International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

# Revolutionizing Banking and Finance: A Comprehensive Review of AIs Role and Future Prospects

**Nilesh D. Kulkarni[1], Saurav Bansal[2]**

[1]Sr. Director – Enterprise Architecture, Fortune Brands Innovations
Email: *nkulkar[at]gmail.com*

[2]Sr. Manager, Architect, Fortune Brands Innovations
Email: *saurav.bansal.kbl[at]gmail.com*

**Abstract:** ***This review paper explores the transformative impact of Artificial Intelligence AI on the banking and finance sector, highlighting its role in enhancing efficiency, security, and customer service. We examine the integration of AI with blockchain, APIs, and cloud computing, emphasizing the opportunities for innovation and the challenges of data quality and skill gaps. The future of AI in banking, characterized by predictive analytics and personalized services, promises significant advancements, notwithstanding the hurdles of implementation and ethical considerations. To ensure a comprehensive and systematic review, we employed a structured approach to literature selection, focusing on peer - reviewed articles and significant reports published in the last decade. We analyzed these sources to identify recurring themes, advancements, and gaps in the current understanding of AIs role in banking and finance, aiming to provide a balanced and insightful overview of the field.***

**Keywords:** Artificial Intelligence (AI), Value Chain, ML, Financial sector, Banking, 4IR

## 1. Introduction

Over the course of several decades, banks have continuously embraced the latest technological innovations to redefine their interactions with customers. In the 1960s, banks introduced ATMs, followed by the introduction of electronic card - based payments in the 1970s. The 2000s witnessed the widespread adoption of 24/7 online banking, and in the 2010s, mobile - based "banking on the go" became prevalent.

The term "Fourth Industrial Revolution" was coined by Klaus Schwab, the founder of the World Economic Forum, in 2016, in a book bearing the same name. This revolution ushers in a world where virtual and physical manufacturing systems collaborate on a global scale with flexibility [1]. It is characterized by the advancement and integration of technologies such as artificial intelligence (AI), robotics, and others that blur the lines between the biological and digital realms. The Fourth Industrial Revolution, often abbreviated as 4IR, relies on technologies like AI, robotics, augmented reality, genome editing, 3D printing, and more. It has already exerted significant influence on virtually every industry in various ways, including the financial sector, where it has introduced innovations like blockchain, APIs, AI, and so forth. The Machine learning in banking, financial services, and insurance accounted for about 18% of the total market, as measured by end - users, at end - 2022 (fig 1)

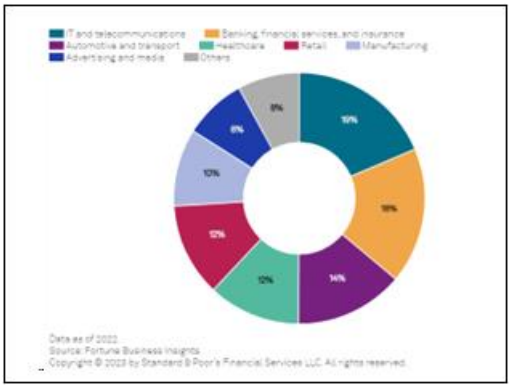


**Figure 1:** Distribution of the AI usage in various industries

The Fourth Industrial Revolution (4IR) and Its Impact on the Financial Sector

Blockchain: Blockchain is a distributed database shared among computers through nodes, storing data in electronic form. This technology enhances the speed and efficiency of business transactions, particularly for Financial Institutions (FIs) conducting international transactions. A prominent foreign bank in our country recently achieved a milestone by successfully completing the nation's first blockchain transaction involving a letter of credit.

***Artificial Intelligence (AI):*** AI is a technology capable of performing tasks that typically require human intelligence, such as speech recognition, visual perception, decision - making, and language translation. AI has transformed the information technology sector and it falls under the domain of computer science, encompassing the creation of intelligent machines and software that mimic human behavior. Despite this, FIs in Bangladesh have yet to fully embrace AI technologies. Adoption of AI has the potential to unlock numerous benefits, including accelerated data processing,

valuable insights, enhanced risk management, and more efficient execution of essential tasks like chatbot support, robot advisory services, predictive analytics, credit scoring, and cybersecurity.

***API (Application Programming Interface):*** APIs enable banks and financial institutions to digitize their services and seamlessly integrate with other digital service providers.

***Cloud Computing:*** As cloud computing continues to advance, it will become increasingly sophisticated and offer banks opportunities to save costs in areas such as procurement and HR. Additionally, it will provide banks with greater flexibility compared to traditional on - premises systems.

Characterizing artificial intelligence (AI) and machine learning (ML) as merely transformative technologies in the banking sector would be an understatement. In a recent survey conducted by Deloitte among IT and business executives within the financial services industry, a striking 86% of those who have adopted AI in financial services believe that AI will not just be important but very or critically so for their business's success in the upcoming two years.

While the banking sector has always been reliant on technology and data, the new data - enabled AI technology has the potential to drive innovation at a faster pace than ever before. AI can enhance efficiency, support growth initiatives, create differentiation, address risk and regulatory requirements, and significantly enhance the overall customer experience. In the past, the development of sophisticated AI systems was costly, limiting their deployment to specific use cases like high - frequency trading. Deloitte's recent AI survey of IT and line - of - business executives at companies that have adopted AI technologies indicates that, from a technological perspective, the barriers to adoption, including cost, are decreasing, making it easier to implement and integrate AI technologies.

## 2. Methodology

The data for this research was sourced from well - regarded academic databases, such as Google Scholar, IEEE Xplore, journals, and studies. We performed thorough searches using keywords like ‘Banking’, ’ ‘Value Chain, 'Generative AI', ‘Financial Services’, and ‘AI use cases for Banking’. This method enabled us to uncover a wide array of sources that could potentially contribute to our review.

### 2.1 AI – Artificial Intelligence

The term 'AI' encompasses a broad and intricate realm of non - human intelligence, marking a notable departure from conventional computational approaches [19].

In 1955, John McCarthy introduced the term "artificial intelligence" to explore whether machines could solve problems and use language as effectively as humans [20] [26]. AI involves developing computer systems that can perform tasks that typically require human intelligence, including learning, reasoning, problem - solving, and decision - making. To achieve this, AI is equipped with the ability to learn and understand new concepts, learn from experience, engage in reasoning, draw conclusions, and interpret symbols in context [26]. These capabilities have enabled AI's successful use in various domains such as game playing, human performance modelling, machine learning, data mining, genetic algorithms, and expert systems [27]. Additionally, AI has found extensive use in robotics, where it helps create machines capable of performing dangerous or difficult tasks beyond human capacity. For instance, AI - powered robots can be used in manufacturing, healthcare, and research environments for tasks such as data collection, surveying, and patient care [27].

As Demis Hassabis, Co - Founder and CEO of DeepMind, concisely puts it, AI is 'the science of making machines smart. Fundamentally, AI grants machines the ability to understand natural language, identify complex data patterns, make informed choices, and acquire knowledge through experiential interactions [21]. This replication of human - like cognitive functions enables machines not only to process and interpret information but also to adjust to various contextual situations, progressively improving their performance through continuous learning [22]. In contrast, deep learning, a subdomain nestled within machine learning, harnesses intricate neural networks comprising interconnected layers, drawing inspiration from the intricate synaptic structure of the human brain [23]. These neural networks exhibit an innate proficiency in deciphering complex patterns within data, rendering them particularly well - suited for tasks such as image recognition [24]. The ubiquitous applicability of AI traverses a diverse spectrum of industries, manufacturing [15], construction, finance, energy, healthcare and primarily for our focus supply chain. In these domains, AI takes on diverse roles, equipping computer systems with the ability to intricately analyze vast datasets, perform challenging and repetitive tasks with unwavering accuracy, provide personalized recommendations to users, and importantly, emulate human - like interactions through the utilization of chatbots [16] and virtual assistants [17].

Although AI has a long history, the recent increase in interest has somewhat blurred its definition and capabilities. Therefore, to foster a deeper and more insightful understanding of AI's significant role in the modern business landscape, it becomes essential to undertake a comprehensive exploration of the various categories of AI.

Machine Learning, a subset of AI, integrates principles from neuroscience, computer science, statistics, and mathematics, indicating a specialized focus despite its close relationship with AI. According to a definition which was originally coined by Mendel and McLaren (1970) and refined by Haykin (1994) [18], machine learning describes the change of a system resulting from an interaction with its environment. In computer science, machine learning falls under the broader category of 'Soft Computing, ' which aims to provide approximate solutions to problems without exact answers. This encompasses systems that find approximate (or ‘soft’) solutions to problems which do not possess exact (or ‘hard’) solutions. As such, machine learning algorithms can be clearly distinguished from traditional computer programs which follow a static set of predetermined instructions. A rule - based computer algorithm will always arrive at the same solution given a set of inputs, whereas training a machine learning algorithm multiple times will largely yield different solutions.

### 2.2 The AI lifecycle

- Problem understanding and risk considerations: Start by establishing a clear definition of the problem you intend to address. Gain a deep understanding of the demands and limitations within the problem domain while taking into account ethical considerations, fairness, transparency, and privacy. Seek additional guidance from the AI Assurance Framework [25] for further information.
- Data acquisition and pre - processing: Identify and collect pertinent data for your AI solution. Prioritize data preprocessing and cleansing to guarantee its quality and appropriateness for modeling purposes. Ensure strict adherence to relevant legal regulations, laws, and ethical guidelines.
- Additional AI techniques: Contemplate the inclusion of supplementary AI methods that extend beyond conventional machine learning, based on the specific needs of your solution. This may encompass the integration of techniques such as natural language processing (NLP), computer vision, knowledge representation, as well as inference and reasoning methods.
- Integration and System Design: Integrate machine learning models or AI components within a wider system or application, taking into account scalability, performance, and compatibility with existing infrastructure.
- User experience and interaction: Create the user interface and interaction components to ensure effortless user engagement and interaction with the AI product.
- Continuous monitoring and improvement: Establish systems for ongoing monitoring of the AI solution's performance, collecting user feedback, and iteratively enhancing the system in response to new data or evolving requirements.

### 2.3 AI Subfields

Fig 1 provides a visual framework for understanding the hierarchy of subfields within the expansive domain of Artificial Intelligence (AI). At the core of AI, it introduces four primary subfields: Generative AI, Machine Learning (ML), Natural Language Processing (NLP) and Computer Vision. Generative AI encompasses various facets, such as text, images, voice, video, and code generation by learning from data patterns, emphasizing its diverse content generation capabilities and its role in identifying anomalies in data. In contrast, Computer Vision encompasses Image Detection, Image Tracking, Image Reconstruction, Image Classification, Motion Detection, and Text recognition (ICR).

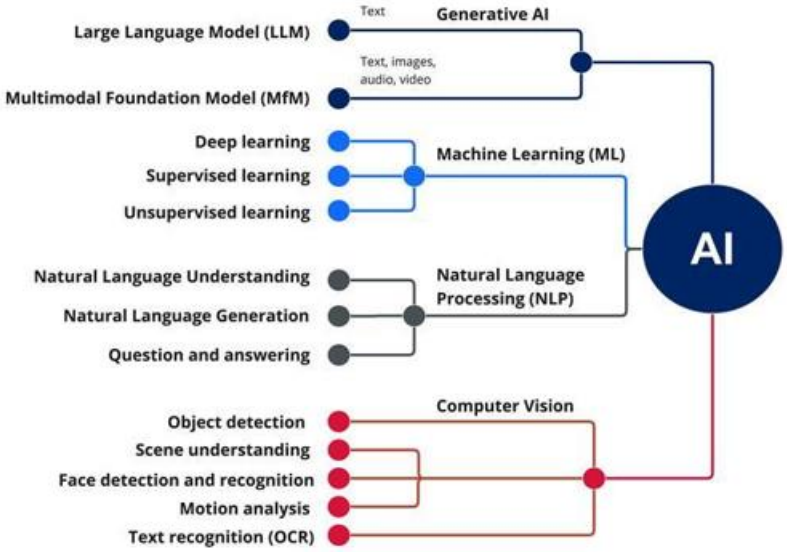


**Figure 3:** Various branches of AI

### 2.4 Artificial Intelligence in Banking

In the banking and finance sectors, AI offers multiple opportunities for optimizing processes, managing risks, and enhancing customer engagement. One of the key areas where AI demonstrates its potential is in data analysis. With its ability to process large volumes of structured and unstructured data, AI algorithms can identify patterns, trends, and anomalies that may go unnoticed by human analysts. This data - driven approach enhances decision - making, allowing banks and financial institutions to identify potential risks, predict market trends, and optimize investment strategies.

Artificial Intelligence in Banking accelerates digitization in end - to - end banking and finance processes. By implementing the power of data analytics, intelligent ML algorithms, and secure in - app integrations, AI applications optimize service quality and help companies identify and combat false transactions. Global spending on artificial intelligence is expected to reach $166 billion in 2023 (with banking one of the largest contributors by industry at about 13%), rising to about $450 billion by 2027, according to a report by International Data Corp. (IDC), a provider of technology market intelligence and advisory services.

Approximately 40% to 50% of banking and financial service providers now incorporate AI into their processes, leveraging the power of next - generation AI capabilities. Companies are convinced that AI represents the future of the banking sector, capable of executing a broad spectrum of operations more quickly, easily, and securely.

Predictive analytics, machine learning, and voice recognition tools significantly enhance the value of digital banking services. AI Chatbots, facial recognition banking apps, and fraud detection systems and applications are all a few best examples of AI in banking and finance industry.

The purpose of this review is to critically analyze the current state of AI applications in the banking and finance sector, identify existing challenges and barriers to implementation, and propose future research directions to maximize AIs potential in this field.

The below table 1 shows the various approaches that some of the banks have taken over last few years –

**Table 1:** Banks & Use cases

| Bank | *Use case* |
|---|---|
| Wells Fargo | The bank uses Dialogflow, Google's conversational AI to empower its virtual assistant, called Fargo. It also is using a large language model (LLM) to help clarify what information clients must provide to regulators. |
| Capital One | Capital One's Eno, the intelligent virtual assistant, is the best example of AI in personal banking. Besides Eno, Capital One also uses virtual card numbers to prevent credit card fraud. |
| Morgan Stanley | The wealth management division is creating a service that uses OpenAI's GPT - 4 technology, enabling employees to easily find important internal information. |
| Goldman Sachs | Its developers are experimenting and testing generative AI tools to assist with code writing and testing. |
| JP Morgan | Researchers at JPMorgan Chase have developed an early warning system using AI and deep learning techniques to detect malware, trojans, and phishing campaigns. Researchers say it takes around 101 days for a trojan to compromise company networks. |

**Figure 3:** Example of a figure caption. (*figure caption*)

Below is the list of top AI potential use cases for banking and financial sectors –

*a) Cybersecurity and Fraud Detection:*
Several digital transactions occur daily as users pay bills, withdraw money, deposit checks, and do much more via apps or online accounts. Fraud has consistently remained a significant concern for banks and financial institutions. Each year, they suffer significant financial losses, amounting to billions of dollars, due to fraudulent activities like identity theft, credit card fraud, and money laundering. In recent times, artificial intelligence (AI) is a potent tool in the fight against fraud. AI algorithms can analyze large amounts of data instantly, helping banks and financial institutions detect suspicious activities and prevent potential losses. The heightened understanding of fraud patterns equips machine learning models to identify suspicious activities with greater precision and efficiency. This translates into faster detection and prevention of fraudulent transactions, ultimately reducing the financial losses that institutions might otherwise face.

*b) Real - time transaction monitoring*
When it comes to transaction security, AI algorithms demonstrate exceptional proficiency in recognizing patterns in real - time and detecting anomalies. They meticulously examine transaction data to identify patterns that could indicate fraudulent actions. For example, the rapid occurrence of multiple transactions from different locations may raise suspicion and suggest an attempt to use a stolen credit card. Additionally, AI algorithms closely monitor spending habits, swiftly identifying abrupt increases in spending or purchases in unconventional categories as potential warning signs. Furthermore, they assess the temporal aspects of transactions, taking into account factors such as timing, frequency, and location to precisely pinpoint suspicious activities.

*c) Risk Management*
AI for risk management is one of the best applications of AI in banking. It is one of the significant advantages of AI - enabled smart banking services. For instance, checking financial status, document verification, and releasing loans are risk - related activities for bankers. The use of AI and machine learning in banking can tackle there intelligently. AI and machine learning in banking can do this task with more accuracy and privacy.

AI - based mobile banking applications easily financial activities and analyze the banking data of the borrower. It could help bankers to identify the risks in giving loans to them. In addition, using the AI - driven risk assessment process, bankers can analyze the borrower's behavior and thus can reduce the possibility of fraudulent acts.

*d) Enhanced Customer experience*
AI chatbots provide efficient first - level support by handling routine customer queries and concerns. They can promptly provide information on account balances, transaction history, and account details, freeing human customer service agents to focus on more complex issues. They provide near - instantaneous responses to customer queries by analyzing customer data, such as transaction history and spending patterns, to provide personalized recommendations to customers. Chatbots reduce waiting times and contribute to a more positive customer experience. Moreover, these chatbots are available round - the - clock, ensuring customers can access assistance and information whenever needed, even outside regular business hours. This availability enhances customer satisfaction and engagement.

*e) Advisory Services*
The growing enthusiasm for passive investment has spurred fintech companies to explore AI solutions. Advisory services revolve around delivering personalized recommendations aligned with individual investors' goals and risk preferences. Financial AI streamlines the investment process to the extent that investors only need to deposit funds into their accounts. The primary advantage of employing this tool is its capacity to enable individuals who may not be well - versed in finance to engage in investment activities. Succeeding in passive investment no longer necessitates conducting financial analyses. Additionally, it proves to be a cost - effective alternative for financial institutions compared to employing human asset managers.

*f) Regulatory Compliance*
Banking is one of the highly regulated sectors of the economy worldwide. Governments use their regulatory authority to ensure that banking customers are not using banks to

perpetrate financial crimes and that banks have acceptable risk profiles to avoid large - scale defaults.

Banks usually maintain an internal compliance team to deal with these problems, but these processes take a lot more time and require huge investments when done manually. The compliance regulations are also subject to frequent change, and banks need to update their processes and workflows following these regulations constantly.

AI and ML in banking can use deep learning and NLP to read new compliance requirements for financial institutions and improve their decision - making process. Even though AI in the banking sector can't replace compliance analysts, it can make their operations faster and more efficient.

*g) Customer segmentation*

AI enables customer segmentation in the banking sector by assessing creditworthiness. Higher credit score customers receive tailored loan offerings, such as lower interest rates or increased loan amounts, optimizing incentives for creditworthy individuals. Conversely, those with lower credit scores are presented with more conservative loan terms, enhancing risk management and aligning lending strategies with individual financial profiles. This customization improves precision in targeting, fostering a more personalized and efficient lending experience for diverse customer segments.

*h) Competitor Analysis*

Conducting competitor analysis within the banking and finance sector equips institutions with the tools to secure a strategic edge by efficiently handling extensive datasets. Machine learning algorithms thoroughly assess competitors' market standings, product portfolios, and customer behaviors, yielding invaluable insights. By analyzing sentiments on social media and news outlets, AI identifies emerging trends and public opinions, helping financial institutions quickly adapt to changing market dynamics. This data - centric approach elevates the quality of decision - making, fosters innovation, and positions organizations to proactively address competitive challenges in this rapidly evolving industry.

*i) AI - driven contract analysis*

AI - driven contract analysis is transforming the banking and finance sectors by automating and expediting the traditionally time - consuming process of contract review. Using advanced natural language processing (NLP) algorithms, AI systems can swiftly analyze complex legal documents, identifying key terms, risks, and obligations. This not only reduces the burden on legal teams but also enhances accuracy and ensures compliance with regulatory requirements. By harnessing AI for contract analysis, financial institutions can streamline operations, mitigate risks, and make more informed decisions, ultimately improving efficiency and regulatory adherence in the contract management lifecycle.

### 2.5 Hurdles to AI Implementation

a) **Lack of Quality Data:** Banks need structured and quality data for training and validation before deploying a full - scale AI - based banking solution. Quality data is required to ensure the algorithm applies to real - life situations. Data fuels AI and allow firms to scale their AI applications. Access to and quality of data remain key hurdles to AI implementation across all respondents, as does access to talent.
b) **Data Cost:** Issues with data quality may imply costly processing steps or, in the worst case, unusable datasets while access to data might be limited by organizations lacking infrastructure for collection, storage, and transfer.
c) **Human Talent:** Access to talent appears to be the most important hindrance for AI Leaders which implies that more sophisticated AI solutions demand different employee capabilities.
d) **Lack of confidence:** AI - based systems are widely applicable in decision - making processes as they eliminate errors and save time. However, they may follow biases learned from previous cases of poor human judgment. Minor inconsistencies in AI systems do not take much time to escalate and create large - scale problems, risking the bank's reputation and functioning.

## 3. Conclusion

In summary, AI presents significant opportunities for the banking and finance sector to improve efficiency, security, and customer engagement. Despite challenges such as data quality and the need for skilled personnel, the potential benefits make pursuing AI integration worthwhile. Future efforts should focus on overcoming these barriers to leverage AIs capabilities fully, ensuring a more innovative and customer - centric banking future

## References

[1] "The Fourth Industrial Revolution", "Klaus Schwab", [Online]. Availlable from: "https: //www.weforum. org/about/the - fourth - industrial - revolution - by - klaus - schwab".
[2] M. Porter, 1985. Competitive Advantage, Creating and Sustaining Superior Performance, The Free Press, New York.
[3] Porter, M.1980. Competitive Strategy: Techniques for Analyzing Industries and Competitors. Competitive Strategy, 1, p.396.
[4] Clemmer, Jim, 1990. The Three Rings of Perceived Value. The Canadian Manager.1; 15 (2): 12 - 15.
[5] S. Caner and F. Bhatti, "A conceptual framework on defining businesses strategy for artificial intelligence, " Contemp. Manage. Res., vol.16, no.3, pp.175–206, Sep.2020.
[6] J. Helm, A. Swiergosz, H. Haeberle, J. Karnuta, 2020, "Machine learning and AI: Definitions, Applications, and Future Directions. "
[7] S. Samoili, M. L. Cobo, B. Delipetrev, F. Martinez - Plumed, E. Gomez, and G. De Prato, "AI watch. Defining artificial intelligence 2.0. towards an operational definition and taxonomy of AI for the AI landscape, " JRC Res., Tech. Rep., JRC126426, 2021.
[8] R. Welsh, "Defining artificial intelligence, " SMPTE Motion Imag. J., vol.128, no.1, pp.26–32, Jan.2019.
[9] X. Hao, G. Zhang, and S. Ma, "Deep learning, " Int. J. Semantic Comput., vol.10, no.3, pp.417–439, 2016.
[10] M. Hussain, H. Al - Aqrabi, M. Munawar, and R. Hill, "Feature mapping for rice leaf defect detection based on

a custom convolutional architecture, " Foods, vol.11, no.23, p.3914, Dec.2022.
[11] "Digital. NSW", "NSW Artificial Intelligence Assurance Framework", [Online]. Availlable from: "https: //www.digital. nsw. gov. au/policy/artificial - intelligence/nsw - artificial - intelligence - assurance - framework"
[12] M. Pournader, H. Ghaderi, A. Hassanzadegan, and B. Fahimnia, 2021, "Artificial intelligence applications in supply chain management. "
[13] H. Min, 2010, "Artificial intelligence in supply chain management: theory and applications. International Journal of Logistics Research and Applications"
[14] Martinez - Barbera, H., & Herrero - Perez, D, "Development of A Flexible AGV for Flexible Manufacturing Systems, " Ind. Robot Int. J., vol.37, pp.459–468, 2010. Https: //Doi. Org/ 10.1108/01439911011063281
[15] Ellram, L. M., & Ueltschy Murfield, M. L, "Supply Chain Management in Industrial Marketing– Relationships Matter, " Industrial Marketing Management, vol.79, pp.36–45, 2019. [Online]. Availlable from: "Https: //Doi. Org/10.1016/J. Indmarman.2019.03.007"
[16] Treleaven, P., & Batrinca, B, "Algorithmic Regulation: Automating Financial Compliance Monitoring and Regulation Using AI and Blockchain, " Journal of Financial Transformation, vol.45, pp.14 - 21, 2017.
[17] Wamba, S. F., Bawack, R. E., Guthrie, C., Queiroz, M. M., & Carillo, K. D. A, "Are We Preparing for A Good AI Society? A Bibliometric Review and Research Agenda," Technological Forecasting & Social Change, 2020. DOI: 10.1016/J. Techfore.2020.120482
[18] "World Economic Forum", "University of Cambridge", "A Global AI in Financial Services Survey"., Jan.2020.
[19] Rekha, A. G., Abdulla, M. S., & Asharaf, S, "Artificial Intelligence Marketing: An Application of a Novel Lightly Trained Support Vector Data Description," J. Inf. Optim. Sci., vol.37, pp.681–691, 2016. [Online]. Availlable from: "Https: //Doi. Org/10.1080/02522667.2016.1191186"
[20] Defee, C. C., & Fugate, B. S, "Changing Perspective of Capabilities in the Dynamic Supply Chain Era," International Journal of Logistics Management, vol.21, no.2, pp.180 - 206, 2010.
[21] Ivanov, D., & Dolgui, A, "Viability of Intertwined Supply Networks: Extending the Supply Chain Resilience Angles Towards Survivability, A Position Paper Motivated by COVID - 19 Outbreak, International Journal of Production Research, vol.58, no.10, pp.2904 - 2915, 2020.
[22] Datta, P, "Supply Network Resilience: A Systematic Literature Review and Future Research," International Journal of Logistics Management, vol.28, no.4, pp.1387 - 1424, 2017.
[23] Sun, M., Ji, J., & Ampimah, B. C, "How to Implement Real - Time Pricing in China? A Solution Based on Power Credit Mechanism," Applied Energy, vol.231, pp.1007–1018, 2018. Https: // Doi. Org/10.1016/J. Apenergy.2018.09.086
[24] Baryannis, G., Validi, S., Dani, S., & Antoniou, G, "Supply Chain Risk Management and Artificial Intelligence: State of the Art and Future Research Directions," International Journal of Production Research, vol.57, no.7, pp.2179 - 2202, 2019.
[25] Huang, M. H., & Rust, R. T, "Engaged To A Robot? the Role of AI in Service, " Journal of Service Research, 2020. DOI: 10.1177/1094670520902266
[26] Kohtamäki, M.; Parida, V.; Patel, P. C.; Gebauer, H. The relationship between digitalization and servitization: The role of servitization in capturing the financial potential of digitalization. Technol. Forecast. Soc. Chang.2020, 151, 119804.
[27] Truant, E.; Broccardo, L.; Dana, L. - P. Digitalisation boosts company performance: An overview of Italian listed companies. Technol. Forecast. Soc. Chang.2021, 173, 121173.