banks. AI is a critical tool for detecting fraud and preventing risk. The relationship between perceived usefulness and intention to embrace AI in banking services plays a substantial mediating function [19]. It is also clear that the use of artificial intelligence to help achieve business and sustainability objectives contributes to significant gains, both economically and in terms of resource efficiency.

In addition to client segmentation, the studies demonstrate the extensive usage of big data in banks. Interest has centered on fraud detection, developing viable business models, predicting insolvency, and various other topics. Instead, banks that are digitizing should leverage big data to provide valuable goods to their consumers, manage potential risks, detect fraudulent activities, and establish efficient business operations [20]. In order to improve strategic management and enhance customer satisfaction, it is crucial for the banking sector to delve into new big data analytical tools, such as Data Mining (DM) techniques, which enable the extraction of valuable insights from vast amounts of data.

[21]. The utilization of Big Data in the banking industry enhances their capacity to address customer needs promptly and boosts interactivity across all operations. This result in improved efficiency, reduced costs, minimized CO2 emissions, and lowered energy consumption... All this helps to make banking more sustainable [22].

Blockchain technology improves bank efficiency through interbank reconciliation, boosts competitiveness and performance as part of an ambidextrous strategy, and advances information processing while lowering operational risks [23]. The utilization of Blockchain technology has the potential to enhance the worldwide financial infrastructure, facilitating sustainable growth through the implementation of more effective systems than those currently in place. Indeed, many institutions are already focused on Blockchain technology to support economic growth and expedite the development of green technologies [24].

The banking industry is ready to embrace the advancements of the Internet of Things and the shift towards intelligent work environments, replacing traditional bank branches. The initial results affirm the efficacy of using IOT for enhancing physical security measures in banks[25]. The time and workload of those involved have been reduced, operating expenses have decreased, information quality has improved, and the overall efficacy of the protection system against criminal attacks has improved [20]. The result is higher-quality, real-time data for processing and decision-making, to scale up [26]. Intelligent technology supports environmental sustainability through knowledge and automation, optimizing the use of natural resources, reducing waste, and using renewable energies such as wind and solar power [27].

The Cloud is an IT service delivery model that offers customers the possibility of faster deployment, greater flexibility, and flexibility to respond rapidly to new requirements [28] to integrate research and improve the performance, accuracy, efficiency, security, and high availability of their IT infrastructure [29].

The global digitization transition is altering all areas of the economy[30]. Banks are under pressure to respond to these changes as well. Branchless banking is an online banking service [31]. Branchless banking offers a range of benefits related to social, economic, and environmental sustainability. Through branchless banking, customers can easily access information about their accounts, make fund transfers, and pay bills, among other convenient services.[32]. By minimizing paperwork and physical labor, significant savings can be achieved in terms of money, energy, fuel, stationery, transportation, space, and other resources that are typically necessary for establishing and maintaining a physical infrastructure.[33], [34]. Additionally, it facilitates the growth of emerging markets while reducing operational, administrative, and labor expenses, all of which promote social, economic, and environmental sustainability.[35]. According to the findings, Internet banking is the most effective technology, in-house research and development is the optimal method for acquisition, and in-house operation is the most suitable operating method for promoting social sustainability.[36]. Table 2 presents technologies used in Bank 4.0.

Table 2 presents key enabling technologies for Bank 4.0

Reference	Artificial Intelligence	Big Data	Blockchain	Cloud	Internet of Thing
Dicuonzo [37]	X	X	X		X

Khanboubi and Al [38]					X
Königstorfer and Thalmann[39]	X				
Rana and Ji [29]				X	
Ramalingam and Venkatesan[26]					X
Hassani and Al [21]		X			X
Ammirato and Al [20]					X
Asadi and Al[28]				X	
Zambon and Al [40]	X				
Ammirato and Al[25]					X
Rahman and Al [19]	X				
Nobanneans al [41]		X	X		
Cocco and Al [42]			X		

4. BANK 4.0 IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

Understanding banking 4.0 can be challenging due to its complexity, which includes various activity streams, elements, properties, and actors. To address this, we have created a conceptual framework that provides a better understanding of banking 4.0 within the context of sustainable development. Our framework, developed through a thorough literature review, examines the relationships between the different parties involved in 4.0 banking. We focused on defining critical themes and assessing the current state of banking 4.0 concerning economic, social, and environmental sustainability. The content provided is aimed towards researchers and practitioners seeking to incorporate essential themes and concepts related to Banking 4.0 and sustainability. We considered various factors during the development process to ensure that our framework is reliable and useful.

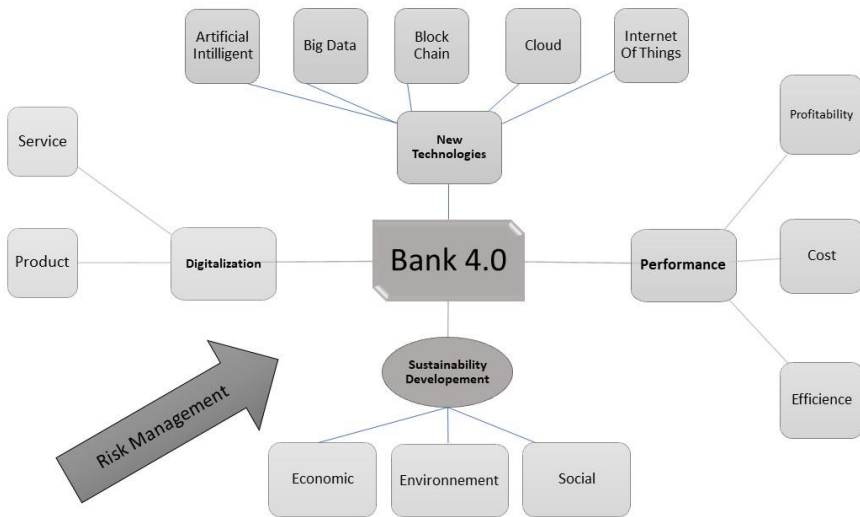


Figure1: Bank4.0 Development Framework

- (1) Digitalisation
- (2) Technologies
- (3) Performance
- (4) Risk management
- (5) Sustainability development

4.1 Digitalisation

The global transformation associated with digitalization is transforming all sectors of the economy[30]. Banks are also under pressure to adapt to these changes [43]. The implementation of point-of-sale information technology fosters competition and enhances the accessibility and attractiveness of banking services to the public. [44]. In order to stay competitive, traditional banks must integrate digital elements into their management and operational systems.[45]. Technological progress will impact how banks operate internally [46]. This entails cost-cutting measures and new organizational structures, approaches, and goals [47]. Furthermore, the digitalization of services and products allows for new responses to bank and consumer needs and the identification of new commercial opportunities [48]. Technological advancements have made a significant contribution to the improvement of banking capacities and the provision of more services of higher quality through the introduction of new mechanisms [49].

An instance of this is the digitization of financial services which adds a unique aspect to service provision and permits varied options for customers, ultimately leading to improved satisfaction.[50].

4.2 New Technologies

The financial services sector should embrace digitalization as an opportunity to enhance their banking services using new technological solutions. This will ensure the protection and satisfaction of the interests of banks, their customers, and the government on a global scale. Digitalization leads to implementing what is known as Bank4.0 [14].

The Bank 4.0 (Banking 4.0) standard acknowledges the use of Industry 4.0 technologies to automate assets, create digital identities, and provide special offers [6], and personalized services and products. As a result, one of the mechanisms banks use to gain a competitive advantage is technological innovation: quality management and control [51]. The banking sector is implementing fourth industrial revolution (industry 4.0) technologies:

- **Artificial intelligence** AI refers to a collection of methods that enable people to replicate their actions on previously analyzed technological systems without the need for additional inputs.[23]. The IA has transformed the banking industry by breaking the historical ties that have kept the sector together for so long, and it now forms an axis where past and present capabilities combine in unprecedented ways [52].
- **Big Data** refers to the vast amount of data generated and collected during commercial transactions and other events [53]. To determine their credit scores, banks rely on historical client data and current factors that are not directly related to solvability [54].
- **Blockchain** is a digital system that allows transactions to be recorded on a large distributed book [55]. It is decentralized because it is not governed by any authority or agency [56]. It is regarded as a "trust-building machine" [57]. The blockchain assists banks in implementing optimal information-processing mechanisms [58].
- **Cloud** is a model of information technology service delivery in which computer services are made available to clients on demand via a public network, regardless of the device or location [59]. It enables better client relationship management (CRM) and provides an unlimited infrastructure for data storage and execution [60].
- **The Internet of Things** is a global network of connected objects that rely on various technologies such as sensors, communications, networks, and information processing. It refers to both the process of connecting physical objects to the Internet and the network that connects these objects [38]. It functions as a cyber-security tool or a mobile point-of-sale system, encrypting your payment information in complete security. Automatic banking machines (GAB) are one of the most critical devices on the Internet of Things. This allows for real-time trading and displays account sales on the screen without human interaction [61].

4.3 Performance

Finally, based on the findings of this study [62], it can be inferred that introducing new and innovative products has a significant impact on the overall success of a business. banks. The study revealed a slight but positive connection between product innovation and the performance of commercial banks.[45], commercial bank management should focus more on improving various products and services. More specifically, Internet financing improves the performance of commercial banks in three ways:

- **Profitability** Researchers have found that Bank 4.0 has significantly boosted the profitability of banks. This can be attributed to the fact that the number of digital banking service users has increased in comparison to the total number of users, resulting in higher profits for the banking industry.[63]. Digitalization has significantly transformed the banking industry, enhancing the productivity and efficiency of both employees and agencies. As technology has advanced, automated processes have reduced manual labor and errors. The model analysis for evaluating digital banking performance obtained from digital banks shows that the more users of remote banking services there are, the higher the bank's ROA [45].
- **Costs** Using digitization as a strategic tool can significantly reduce the cost of banking transactions. Banks have incurred significant infrastructure and training costs to provide digital banking services, but these costs are typically amortized over a short period [63]. Internet banking services have evolved into a strategic resource for achieving efficiency gains, operational control, and cost savings.
- **Efficiency** Since the introduction of digitalization, the overall efficiency of the banking sector has improved. Employee productivity can be increased through training and feedback, and they can easily adapt to a constantly changing technology [63]. The ability to use financial technology to create strategic value is a critical differentiator between banks [64].

4.4 Risk management

As we move forward, the field of risk management stands to gain significantly from advancements in technology, including big data, machine learning, artificial intelligence, cloud computing, and enhanced analytical tools.[1]. These technologies enable risk management functions to make more decisions that are informed. This also contributes to data infrastructure development, allowing organizations to spend more time analysing data rather than managing it [65]. Furthermore, as banks increase online transactions with new technologies, piracy and virus infection risk must be avoided and managed [66].

Aside from various financial risks, there are also non-banking risks. Technique risk is a component. This includes cybersecurity risks [66], risks associated with noncompliance with data protection regulations, and risks associated with existing systems. Banks have detailed plans to manage financial risks but are only sometimes aware of technical risks. When attempting to mitigate technological risks, banks may face several challenges.

4.5 Sustainability development

There are inconsistencies in the measurement and study of sustainability due to the various interpretations of the concept. Sustainable banking encompasses the delivery of financial products and services that address the needs of people safeguard the environment, and yield profits [71].

As an illustration, certain researchers have characterized sustainability as the expansion of a company, commendable economic efficiency, and sustained profitability in the long run.[67]. According to recent scholars, sustainability encompasses economic, social, and environmental aspects. Let us explore each aspect further. [68]. This paper focuses on attaining a sustainable Bank 4.0 by acknowledging sustainable development as an approach that encompasses the economic, environmental, and social dimensions of business growth, commonly referred to as the three pillars of sustainability.[69],[70]. To have a Bank 4.0 it is necessary to respect these three notions.

- **Social sustainability** Social sustainability is concerned with promoting human well-being and optimizing development potential by fulfilling human needs.[71]. It is important for businesses to address social inequalities and enhance the well-being of their employees, local communities, suppliers, customers, and the government, in order to foster positive relationships among these stakeholders.[68].In the banking industry, this means expanding employment possibilities, community-based spending, charitable giving, and collaborations and engagements with the community [27]. Sustainability in the workplace is beneficial for organizations as it helps to retain employees and improve their reputation and performance. It also reduces workplace hazards and ensures the safety of employees.[72]. Ensuring the health and safety of employees is a crucial aspect of promoting workplace sustainability. By prioritizing the well-being of workers, companies can enhance their operational efficiency and overall productivity.[73].
- **Environmental sustainability** It is important for banks, as well as other institutions, to take into account environmental concerns when making decisions that will have long-term impacts.[74]. They must create and implement appropriate environmental strategies to solve these problems and achieve environmental sustainability[11]. As a responsible business, it is essential to prioritize environmental sustainability by reducing the negative impact of our activities on the natural environment, including land, air, and water. This requires us to adopt eco-friendly practices such as minimizing pollution, conserving resources, and reducing our ecological footprint.[75]. Financial institutions can take steps to mitigate the harmful impact of their offerings on the environment. This can include eliminating the use of polluting packaging and implementing robust recycling programs that encourage the reuse of waste materials Energy consumption is a significant factor in the depletion of fossil resources and contributes to global warming and pollution. Therefore, it is essential to reduce the use of nonrenewable energy and shift towards renewable energy sources like solar, wind, tidal, and biomass. Such a shift can positively influence companies' environmental performance. [27].
- **Economic sustainability** focuses on the enduring economic impact, achievements, and endurance of businesses, prioritizing long-term economic prosperity over immediate financial gains. When borrowers fail to repay their loans as agreed, it can harm a bank's financial performance and sustainability. Banks have a significant impact on sustainability as they can either facilitate or

hinder it. The sustainability of banks is closely tied to the sustainability of the businesses they lend to [76]. The economic viability of banks is crucial for their survival and long-term success. [77]. Banks are also driven by economic sustainability to enhance their financial performance.[78], enhancing shareholder trust by raising earnings per share [77]. Economic sustainability, in addition to business sustainability, is concerned with macroeconomic growth and development. . In addition, economic sustainability encompasses various factors such as setting minimum wages, promoting job creation, investing in research and development, implementing internal control measures, and establishing a sound governing structure for corporations.

5. Conclusion

As new technologies continue to emerge, they bring with them fresh ideas that challenge our established ways of thinking. The digitization of financial services requires more than just the adoption of new technologies; it calls for a fundamentally different mindset from all players involved. With the rapid pace of change, it is safe to say that the future of banking will look vastly different before long. Artificial intelligence is set to revolutionize the industry by automating numerous processes, enhancing communication, and elevating the quality of banking services.

The ability of banks to quickly adapt to new data processing methods and utilize technology will play a crucial role in determining future changes at the organizational level. Proper regulation of the financial framework, in addition to numerical processes, is essential for eliminating or mitigating risks.

This paper holds significant importance both in theory and in practice. Firstly, it lays a strong groundwork for the subject of Bank4.0 in today's digital world. Secondly, it can serve as a valuable resource for researchers who want to gain a comprehensive understanding of the Bank 4.0 and sustainable development framework. We have successfully developed a conceptual framework for implementing Bank4.0, which will serve as a useful guide for future projects. This study is unique in its focus on Bank4.0, its technologies, and sustainable development, and adds to the existing literature on Bank 4.0.

Professionals in the banking industry, including specialists and managers, are encountering new trends, techniques, and methods derived from Industry 4.0. As a result, they may require assistance in implementing Bank4.0 while considering sustainable development, as well as clarification on which technologies to use for their banking activities. Additionally, they may need guidance in assessing the impact of each technology on the banking sector. To address these concerns, our research team has developed a framework, as depicted in Figure 1, to aid practitioners and managers in implementing Bank4.0 and identifying potential risks.

In the computer industry, the security environment brings about both challenges and opportunities for finding solutions to problems. It is important to consider the needs of all banking service users, including new clients and individuals from different age groups. As digitization continues to shape the banking industry, banks need to adjust their business models to meet market demands for economic sustainability, long-term

contributions, performance, and survival. Adapting to future changes will depend on their ability to quickly learn and adopt new ways of processing large amounts of data.

In the digital economy, it is crucial to safeguard the customers and their data while ensuring fairness among companies that operate in similar fields. It is vital to apply the same rules to all market participants. Achieving this balance requires considering factors such as competition, innovation, security, sustainability, and customer protection. The banking sector's transition into Industry 4.0 should not compromise security in the pursuit of competition and innovation.

When it comes to developing technologies for Bank 4.0, the most significant research limitations are related to the required technology and infrastructure. As such, researchers should prioritize identifying and addressing the following elements: (1) the legal and regulatory implications of emerging technologies in the banking sector, (2) the industry factors that influence entry into banking 4.0, (3) the impact of new technologies on the bank's sustainable development, and (4) empirical research into the relationship between 4.0 banking, performance, and financial risk management.

References

- [1] K. Zekhnini, A. Cherrafi, I. Bouhaddou, Y. Benghabrit, et J. A. Garza-Reyes, « Supply chain management 4.0: a literature review and research framework », *BIJ*, vol. 28, n° 2, p. 465-501, sept. 2020
- [2] K. Zekhnini, A. Cherrafi, I. Bouhaddou, A. Chaoui Benabdellah, et S. Bag, « A model integrating lean and green practices for viable, sustainable, and digital supply chain performance », *International Journal of Production Research*, vol. 60, n° 21, p. 6529-6555, nov. 2022
- [3] V. L. Da Silva, J. L. Kovaleski, et R. N. Pagani, « Technology transfer in the supply chain oriented to industry 4.0: a literature review », *Technology Analysis & Strategic Management*, vol. 31, n° 5, p. 546-562, mai 2019
- [4] M. Hermann, T. Pentek, et B. Otto, « Design Principles for Industrie 4.0 Scenarios: A Literature Review », 2015
- [5] X. Xu, Y. Lu, B. Vogel-Heuser, et L. Wang, « Industry 4.0 and Industry 5.0—Inception, conception and perception », *Journal of Manufacturing Systems*, vol. 61, p. 530-535, oct. 2021
- [6] J. Her, « Industry 4.0 as a factor of productivity increase », p. 6.
- [7] M. R. Meena et D. G. Parimalarani, « IMPACT OF DIGITAL TRANSFORMATION ON EMPLOYMENT IN BANKING SECTOR », vol. 9, n° 01, p. 6, 2020.
- [8] R. Gupta, « Industry 4.0 Adaption in Indian Banking Sector—A Review and Agenda for Future Research », *Vision: The Journal of Business Perspective*, vol. 27, n° 1, p. 24-32, févr. 2023
- [9] P. S. R. Nethravathi *et al.*, « Business intelligence appraisal based on customer behaviour profile by using hobby based opinion mining in India: a case study », *Economic Research-Ekonomska Istraživanja*, vol. 33, n° 1, p. 1889-1908, janv. 2020
- [10] H. Boateng, D. R. Adam, A. F. Okoe, et T. Anning-Dorson, « Assessing the determinants of internet banking adoption intentions: A social cognitive theory perspective », *Computers in Human Behavior*, vol. 65, p. 468-478, déc. 2016
- [11] R. F. Malaquias et A. F. Silva, « Understanding the use of mobile banking in rural areas of Brazil », *Technology in Society*, vol. 62, p. 101260, août 2020
- [12] J. Lee, J.-H. Kang, S. Jun, H. Lim, D. Jang, et S. Park, « Ensemble Modeling for Sustainable Technology Transfer », *Sustainability*, vol. 10, n° 7, p. 2278, juill. 2018

- [13] R. Antolín-López, J. Delgado-Ceballos, et I. Montiel, « Deconstructing corporate sustainability: a comparison of different stakeholder metrics », *Journal of Cleaner Production*, vol. 136, p. 5-17, nov. 2016
- [14] A. Mehdiabadi, M. Tabatabeinasab, C. Spulbar, A. Karbassi Yazdi, et R. Birau, « Are We Ready for the Challenge of Banks 4.0? Designing a Roadmap for Banking Systems in Industry 4.0 », *IJFS*, vol. 8, n° 2, p. 32, mai 2020
- [15] L. Votintseva, M. Andreeva, I. Kovalenin, et R. Votintsev, « Digital transformation of Russian banking institutions: assessments and prospects », *IOP Conf. Ser.: Mater. Sci. Eng.*, vol. 497, p. 012101, avr. 2019
- [16] K. Zekhnini, A. Cherrafi, I. Bouhaddou, A. C. Benabdellah, et R. Raut, « A holonic architecture for the supply chain performance in industry 4.0 context », *International Journal of Logistics Research and Applications*, p. 1-28, nov. 2021
- [17] S. Rebai, M. N. Azaiez, et D. Saidane, « A multi-attribute utility model for generating a sustainability index in the banking sector », *Journal of Cleaner Production*, vol. 113, p. 835-849, févr. 2016
- [18] R. A. Begum et J. J. Pereira, « The awareness, perception and motivational analysis of climate change and business perspectives in Malaysia », *Mitig Adapt Strateg Glob Change*, vol. 20, n° 3, p. 361-370, mars 2015
- [19] M. Rahman, T. H. Ming, T. A. Baigh, et M. Sarker, « Adoption of artificial intelligence in banking services: an empirical analysis », *IJOEM*, déc. 2021
- [20] S. Ammirato, F. Sofo, A. M. Felicetti, et C. Raso, « The potential of IoT in redesigning the bank branch protection system: An Italian case study », *BPMJ*, vol. 25, n° 7, p. 1441-1473, oct. 2019
- [21] H. Hassani, X. Huang, et E. Silva, « Digitalisation and Big Data Mining in Banking », *BDCC*, vol. 2, n° 3, p. 18, juill. 2018
- [22] T. Hahn, J. Pinkse, L. Preuss, et F. Figge, « Tensions in Corporate Sustainability: Towards an Integrative Framework », *J Bus Ethics*, vol. 127, n° 2, p. 297-316, mars 2015
- [23] N. Kaur, S. L. Sahdev, M. Sharma, et L. Siddiqui, « BANKING 4.0: “THE INFLUENCE OF ARTIFICIAL INTELLIGENCE ON THE BANKING INDUSTRY & HOW AI IS CHANGING THE FACE OF MODERN DAY BANKS” », *IJM*, vol. 11, n° 6, juin 2020
- [24] D. Wang, D. Zhao, et F. Chen, « Research on Financing Strategy of Green Energy-Efficient Supply Chain Based on Blockchain Technology », *Energies*, vol. 16, n° 7, p. 2985, mars 2023
- [25] S. Ammirato, F. Sofo, A. M. Felicetti, et C. Raso, « A methodology to support the adoption of IoT innovation and its application to the Italian bank branch security context », *EJIM*, vol. 22, n° 1, p. 146-174, janv. 2019
- [26] H. Ramalingam et V. P. Venkatesan, « Conceptual analysis of Internet of Things use cases in Banking domain », in *TENCON 2019 - 2019 IEEE Region 10 Conference (TENCON)*, Kochi, India: IEEE, oct. 2019, p. 2034-2039.
- [27] J. Kurila, L. Lazuras, et P. H. Ketikidis, « Message framing and acceptance of branchless banking technology », *Electronic Commerce Research and Applications*, vol. 17, p. 12-18, mai 2016
- [28] S. Asadi, M. Nilashi, A. R. C. Husin, et E. Yadegaridehkordi, « Customers perspectives on adoption of cloud computing in banking sector », *Inf Technol Manag*, vol. 18, n° 4, p. 305-330, déc. 2017
- [29] D. M. E. Rana et M. L. Z. Ji, « The Role and Potential Applications of Cloud Computing in the Banking Industry ».

- [30] D. Ivanov et A. Dolgui, « A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0 », *Production Planning & Control*, vol. 32, n° 9, p. 775-788, juill. 2021
- [31] S. Kim, H.-J. Kwon, et H. Kim, « Mobile Banking Service Design Attributes for the Sustainability of Internet-Only Banks: A Case Study of KakaoBank », *Sustainability*, vol. 15, n° 8, p. 6428, avr. 2023
- [32] D. Chawla et H. Joshi, « Consumer perspectives about mobile banking adoption in India – a cluster analysis », *IJBM*, vol. 35, n° 4, p. 616-636, juin 2017
- [33] C. Deegan, « Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation », *Accounting, Auditing & Accountability Journal*, vol. 15, n° 3, p. 282-311, août 2002.
- [34] D. G. Deka, « GREEN BANKING PRACTICES: A STUDY ON ENVIRONMENTAL STRATEGIES OF BANKS WITH SPECIAL REFERENCE TO STATE BANK OF INDIA », *Management Studies*, n° 3, 2015.
- [35] T. Hahn, J. Pinkse, L. Preuss, et F. Figge, « Tensions in Corporate Sustainability: Towards an Integrative Framework », *J Bus Ethics*, vol. 127, n° 2, p. 297-316, mars 2015
- [36] M. Chavosh Nejad, S. Mansour, et A. Karamipour, « An AHP-based multi-criteria model for assessment of the social sustainability of technology management process: A case study in banking industry », *Technology in Society*, vol. 65, p. 101602, mai 2021
- [37] G. Dicuonzo, G. Galeone, E. Zappimulso, et V. Dell'Atti, « RISK MANAGEMENT 4.0: THE ROLE OF BIG DATA ANALYTICS IN THE BANK SECTOR », *IJEFI*, vol. 9, n° 6, p. 40-47, oct. 2019
- [38] F. Khanboubi, A. Boulmakoul, et M. Tabaa, « Impact of digital trends using IoT on banking processes », *Procedia Computer Science*, vol. 151, p. 77-84, 2019
- [39] F. Königstorfer et S. Thalmann, « Applications of Artificial Intelligence in commercial banks – A research agenda for behavioral finance », *Journal of Behavioral and Experimental Finance*, vol. 27, p. 100352, sept. 2020
- [40] I. Zambon, M. Cecchini, G. Egidi, M. G. Saporito, et A. Colantoni, « Revolution 4.0: Industry vs. Agriculture in a Future Development for SMEs », *Processes*, vol. 7, n° 1, p. 36, janv. 2019
- [41] H. Nobanee, M. N. Dilshad, M. Al Dhanhani, M. Al Neyadi, S. Al Qubaisi, et S. Al Shamsi, « Big Data Applications the Banking Sector: A Bibliometric Analysis Approach », *SAGE Open*, vol. 11, n° 4, p. 215824402110672, oct. 2021
- [42] L. Cocco, A. Pinna, et M. Marchesi, « Banking on Blockchain: Costs Savings Thanks to the Blockchain Technology », *Future Internet*, vol. 9, n° 3, p. 25, juin 2017
- [43] D. Larson et V. Chang, « A review and future direction of agile, business intelligence, analytics and data science », *International Journal of Information Management*, vol. 36, n° 5, p. 700-710, oct. 2016
- [44] G. Y. Peshkova et O. V. Zlobina, « Digital Transformation Of Banking With Speech Technologies », présenté à International Conference on Economic and Social Trends for Sustainability of Modern Society, oct. 2020, p. 294-303
- [45] E. V. Koroleva et T. Kudryavtseva, « Factors Influencing Digital Bank Performance », in *Digital Science 2019*, T. Antipova et Á. Rocha, Éd., in *Advances in Intelligent Systems and Computing*, vol. 1114. Cham: Springer International Publishing, 2020, p. 325-333.
- [46] A. I. Said et M. Angelita, « Determining Factors for Success of Banking Digital Transformation », in *Proceedings of the 3rd Asia Pacific Management Research Conference (APMRC 2019)*, Bali, Indonesia: Atlantis Press, 2020

- [47] M. Barroso et J. Laborda, « Digital transformation and the emergence of the Fintech sector: Systematic literature review », *Digital Business*, vol. 2, n° 2, p. 100028, 2022
- [48] M. Kohtamäki, V. Parida, P. C. Patel, et H. Gebauer, « The relationship between digitalization and servitization: The role of servitization in capturing the financial potential of digitalization », *Technological Forecasting and Social Change*, vol. 151, p. 119804, févr. 2020
- [49] B. L. Del Gaudio, C. Porzio, G. Sampagnaro, et V. Verdoliva, « How do mobile, internet and ICT diffusion affect the banking industry? An empirical analysis », *European Management Journal*, vol. 39, n° 3, p. 327-332, juin 2021
- [50] T. Abbasi et H. Weigand, « The Impact of Digital Financial Services on Firm's Performance: a Literature Review ». arXiv, 3 mai 2017
- [51] C. Poğăciuş et R. Dovleac, « Implementation and impact of Industry 4.0 and Quality 4.0 in the banking sector », *MATEC Web Conf.*, vol. 342, p. 09008, 2021
- [52] M. H. Thowfeek, S. S. Nawaz, et M. B. Fathima, « Drivers of Artificial Intelligence in Banking Service Sectors », *Solid State Technology*, vol. 63, n° 5, p. 13, 2020.
- [53] M. S. Barr, B. Koziara, M. D. Flood, A. Hero, et H. V. Jagadish, « Big Data in Finance: Highlights from the Big Data in Finance Conference Hosted at the University of Michigan October 27-28, 2016 », *SSRN Journal*, 2018
- [54] M. Hurley et J. Adebayo, « CREDIT SCORING IN THE ERA OF BIG DATA », *Big Data*, vol. 18, p. 69, 2016.
- [55] J. Hou, C. Wang, et S. Luo, « How to improve the competitiveness of distributed energy resources in China with blockchain technology », *Technological Forecasting and Social Change*, vol. 151, p. 119744, févr. 2020
- [56] S. E. Chang, Y.-C. Chen, et M.-F. Lu, « Supply chain re-engineering using blockchain technology: A case of smart contract based tracking process », *Technological Forecasting and Social Change*, vol. 144, p. 1-11, juill. 2019
- [57] A. Mazurchenko, M. Zelenka, et K. Maršíková, « DEMAND FOR EMPLOYEES' DIGITAL SKILLS IN THE CONTEXT OF BANKING 4.0 », *E+M*, vol. 25, n° 2, p. 41-58, juin 2022
- [58] N. Cucari, V. Lagasio, G. Lia, et C. Torriero, « The impact of blockchain in banking processes: the Interbank Spunta case study », *Technology Analysis & Strategic Management*, vol. 34, n° 2, p. 138-150, févr. 2022
- [59] S. Marston, Z. Li, S. Bandyopadhyay, J. Zhang, et A. Ghalsasi, « Cloud computing — The business perspective », *Decision Support Systems*, vol. 51, n° 1, p. 176-189, avr. 2011
- [60] M. Zineldin et V. Vasicheva, « Banking and Financial Sector in the Cloud: Knowledge, Quality and Innovation Management », in *Cloud Systems in Supply Chains*, F. Soliman, Éd., London: Palgrave Macmillan UK, 2015, p. 178-194.
- [61] Z. Mani et I. Chouk, « Consumer Resistance to Innovation in Services: Challenges and Barriers in the Internet of Things Era », *J PROD INNOV MANAG*, vol. 35, n° 5, p. 780-807, sept. 2018
- [62] M. G. Agboola *et al.*, « Effect of digitalization on the performance of commercial banks in Nigeria », *IOP Conf. Ser.: Earth Environ. Sci.*, vol. 331, n° 1, p. 012014, sept. 2019
- [63] S. N. Azmi, S. Akhtar, et R. Nadeem, « Impact of Digitalisation on Bank Performance: A Study of Indian Banks », p. 15, 2020.
- [64] A. Al-Ajlouni et Dr. M. S. Al-Hakim, « Financial Technology in Banking Industry: Challenges and Opportunities », *SSRN Journal*, 2018
- [65] H. Birkel, J. Veile, J. Müller, E. Hartmann, et K.-I. Voigt, « Development of a Risk Framework for Industry 4.0 in the Context of Sustainability for Established Manufacturers », *Sustainability*, vol. 11, n° 2, p. 384, janv. 2019

- [66] N. Ngoc Thach, H. Thanh Hanh, D. T. Ngoc Huy, S. Gwozdziejewicz, L. T. Viet Nga, et L. T. Thanh Huong, « TECHNOLOGY QUALITY MANAGEMENT OF THE INDUSTRY 4.0 AND CYBERSECURITY RISK MANAGEMENT ON CURRENT BANKING ACTIVITIES IN EMERGING MARKETS - THE CASE IN VIETNAM », *IJQR*, vol. 15, n° 3, p. 845-856, août 2021
- [67] R. Isaksson et U. Steimle, « What does GRI-reporting tell us about corporate sustainability? », *The TQM Journal*, vol. 21, n° 2, p. 168-181, févr. 2009
- [68] J. F. Hair Jr, M. Sarstedt, L. Hopkins, et V. G. Kuppelwieser, « Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research », *European Business Review*, vol. 26, n° 2, p. 106-121, mars 2014
- [69] N. O. D. Ellili et H. Nobanee, « Impact of economic, environmental, and corporate social responsibility reporting on financial performance of UAE banks », *Environ Dev Sustain*, vol. 25, n° 5, p. 3967-3983, mai 2023
- [70] M. Stojčić, E. Zavadskas, D. Pamučar, Ž. Stević, et A. Mardani, « Application of MCDM Methods in Sustainability Engineering: A Literature Review 2008–2018 », *Symmetry*, vol. 11, n° 3, p. 350, mars 2019
- [71] M. Khan, H. U. Rahman, Q. B. Baloch, A. Ahmad, et M. Zahid, « Is there any difference between the theory and practice for the association between environmental sustainability and firm performance in Pakistan? », *Bus Strat Dev*, vol. 4, n° 3, p. 371-382, sept. 2021
- [72] K. T. Kustina, « Branchless Banking, Third-Party Funds, and Profitability Evidence Reference to Banking Sector in Indonesia », *Control Systems*, vol. 11, n° 2, 2019.
- [73] C. Labuschagne, A. C. Brent, et R. P. G. Van Erck, « Assessing the sustainability performances of industries », *Journal of Cleaner Production*, vol. 13, n° 4, p. 373-385, mars 2005
- [74] J. Lubchenco, « Entering the Century of the Environment: A New Social Contract for Science », *Science*, vol. 279, n° 5350, p. 491-497, janv. 1998
- [75] M. M. Muthinja et C. Chipeta, « What Drives Financial Innovations in Kenya's Commercial Banks? An Empirical Study on Firm and Macro-Level Drivers of Branchless Banking », *Journal of African Business*, vol. 19, n° 3, p. 385-408, juill. 2018
- [76] S. Moufty, E. Clark, et B. Al-Najjar, « The different dimensions of sustainability and bank performance: Evidence from the EU and the USA », *Journal of International Accounting, Auditing and Taxation*, vol. 43, p. 100381, juin 2021
- [77] K. J. Preacher et R. C. MacCallum, « Exploratory Factor Analysis in Behavior Genetics Research: Factor Recovery with Small Sample Sizes ».
- [78] A. Kashi et M. E. Shah, « Bibliometric Review on Sustainable Finance », *Sustainability*, vol. 15, n° 9, p. 7119, avr. 2023