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Roles of Artificial Intelligence and the Internet of Things (IoT) in the Project Management of Food Supply and Distribution

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Abstract: Recently, the food industry has faced numerous challenges such as rising demand, climate change, and the imperative to improve the quality and safety of food products. This research investigated the role of artificial intelligence (AI) and the Internet of Things (IoT) in managing food supply and distribution projects. The main objective of this study was to analyze how these technologies could be implemented to optimize the process of supply chain and enhance the efficiency and effectiveness in food distribution. Successful cases of technological implementation in the food industry highlighted the associated benefits and challenges of adopting AI and IoT. Ten critical factors influencing the roles of AI and IoT in food supply and distribution were identified and considered in the current study. Following a systematic coding process through meta-synthesis, concepts related to each factor were extracted from previous studies. Finally, expert opinions were gathered by a questionnaire survey whereas the Kappa index was calculated using SPSS software. The obtained value of 0.78 indicated a desirable agreement in the perspectives between researchers and experts. By leveraging AI, organizations are able to analyze big data, predict demand, optimize inventory, and reduce resource waste. Likewise, IoT, through connecting devices and sensors to the network, enables the collection of real-time data, which assists managers in making better decisions regarding the timing and location of food distribution.

Keywords: Artificial intelligence; Internet of Things; Project management; Supply; Distribution; Food industry

1 Introduction

In today's world, managing food supply and distribution projects has become one of the major challenges in the food industry due to supply chain complexities, demand fluctuations, and the need to maintain product quality and safety [1]. With the rising demand for fresh and high-quality products, optimizing supply and distribution processes has become increasingly important [2]. Moreover, lack of coordination between different stages of supply and distribution, insufficient and untimely information, and inefficiencies in demand forecasting can lead to resource wastage, increased costs, and reduced customer satisfaction [3]. In this regard, modern technologies such as AI and the IoT are recognized as key tools for improving efficiency and reducing costs in this industry [4]. Given these challenges, AI and IoT are considered effective solutions for enhancing the management of food supply and distribution projects [5–7]. AI, with its ability to analyze big data, apply machine learning, and perform predictive analytics, contributes to process optimization and intelligent decision-making [8–10]. On the other hand, IoT provides wireless connectivity and real-time data collection from devices and sensors, enabling precise monitoring of storage and transportation conditions. However, challenges such as high implementation costs, the need for proper infrastructure, and security concerns may hinder the full utilization of these technologies [11]. Considering these factors, the present study holds significant importance in food supply and distribution project management, as AI and IoT are regarded as transformative tools in the food industry [12]. With the continuous growth of population and the increasing demand for timely and high-quality food supply, optimizing these processes has become a necessity. The integration of AI and IoT can greatly enhance supply chain efficiency [13]. These technologies, by providing accurate analysis and intelligent forecasting, enable quick and effective decision-making. For instance, demand forecasting using AI algorithms can reduce resource waste and optimize inventory [14]. IoT enables close monitoring of transportation and storage conditions such as temperature, humidity, and environmental factors that directly impact food quality and safety. This helps prevent issues such as spoilage and reduced product quality. Rapid changes in demand and market conditions require flexibility and responsiveness [15]. AI supports managers in quickly adapting to market fluctuations by analyzing large datasets and identifying consumption patterns [16–19].

In today's competitive world, companies need to leverage modern technologies to enhance their competitive advantages. Research in this area can help identify best practices and strategies for using AI and IoT in supply and distribution project management, enabling companies to perform better in global markets. Moreover, given environmental challenges and the need for sustainable development, these technologies can contribute to reducing energy consumption and resource waste in supply and distribution processes.

In summary, addressing this topic not only helps improve food supply and distribution processes but also contributes to enhancing people's quality of life and ensuring food security. Hence, investigating the role of AI and IoT in managing food supply and distribution projects, along with identifying the challenges and opportunities they present, is essential for improving efficiency and service quality in the food industry.

2 Literature Review

In recent years, with the advancement of modern technologies, the food industry has been moving toward transformation and improvement of supply and distribution processes. AI and the IoT are recognized as two key technologies in this transformation. AI, with its capabilities in big data analysis and machine learning, helps organizations identify demand patterns and provide accurate predictions of consumer behavior. This enables managers to make better decisions regarding inventory management and product distribution [6].

On the other hand, IoT connects devices and sensors to networks, allowing real-time data collection from the supply chain. These data include information such as temperature, humidity, and the condition of products during transportation, which can help improve the quality and safety of food products [7].

Numerous studies have been conducted on the impact of AI and IoT on the food supply chain and distribution: Misra et al. [12] investigated the application of IoT in monitoring food transportation conditions. Findings showed that IoT improves food safety and quality while reducing costs and delivery times. Ben-Daya et al. [5] examined the role of AI in demand forecasting within the food supply chain. Results indicated that machine learning algorithms can reduce food waste and enhance efficiency. Singh et al. [19] explored the role of AI in inventory optimization for food supply chains, showing its potential to prevent stockouts and overstocking. Purnama and Sejati [15] studied the challenges of IoT implementation in the food sector, highlighting technical and economic barriers such as infrastructure needs and staff training. Gajić et al. [9] analyzed the combined use of AI and IoT in the food supply chain, demonstrating their contribution to better decision-making and increased transparency. Sharma and Shivandu [17] Investigated IoT in food product traceability, showing that it enables more accurate and timely tracking, reduces waste, and improves quality. Mu et al. [14] focused on AI in big data analytics for food supply chains, showing how advanced algorithms can identify consumption patterns and optimize processes. Halder et al. [11] explored the role of IoT in improving communication within food supply chains, highlighting its potential to enhance coordination between suppliers and distributors. Ali et al. [3] studied AI in enhancing food quality throughout the supply chain, demonstrating its ability to detect and prevent quality issues. Abdul-Yekeen et al. [1] discussed ethical and privacy concerns in applying AI and IoT in the food industry, stressing the need for proper policies to protect sensitive data.

According to above mentioned, previous studies indicate that AI and IoT, as core technologies, can optimize food supply and distribution chains. However, challenges such as high costs, the need for IT infrastructure, and data privacy issues remain. This body of literature provides the foundation for a more comprehensive investigation into the role of AI and IoT in food supply and distribution project management.

3 Methodology

The present research is applied in nature, as it seeks to provide practical solutions for improving food supply and distribution processes using AI and the IoT. It includes the development of a conceptual model, the design of intelligent systems, and the presentation of optimization strategies to help project managers make better decisions and enhance efficiency. In terms of approach, this study is qualitative. It focuses on an in-depth exploration of experiences, perspectives, and expert opinions regarding the use of AI and IoT in managing food supply and distribution projects. Such a qualitative inquiry may involve interviews, focus groups, and content analysis. The primary aim is to better understand the challenges, needs, and expectations of various stakeholders in this field. For data analysis, this study adopts the meta-study approach, which has been increasingly used in recent years to review and analyze past research. Meta-study involves an in-depth evaluation of research works in a specific field and consists of four domains: meta-method, meta-theory, meta-analysis, and meta-synthesis. In particular, this research applies qualitative meta-synthesis as its methodology. Meta-synthesis is a qualitative research technique aimed at integrating results and findings from multiple qualitative studies. Rather than simply summarizing, it systematically collects and interprets related studies to generate new insights, themes, and conceptual frameworks. By combining existing findings, it seeks to provide deeper interpretations and broader perspectives. One critical consideration in meta-synthesis is the number of studies. Since the goal is in-depth analysis rather than breadth, the number of studies should remain limited. In this research, fewer than 70 articles were included. The most credible meta-synthesis model, proposed by Sandelowski and Barroso (2007), has been adopted as the methodological framework.

To implement a case study research method, the following steps are usually followed:

1. Defining the research problem: Identifying and precisely stating the problem to be investigated.
2. Literature review: Reviewing sources and articles related to the research topic to better understand the context and background of the research.
3. Determining research objectives: Specifying the research objectives and questions to be answered.
4. Choosing a research method: Deciding on data collection methods (qualitative or quantitative) and the tools needed.
5. Data collection: Conducting interviews, questionnaires, or observations to gather the necessary information.
6. Data analysis: Using statistical or analytical methods to examine and analyze the collected data.
7. Conclusion: Extracting results from the data analysis and answering the research questions.

These steps can vary depending on the type of research and its context, but in general this process is commonly used in most research.

4 Findings

In the first step of the research, focusing on the research objective, we seek to answer the following question. What are the factors affecting the role of artificial intelligence and the Internet of Things in food supply and distribution projects? After determining the initial research question of the combined study, researchers set the primary thematic parameters of what? Population? (Who), when? And methodological (How?) for their search. These parameters constitute the inclusion criteria of a research project and become clear.

Table 1. Research thematic parameters

Parameter	Question
What? (Study question)	What are the factors affecting the role of artificial intelligence and the Internet of Things in food supply and distribution projects?
Who? (Study population)	ASCE and Taylor and Francis reputable scientific databases The target population of the study was determined to answer this question, the ASCE and Taylor Francis databases. The reason for choosing these databases was that the aforementioned databases contain the most important publications in the field of project management with a high impact factor and are considered a reference database in the field of specialized research on construction project management. The time scope of the targeted research in this study also includes the period from 2000 to 2025.
When? (Time frame)	Articles and studies from 2000 to 2025.
How? (Method of data collection)	Documentary analysis of secondary data.

Table 2. Data storage for foreign resources

Foreign Dataset
https://www.tandfonline.com/
https://www.asce.org/

Table 3. Keywords

Search Keywords
Artificial Intelligence
Internet of Things
Project Management

In the present study, based on the determination of thematic parameters (Table 1), primary articles indexed in reputable databases (Table 2) have been identified. The keywords determined for searching the articles are presented in Table 3.

Table 4. Input and output of research criteria

Input Criteria	Output Criteria
Entry criteria (article selection)	Articles published in journals with an impact factor of less than 4 were excluded.
Articles with the most relevant content related articles by purpose	Articles with a different purpose than the present study were excluded.
Articles by title	Articles that did not include sufficient information on the research objectives.
Articles based on qualitative assessment via CASP	Articles based on qualitative assessment through CASP.

Table 5. Initial extracted codes and related resources

Row	Cause	Description	Resources
1	Quality data	Accurate and timely data are key factors in the performance of AI and IoT. Data quality has a direct impact on the accuracy of predictions and analyses.	[1–6, 8, 10]
2	IT infrastructure	The existence of appropriate IT infrastructure, including fast and stable communication networks, servers and storage systems, is essential for the effective implementation of IoT and AI.	[20–23]
3	Security systems	Data and information security in the supply chain is very important. The use of security protocols and encryption technologies can help protect data.	[24]
4	Organizational culture	Organizational culture and acceptance of new technologies among employees and managers can have a great impact on the success of AI and IoT implementation. Training and awareness are essential in this regard.	[10–15, 18]
5	Stakeholder collaboration	Effective collaboration and communication between all stakeholders, including suppliers, distributors and retailers, can help improve processes and optimize the supply chain.	[12, 15]
6	Laws and regulations	The existence of appropriate laws and regulations in the field of using data and new technologies can help facilitate or limit the implementation of AI and IoT.	[20–23]
7	Technology development	Technological advances in the field of AI, machine learning and the Internet of Things can help improve the performance and efficiency of systems.	[24]
8	Advanced analytics	The use of advanced algorithms and analytical models to process data and extract patterns can help improve decision-making and predictions.	[10–15, 18]
9	Risk management	Identifying and managing risks associated with the implementation of new technologies, including financial, security and operational risks, can have a great impact on the success of projects.	[12, 15]
10	Financial support	Access to sufficient financial resources to invest in new technologies and the necessary infrastructure are among the factors affecting the success of AI and IoT implementation.	[8, 10, 15]

Then, quality articles that are appropriate to the research objective are selected for information retrieval. The researcher selected the input and output criteria for selecting the articles. The input and output criteria are determined in Table 4. After selecting and eliminating texts that are appropriate to the determined criteria, the validity of the articles was evaluated through the CASP validation method. To prevent bias, the validation of the articles was performed by another researcher.

In the final screening, the articles were evaluated based on the CASP evaluation method, and finally 28 articles were selected as final articles to combine the results and achieve appropriate indicators to answer the research question. Then, to extract information from the articles to achieve the research objective. This research seeks to identify factors affecting the explanation of the role of artificial intelligence and the Internet of Things. Therefore, the factors identified in the selected articles must be extracted. Therefore, by carefully studying the selected articles, the factors affecting project management based on artificial intelligence and the Internet of Things were extracted in each article. Table 5 shows the results of the fourth step of the meta-analysis.

In the Meta synthesis method, the ultimate goal is to create a coherent understanding of the extracted codes. Meta synthesis is a systematic review approach that clarifies the discrete and ambiguous results of a subject area by combining and analyzing. Meta synthesis is an approach to creating a new pattern from existing refinements. In this study, all the extracted codes from the previous step are combined and categorized by revisiting the concepts of analysis, and the recoding process is carried out with the intention of integrating the concepts. Table 6 shows how the analysis and combination of the Meta synthesis method are carried out by classifying the concepts and factors identified.

Table 6. Results of analysis

Criteria	Index	Open-Code	Frequently
Causes related to the role of artificial intelligence	Quality Data	Inventory Level	18
		Demand Level	14
	Technology Development	Progress in Deep Learning and Neural Network Development	20
	Advanced Analytics	Trend Identification	6
	Risk Management	System Intrusion and Unauthorized Access to Data	6
Causes related to the role of the Internet of Things	IT Infrastructure	Storage systems	20
	Security Systems	Firewalls	9
		Antivirus software	5
		Intrusion detection systems and encryption protocols	14
	Organizational Culture	Learning and strengthening the acceptance of positive changes	14
	Stakeholder Collaboration	Developing relationships between suppliers and other chain stakeholders	5
		Process improvement	14
	Laws and Regulations	Environmental requirements	5
		Information security	5
	Financial Support	Budgeting	5

Finally, in order to control the quality and reliability of the findings of the present study, in addition to utilizing the critical assessment skills program, Cohen's Kappa index was used to calculate the agreement between the researcher and the expert. The Kappa index fluctuates between zero and one, and the closer the value of the index is to one, the greater the agreement between the parties. After receiving the expert opinions through a questionnaire prepared for this purpose, the Kappa index was calculated using SPSS software and the result was 0.78, which indicated a favorable agreement between the researcher and the expert opinions.

5 Conclusion

In today's world, the food industry faces multiple challenges, including increasing demand, climate change, resource constraints, and the need to improve the quality and safety of food products. In this regard, new technologies such as AI and the IoT are recognized as key tools for optimizing the supply and distribution processes of food products. With the ability to analyze big data and learn from past patterns, AI can help predict demand, optimize inventory, and reduce resource waste. On the other hand, the IoT allows for the collection of real-time data from the supply chain by connecting devices and sensors to the network. This data can help managers make better decisions about when and where to distribute products, thereby increasing the efficiency and effectiveness of the supply chain.

Research in this area can examine how these technologies can be implemented in the management of food supply and distribution projects, identify the benefits and challenges associated with them, and analyze the impact of these technologies on the quality and safety of food products. Also, this research can help examine successful cases of implementing AI and IoT in the food industry and provide solutions to improve processes and increase productivity in this area. Using AI, organizations are able to analyze big data and extract useful patterns for forecasting demand, optimizing inventory, and reducing resource waste. Also, by providing the ability to collect real-time data from the supply chain, the IoT allows managers to quickly respond to market changes and customer needs. The combination of these two technologies can lead to the creation of a smart and efficient supply chain in which decisions are made based on accurate and timely data. In addition, these technologies can help improve the quality of food products, increase transparency in supply and distribution processes, and reduce costs.

Finally, to optimally utilize these technologies, organizations should pay attention to investing in IT infrastructure, training employees, and creating an appropriate organizational culture. With this approach, greater success can be achieved in managing food supply and distribution projects and help meet the growing needs of society in a sustainable and efficient manner.

Given the increasing importance of food security and the need to optimize the supply chain, this research can serve as a valuable resource for researchers, managers, and policymakers in improving the efficiency and sustainability of the food industry. For further research, the importance of each of the causes related to AI and IoT identified in this research can be ranked using multi-criteria decision-making methods. In addition, using structural equations, the impact of each of the coded concepts based on the identified causes for artificial intelligence and the Internet of Things in the management of food supply and distribution projects can be calculated.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The author declares no conflict of interest.

References

[1] A. M. Abdul-Yekeen, O. Rasaq, M. A. Ayinla, A. Sikiru, V. Kujore, and T. O. Agboola, "Utilizing the internet of things (IoT), artificial intelligence, machine learning, and vehicle telematics for sustainable growth in small and medium firms (SMEs)," *J. Artif. Intell. Gen. Sci.*, vol. 5, no. 1, pp. 237–274, 2024. https://doi.org/10.60087/jaigs.v5i1.197

[2] N. Adamashvili, N. Zhizhilashvili, and C. Tricase, "The integration of the internet of things, artificial intelligence, and blockchain technology for advancing the wine supply chain," *Computers*, vol. 13, no. 3, p. 72, 2024. https://doi.org/10.3390/computers13030072

[3] G. Ali, M. M. Mijwil, I. Adamopoulos, and J. Ayad, "Leveraging the internet of things, remote sensing, and artificial intelligence for sustainable forest management," *Babylonian J. Internet Things*, vol. 2025, pp. 1–65, 2025. https://doi.org/10.58496/BJIoT/2025/001

[4] Z. Bekkali and R. Lasri, "The internet of things, applications and technologies used: The case of blockchain technology in smart agriculture," *J. Glob. Innov. Agric. Sci.*, vol. 13, pp. 771–782, 2025. https://doi.org/10.22194/JGIAS/25.1583

[5] M. Ben-Daya, E. Hassini, Z. Bahroun, and B. H. Banimfreg, "The role of internet of things in food supply chain quality management: A review," *Qual. Manag. J.*, vol. 28, no. 1, pp. 17–40, 2020. https://doi.org/10.1080/10686967.2020.1838978

[6] M. N. M. Bhutta and M. Ahmad, "Secure identification, traceability and real-time tracking of agricultural food supply during transportation using internet of things," *IEEE Access*, vol. 9, pp. 65 660–65 675, 2021. https://doi.org/10.1109/ACCESS.2021.3076373

[7] T. Bidyalakshmi, B. Jyoti, S. M. Mansuri, A. Srivastava, D. Mohapatra, Y. B. Kalnar, and N. Indore, "Application of artificial intelligence in food processing: Current status and future prospects," *Food Eng. Rev.*, vol. 17, no. 1, pp. 27–54, 2025. https://doi.org/10.1007/s12393-024-09386-2

[8] F. Fuentes-Peñailillo, K. Gutter, R. Vega, and G. C. Silva, "Transformative technologies in digital agriculture: Leveraging internet of things, remote sensing, and artificial intelligence for smart crop management," *J. Sens. Actuator Netw.*, vol. 13, no. 4, p. 39, 2024. https://doi.org/10.3390/jsan13040039

[9] T. Gajić, M. D. Petrović, A. M. Pešić, M. Conić, and N. Gligorijević, "Innovative approaches in hotel management: Integrating artificial intelligence (AI) and the internet of things (IoT) to enhance operational efficiency and sustainability," *Sustainability*, vol. 16, no. 17, p. 7279, 2024. https://doi.org/10.3390/su16177279

[10] G. X. Xiao, N. Samian, M. F. M. Faizal, M. A. Z. M. As'ad, M. F. M. Fadzil, A. Abdullah, and I. Hermadi, "A framework for blockchain and internet of things integration in improving food security in the food supply chain," *J. Adv. Res. Appl. Sci. Eng. Technol.*, vol. 34, no. 1, pp. 24–37, 2024. https://doi.org/10.37934/araset.34.1.2437

[11] S. Halder, M. R. Islam, Q. Mamun, A. Mahboubi, P. Walsh, and M. Z. Islam, "A comprehensive survey on AI-enabled secure social industrial internet of things in the Agri-food supply chain," *Smart Agric. Technol.*, p. 100902, 2025. https://doi.org/10.1016/j.atech.2025.100902

[12] N. N. Misra, Y. Dixit, A. Al-Mallahi, M. S. Bhullar, R. Upadhyay, and A. Martynenko, "IoT, big data, and artificial intelligence in agriculture and food industry," *IEEE Internet Things J.*, vol. 9, no. 9, pp. 6305–6324, 2020. https://doi.org/10.1109/JIOT.2020.2998584

[13] A. Morchid, Z. Oughannou, R. El Alami, H. Qjidaa, M. O. Jamil, and H. M. Khalid, "Integrated internet of things (IoT) solutions for early fire detection in smart agriculture," *Results Eng.*, vol. 24, p. 103392, 2024. https://doi.org/10.1016/j.rineng.2024.103392

[14] W. J. Mu, G. A. Kleter, Y. Bouzembrak, E. Dupouy, L. J. Frewer, F. N. Radwan Al Natour, and H. J. P. Marvin, "Making food systems more resilient to food safety risks by including artificial intelligence, big data, and internet of things into food safety early warning and emerging risk identification tools," *Compr. Rev. Food Sci. Food Saf.*, vol. 23, no. 1, p. e13296, 2024. https://doi.org/10.1111/1541-4337.13296

[15] S. Purnama and W. Sejati, "Internet of Things, big data, and artificial intelligence in the food and agriculture sector," *Int. Trans. Artif. Intell.*, vol. 1, no. 2, pp. 156–174, 2023.

[16] K. Radhika, S. Mohammed, S. K. Tadepalli, and K. Puvvula, "Food supply chain management by leveraging AI, IoT, and blockchain technologies," in *The Future of Agriculture: IoT, AI and Blockchain Technology for Sustainable Farming*. Bentham Science Publishers, 2024, pp. 119–141. https://doi.org/10.2174/97898152743491240101

[17] K. Sharma and S. K. Shivandu, "Integrating artificial intelligence and Internet of Things (IoT) for enhanced crop monitoring and management in precision agriculture," *Sens. Int.*, vol. 5, p. 100292, 2024. https://doi.org/10.1016/j.sintl.2024.100292

[18] S. Sharma, V. K. Gahlawat, K. Rahul, R. S. Mor, and M. Malik, "Sustainable innovations in the food industry through artificial intelligence and big data analytics," *Logistics*, vol. 5, no. 4, p. 66, 2021. https://doi.org/10.3390/logistics5040066

[19] S. Singh, A. Gupta, and A. P. Shukla, "Optimizing supply chain through internet of things (IoT) and artificial intelligence (AI)," in *2021 International Conference on Technological Advancements and Innovations (ICTAI)*, Tashkent, Uzbekistan, 2021, pp. 257–263. https://doi.org/10.1109/ICTAI53825.2021.9673265

[20] M. Abolghasemian, A. G. Kanafi, and M. Daneshmand-Mehr, "Simulation-based multiobjective optimization of open-pit mine haulage system: A modified-NBI method and meta modeling approach," *Complexity*, vol. 2022, no. 1, p. 3540736, 2022. https://doi.org/10.1155/2022/3540736

[21] M. Abolghasemian, A. G. Kanai, and M. Daneshmandmehr, "A two-phase simulation-based optimization of hauling system in open-pit mine," *Iran. J. Manag. Stud.*, vol. 13, no. 4, pp. 705–732, 2020. https://doi.org/10.22059/ijms.2020.294809.673898

[22] P. Kaur, M. Chand, D. Kaur, and M. Rakshit, "Inventory modeling for deteriorating items with stock dependent demand, shortages and inflation under two-warehouse storage management system in a fuzzy environment," *Complexity Anal. Appl.*, vol. 1, no. 1, pp. 14–24, 2024. https://doi.org/10.48314/caa.v1i1.19

[23] C. J. Okafor, "Geometric analysis of gutter bracket using different NX siemens solver for linear and nonlinear investigation," *Complexity Anal. Appl.*, vol. 2, no. 1, pp. 1–11, 2025. https://doi.org/10.48314/caa.v2i1.35

[24] M. Abolghasemian and H. Darabi, "Simulation based optimization of haulage system of an open-pit mine: Meta modeling approach," *Organ. Resour. Manag. Res.*, vol. 8, no. 2, pp. 1–17, 2018.