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OPTIMIZATION TECHNIQUES IN PERISHABLE FOOD SUPPLY CHAINS: A SYSTEMATIC LITERATURE REVIEW AND COMPARATIVE ANALYSIS

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ABSTRACT

The complexity of perishable food supply chains must be addressed with optimisation techniques in order to increase productivity, reduce waste, and improve overall performance. In the context of perishable food supply chains, this systematic literature review and comparative analysis thoroughly evaluate a wide range of optimisation techniques. Various techniques, including linear programming, metaheuristics, dynamic programming, and simulation optimisation are categorised, assessed, and compared in this paper. This review offers insightful information on the benefits, drawbacks, and applicability of various optimisation techniques. Researchers and practitioners looking to choose the best methods for enhancing perishable food supply chains will find this study to be a useful resource.

Keywords:
Optimization Techniques, Perishable Food Supply Chains, Linear Programming, Dynamic Programming, Simulation Optimization.

1. Introduction

Perishable food supply chains are essential for ensuring that consumers receive fresh, highquality foods in a timely manner. Due to the perishable nature of the goods these supply chains handle, it is imperative that they are managed effectively as they are subject to a number of difficulties. Fresh produce, dairy products, and meats are examples of perishable foods that have short shelf lives and are extremely sensitive to variables like temperature changes, humidity, and storage techniques. If these supply chains are not optimised, there could be significant losses in terms of money as well as wasted food and tainted food safety. (Riad et al., 2018).

The efficient and quick delivery of perishable goods has become a bigger concern for the global food industry in recent years. Perishable goods, which have a limited shelf life and are susceptible to spoilage, quality loss, and wastage while being transported and stored, include fruits, vegetables, dairy products, and meats. It is imperative that companies, decision-makers, and researchers focus on figuring out how to optimise the food supply chain for perishable goods (Haji et al., 2020a).

Food products known as perishable commodities have a short shelf life and demand specialised handling and transportation to preserve their quality and freshness (Kayikci et al., 2022a). These commodities provide distinct issues throughout the supply chain due to their inherent nature. (Haji et al., 2020b, Jouzdani & Govindan, 2021a). Some of the key challenges include:

- Shelf-life management: Because perishable commodities have a limited shelf life, they must be moved, stored, and distributed right away to prevent waste and deterioration.
- Temperature control: Maintaining the quality of perishable goods depends heavily on temperature. To stop deterioration, the right temperature must be maintained during both shipment and storage.
- Lack of real-time visibility in many food supply chains makes it difficult to monitor and track the status of perishable goods as they travel from the farm to the consumer.
- Seasonal demand variations: Because demand for some perishable goods might change dramatically with the passing of the year and particular occasions, there may be an imbalance between supply and demand.
- The perishable nature of the commodities: Unlike non-perishable products, perishable goods cannot be stored for an extended amount of time and must be moved with careful planning and scheduling.

Minimising food waste, satisfying customer needs, guaranteeing food safety, and improving the overall effectiveness of the food supply chain all depend on addressing these issues.

In recent years, there has been an increase in interest in perishable food supply chain optimisation because of its potential to increase operational effectiveness, cut waste, and boost sustainability in general (Kasar et al., 2025). Effective optimisation can result in better resource utilisation, lower energy use, lower transportation costs, and ultimately, the delivery of fresher goods to customers (Nicolas Denis et al., 2020). Additionally, optimising perishable food supply chains become an essential priority for both industry stakeholders and policymakers in an era where food security and environmental concerns are top priorities.

Perishable food supply chains can methodically address their complex problems by using optimisation techniques. Managing inventory to prevent spoilage, choosing the best transportation routes, balancing production with demand patterns, and ensuring appropriate storage conditions are a few of these difficulties (Lejarza & Baldea, 2022). In order to make well-informed decisions that take into account a variety of factors and constraints, supply chain managers can use optimisation techniques (Kasar et al., 2025). The supply chain functions better overall and waste is reduced as a result of their ability to balance price, delivery time, and quality maintenance (Lemma et al., 2014).

The primary goal of this paper is to conduct an exhaustive and methodical review of the literature on the various optimisation strategies used in perishable food supply chains. This review aims to provide a clear understanding of the state of the art in optimisation strategies for addressing the challenges specific to perishable food products by analysing and synthesising the body of existing knowledge. This research will also conduct a comparative analysis of the various optimisation techniques, evaluating their benefits and drawbacks in relation to perishable food supply chains. Heuristic algorithms, simulation-based methods, mathematical modelling strategies, and cutting-edge technologies like machine learning and artificial intelligence are among the optimisation techniques that this review covers. Even though optimisation strategies are the main topic, the review will also go over recent developments and possible directions for further investigation in this area

2. Research Methodology

The systematic literature review was carried out using a strict and structured methodology to guarantee the accuracy and dependability of the review process. Data extraction, synthesis, and analysis are just a few of the clearly defined stages in the systematic review process, which also includes problem formulation, literature search, study selection, and data extraction (Tranfield et al., 2003). This method makes it possible to find and include pertinent studies while reducing bias and guaranteeing a transparent and reproducible methodology. The three stages listed below make up the review procedure used in our study.

- Searching/Exploring
- Screening/Filtering
- Synthesis/Deductive Reasoning

2.1 Searching

To find the most relevant sources, a methodical and thorough search strategy was created. As one of the largest index and citation databases with a broad coverage of top-notch scientific journals, conference proceedings, and books, the search was conducted in the title, abstract, and keywords in the papers from the Scopus database. (Baas et al., 2020). The search terms included variations of "perishable food supply chains," "optimization techniques," "mathematical modelling," "heuristic algorithms," "simulation-based optimization," "machine learning," and "case studies." Boolean operators (AND, OR) were used to refine the search and ensure a balance between specificity and inclusivity.

2.2 Screening/Filtering

A two-step screening procedure was used after the initial pool of studies was found. The first step involved reviewing study titles and abstracts to weed out studies that obviously did not meet the inclusion criteria. The second step involved determining the eligibility of full-text articles of potentially pertinent studies. Key details, including the study's objectives, optimisation techniques employed, perishable food products taken into consideration, research methodologies, and key findings, were captured through systematic data extraction. 674 documents were found by the search process that matched the search criteria. Due to the possibility of duplicate articles being produced by keyword combinations, the search results were first examined to remove duplicate records.

A total of 614 documents were left after duplicates were removed. To further weed out articles that did not meet the inclusion and exclusion criteria listed in Table 1 below, the titles and abstracts of the articles on the list were examined. Following an extensive scan of their contents, irrelevant articles were further filtered out. In order to find pertinent articles for the review that the search process had missed, references contained within the chosen papers were also looked through. A comprehensive analysis of 66 articles was made possible thanks to the methodical search and screening procedure. Figure 1 below provides an overview of the article choice and screening procedure.

Table 1: Choosing Relative Studies: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
• Articles addressing optimization techniques in the context of perishable food supply chains. • Articles published in peer-reviewed journals. • Articles written in English. • Articles published within a specified timeframe (2013-2023).	• Articles not directly related to optimization techniques or perishable food supply chains. • Articles unpublished or lacked peer review. • Review articles • Articles not available in the English language.

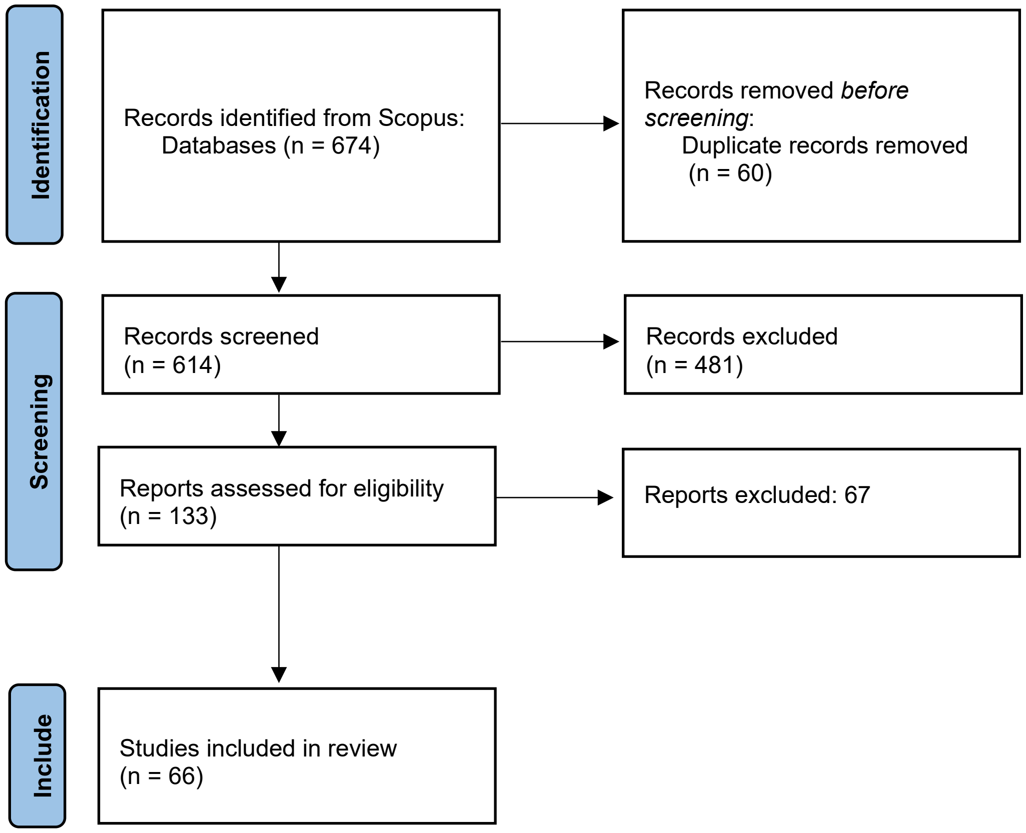

Figure 1: Article Selection and Screening Process

2.3 Synthesis/Deductive Reasoning

Synthesis of the extracted data involved organizing studies into thematic categories based on the optimization techniques employed. A narrative synthesis approach was used to summarize and discuss the findings of the selected studies within each category. This synthesis allowed for the identification of trends, patterns, and insights related to the application of optimization techniques in perishable food supply chains. The framework listed below was used to thoroughly analyse and summarise the chosen articles:

- Distribution of articles
- Research Areas in PFSC
- Type of Research

2.3.1 Distribution of articles:

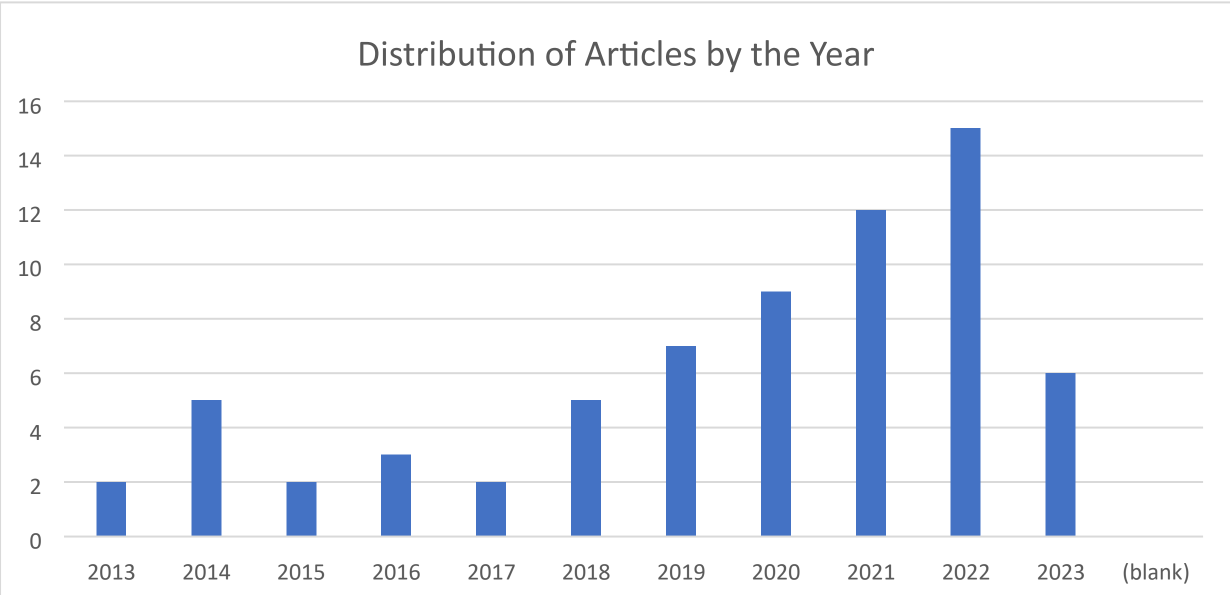

Figure 2. Article Distribution by Year of Publication

2.3.2 Research Areas in PFSC:

Table 2. Article Distribution by Research Areas

Research Areas	% Contribution
Cost optimization	1.52
Demand Forecasting	10.61
Industry 4.0	4.55
Inventory Management	51.52
Dynamic Pricing	4.55
Logistics Design	3.03
Production Planning	1.52
Sustainability	1.52
Transportation	1.52
Warehouse management	1.52
Pricing and inventory control	1.52

2.3.3 Types of Research:

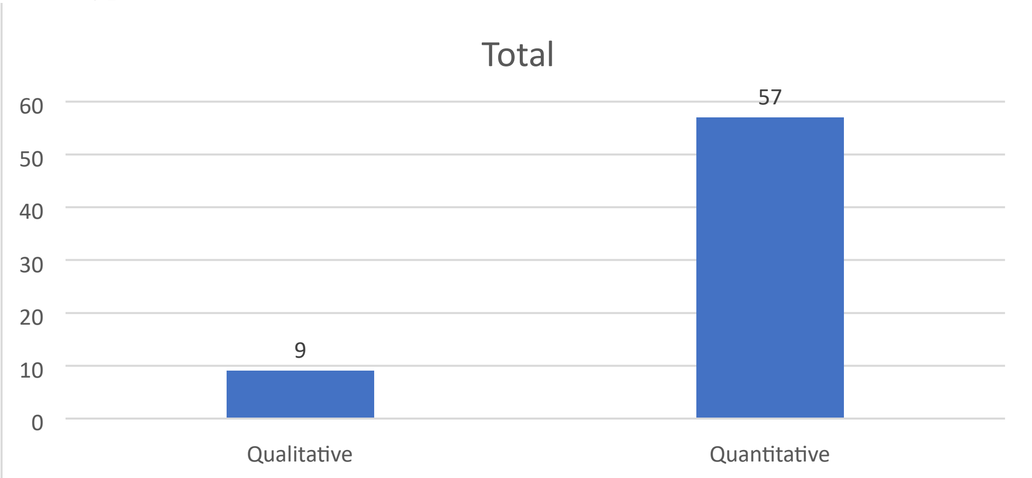

Figure 3. Distribution of Articles by Type of Research

3. Significant findings from the Literature

The optimisation of PFSC has become a prominent area of interest for academics, researchers, and practitioners, it can be seen from the reviewed articles. Only a few of the studies concentrated on implementing industry 4.0 technologies for concurrently addressing multiple challenges, even though the majority of them addressed inventory management and demand forecasting within PFSCs. The sub-sections that follow offer an overview of the key conclusions with regard to each of the issues covered by PFSCs.

3.1 Challenges and Optimization Methods:

The table 3 provides a concise overview of each challenge and the corresponding optimization methods that can be employed to address them in perishable food supply chains. The various challenges

Table 3. Challenges and Optimization Methods.

Challenges	Optimization Methods
1. Shelf-Life Management:	- Dynamic Pricing Optimization - Inventory Routing Optimization
2. Demand Uncertainty:	- Demand Forecasting Models - Safety Stock Optimization
3. Temperature Control and Quality Preservation:	- Cold Chain Optimization - Quality Monitoring Systems
4. Short Lead Times:	- Route Optimization - Just-in-Time (JIT) Strategies
5. Perishable Inventory Management:	- Optimal Replenishment Policies - Inventory Optimization Software
6. Supplier Variability:	- Supplier Collaboration and Negotiation - Multi-Sourcing Strategies
7. Regulatory Compliance:	- Compliance Monitoring Systems - Traceability and Recall Management

3.2 Optimization Techniques in Perishable Food Supply Chains

At its core, optimization involves finding the best possible solution among a set of feasible alternatives. In the context of supply chains, optimization techniques are systematic approaches that help decision-makers determine the optimal values of variables while adhering to constraints. These techniques aim to maximize or minimize specific objectives, considering various constraints and limitations imposed by the supply chain environment.

Optimization techniques can be categorized into various groups each suited to different problem types and complexities:

3.2.1 *Mathematical Modelling Approaches:* Mathematical models represent supply chain scenarios using equations and inequalities. Linear programming, integer programming, and nonlinear programming are mathematical techniques used to optimize decisions regarding production, inventory, and transportation.

Table 4. Comparison of Various Mathematical Modelling approaches.

Article	Main Techniques Explored	Key Insights
(Gailan Qasem et al., 2023)	Base stock-Constant Work-in-Process (BCONWIP), Simulationoptimization	- B-CONWIP policy yields the lowest total cost, outperforming existing basestock policies, even with higher ordering costs.
(Abbasian et al., 2023)	Dynamic Pricing Strategy, Hybrid Method (Heuristic Multi-Choice Goal Programming and Utility Function Genetics Algorithm)	- Dynamic pricing strategy enhances network resiliency and sustainability, achieving cost and CO2 emission reduction.
(Mousavi et al., 2022)	Stochastic Mathematical Model, Five-Phase Matheuristic Algorithm	- Integration of production, inventory, and routing decisions for perishable products with uncertain demand, leading to reduced waste and costs.
(M. Zhang et al., 2022)	Newsvendor Model, Analysis of Overconfident Behavior	- Overconfident retailers' impacts on optimal pricing and order quantity decisions and profits, with insights for adjustment based on retailer behavior.
(Sajadi & Ahmadi, 2022) (2022)	Integrated Mathematical Model, Genetic Algorithm (GA), Vibration Damping Optimization (VDO) Algorithm	- An integrated approach for assortment planning, shelf space allocation, and inventory management to maximize sales and retail profit, validated with real case study and metaheuristic solvers.

3.2.2 *Heuristic and Metaheuristic Methods:* Heuristics are practical problem-solving strategies that offer quick, though not necessarily optimal, solutions. Metaheuristics, such as genetic algorithms and simulated annealing, guide the search for optimal solutions by exploring large solution spaces efficiently.

Table 5. Comparison of various Heuristic and Metaheuristic Methods

Article	**Main Techniques Explored**	**Key Insights**
(Sharifi et al., 2021)	Lot Sizing Model, Sampling Plan, Destructive Testing, Inspection Errors	- Created a perishable inventory policy that works best for a system that produces both perfect and flawed items. - Included inspection and destructive testing errors to the model. - Developed a straightforward algorithm to determine the ideal order quantity. - Conducted a sensitivity analysis and used numerical examples to validate the model.
(Nakandala et al., 2016)	Genetic Algorithms (GA), Fuzzy Genetic Algorithms (FGA), Improved Simulated Annealing (SA) with Repair Mechanism	- Created a total cost model for transporting fresh food that took into account all of the costs involved. - Used a repair mechanism to show how to apply GA, FGA, and SA for cost optimisation and quality maintenance. - FGA performed better in terms of cost optimisation than GA and SA. - Offered a practical strategy for supply chain and logistics decision-making in the fresh food sector while keeping product quality above acceptable thresholds.

3.2.3 *Simulation-Based Optimization:* Simulation-based optimization relies on computer simulations to analyse different scenarios and make decisions. Simulations replicate real-world processes, enabling supply chain managers to optimize complex systems while accounting for uncertainties.

Table 6. Comparison of Simulation-Based Optimization Methods

Article	Main Techniques Explored	Key Insights
(Abbas et al., 2022)	Simulation Optimization, TimeSaving Measurement	- Implementation of One Belt One Road (OBOR) supply chain for perishable products leads to improved quality, trading, and significant timesaving. - Fast train supply chain offers even higher quality and trading potential.
(Piva et al., 2022)	Simulation Modeling, Reordering Policies	- Simulation model evaluates traditional reordering policies for perishable items, optimizing the reorder process and comparing with current performance.
(Yang et al., 2020)	Deterioration Control, Inventory Management	- Deterioration rate as controllable variable, proposal of freshnesspreservation effort (FPE) indicator, investigation of optimal order quantity, numerical analysis, and managerial implications.
(Y. Zhang et al., 2021)	Inventory Management, Pricing, Discrete-Event Simulation	- Development of simulation model for perishable inventory management considering agents, rent spaces, risk aversion, and pricing. - Optimization of inventory scheme and pricing strategy for improved profits.
(Zhu & Krikke, 2020)	PFSC Management, Simulation Dynamics	- Application of system dynamics simulation to study a cheese supply chain, identification of feedback loops, analysis of endogenous demand generation, suggestions for information sharing and decisionmaking strategies.

3.2.4 *Machine Learning and Artificial Intelligence Techniques:* Machine-learning techniques leverage data to learn patterns and make predictions or decisions. Artificial intelligence techniques, like neural networks and decision trees, simulate intelligent human behaviour to handle complex decision-making tasks.

Table 7. Comparison of Machine Learning and Artificial Intelligence Techniques Methods

Article	**Main Techniques Explored**	**Key Insights**
(Nassibi et al., 2023)	Support Vector Machine (SVM) Long Short-Term Memory (LSTM)	- LSTM outperformed SVM in forecasting quarterly time series, aiding accurate demand prediction in volatile markets.
(Kavya B et al., 2022)	Random Forest Regression	- An ensemble approach handles fluctuations in demand, especially for shortshelf-life and seasonal products, improving inventory management.
(De Moor et al., 2022)	Deep Q-Network Algorithm	- Transfer learning from heuristics stabilizes training and enhances performance in complex inventory control for perishable goods.
(Kumar et al., 2021)	Random Forest Regression	- Predicting weekly order proposals for perishable goods using Random Forest regression, accounting for supplier delivery times and order constraints.
(Bardeji et al., 2020)	MLP Neural Network, GA, ICA	- Combining neural networks with GA and ICA improves inventory cost efficiency and forecast accuracy for perishable drugs.
(Dellino et al., 2018)	ARIMA, ARIMAX, Transfer Function Models	- Dynamic selection of forecasting models based on price impact, using Sequential Parameter Optimization, enhances order planning and sales forecasts.

3.2.5 *Multi-Objective Optimization Approaches:* Multi-objective optimization addresses scenarios with conflicting objectives. Pareto optimization and evolutionary algorithms provide solutions that represent trade-offs between objectives, allowing decision-makers to select the most suitable compromise.

Table 8. Comparison of Multi-Objective Optimization Approaches Methods

Article	**Main Techniques Explored**	**Key Insights**
(Abbas et al., 2023)	Multi-objective simulation model	- Created a multi-objective conceptual simulation model to optimise the perishable food supply chain's cost, environmental impact, quality, safety, and transportation facility. showed the potential for reducing environmental and social effects without compromising cost, as well as the effect of emphasising cost factors on environmental and social impacts.
(Dai et al., 2022)	Mathematical modeling, Optimization algorithms	- Two multi-echelon inventory models with price- and stock-dependent demand were proposed for perishable goods. - Created algorithms to determine the best replenishment cycle, frequency, and volume. - Conducted computational experiments and sensitivity analyses to learn more about how parameters affect the best possible solutions.
(Duong et al., 2015)	Multi-criteria approach, Inventory theory	- Developed a multi-criteria inventory management system for products that are both perishable and interchangeable. - Added performance indicators like Fill Rate, Average Inventory, and Order Rate Variance Ratio. - Added multiple period lifetime, positive lead time, and required level of customer service for perishable goods to the inventory theory.

(Duong et al., 2020)	Multimethodological approach	- Created a framework for making decisions regarding the non-financial replenishment of perishable health products. - Integrated data envelopment analysis (DEA), analytical hierarchy process (AHP), and discrete event simulation (DES) methodologies. - Showed that it was possible to define a replenishment policy, enhance hospital performance, and do so at a low cost by using non-financial measures.
(Govindan et al., 2014)	Multi-objective optimization, Hybrid approach	- Used a two-echelon multiple-vehicle locationrouting problem with time windows (2ELRPTW) to address sustainability in perishable food supply chain network design. - a multi-objective hybrid approach (MHPV) was created that combines the multi-objective particle swarm optimisation (MOPSO) and customised multi-objective variable neighbourhood search (AMOVNS) algorithms.
(Jouzdani & Govindan, 2021b)	Multi-objective mathematical programming	- Created a multi-objective mathematical programming model for the network design of a sustainable perishable food supply chain. - Product lifetime variations and perishability effects on vehicle refrigerator usage were explicitly modelled. - Analysed the relationships and interactions between sustainability's economic, environmental, and social facets.
(Liu et al., 2021)	Integrated locationinventoryrouting model	- Developed a location-inventory-routing model that is integrated for perishable goods. - Took into account economic cost, product freshness, and carbon emissions. In order to maximise economic cost, carbon emissions, and product freshness, a multiobjective planning model was developed. - Used a case study to demonstrate the proposed model's efficacy.

(Mohammadi et al., 2023)	Multi-objective mixed-integer non-linear model	- Created a multi-objective model with pricedependent demand and deterioration rates for a sustainable supply chain of perishable goods. - Recognised as producers, retailers, distribution centres, and suppliers. - Sought to maximise profit, accomplish social goals, and reduce overall costs and environmental effects. - Sensitivity analyses and a case study were used to validate the model.
(Verdouw et al., 2016)	Virtualization, Internet of Things	- Examined how Internet of Things (IoT) technologies can be used to virtualize food supply chains. - Developed a design for an information system architecture that would support virtual supply chain management. - Applied the architecture to a case study involving a fish supply chain. - Discussed how IoT can improve simulation, decision support, and supply chain optimisation using operational data.

The multifaceted nature of modern supply chains demands a diverse set of optimization techniques. These techniques empower supply chain professionals to tackle challenges effectively, adapt to uncertainties, and drive efficiency in the face of complexity. In the subsequent sections, we will delve into these techniques, exploring their applications and significance in the context of supply chain optimization.

4. Future Trends and Research Directions

This section on future trends and research directions aims to provide a roadmap for potential avenues of exploration in optimizing perishable food supply chains. By addressing emerging trends, identifying gaps, and suggesting areas for further investigation, you can contribute to the ongoing advancement of this field.

4.1 **Emerging Trends:** The emerging trends in the area of optimisation of PFSC are mentioned in the subsection,

- Digitalization and IoT Integration: Investigate how the integration of Internet of Things (IoT) devices and sensors can enhance real-time monitoring of temperature, humidity, and other environmental factors (Moudoud et al., 2019; Riad et al., 2018).

Explore how this data can be used to make dynamic decisions in optimizing transportation routes, storage conditions, and order fulfilment.

- Data Analytics and Predictive Models: Examine the potential of advanced data analytics and predictive models to enhance demand forecasting accuracy. Investigate machine-learning techniques that can analyse historical sales data, market trends, and even external factors like weather to improve supply chain planning (Seyedan & Mafakheri, 2020).
- Block chain Technology for Traceability: Explore how block chain technology can be employed to ensure traceability and transparency in perishable food supply chains. Investigate its potential to track the origin, handling, and storage conditions of products to improve quality control and consumer trust (Khanna et al., 2022; Varriale et al., 2021).
- Collaborative Networks and Sharing Economy: Study the emerging trend of collaborative networks and sharing economy models in perishable food supply chains. Analyse how multiple stakeholders, including producers, distributors, retailers, and even end consumers, can collaborate to optimize the flow of perishable products (Vila-Lopez & Küster-Boluda, 2022).

4.2 The Potential Research Gaps:

- Multi-Objective Optimization: Investigate how multi-objective optimization can be applied to balance conflicting goals, such as minimizing costs while maximizing sustainability and minimizing waste (Orjuela-Castro et al., 2022). Develop models that consider economic, environmental, and social factors simultaneously.
- Supply Chain Resilience: Explore how optimization techniques can be adapted to enhance the resilience of perishable food supply chains against disruptions, whether they arise from natural disasters, supply chain disruptions, or other unforeseen events (Davis et al., 2021; Zamani et al., 2022).
- Dynamic Decision Making: Study approaches that allow for dynamic decisionmaking based on real-time information. Investigate how optimization models can adjust supply chain operations in response to sudden changes in demand, supply, or external factors (Kayikci et al., 2022b).

- Sustainable Practices: Examine ways to integrate sustainability considerations into optimization models. This could involve optimizing for reduced carbon emissions, energy consumption, and other environmental impacts throughout the supply chain (Jouzdani & Govindan, 2021b).

4.3 Areas for Further Investigation:

- Personalized and Localized Supply Chains: Investigate how optimisation techniques can be used to build more individualised and localised supply chains that would enable consumers to access fresh, locally sourced perishable goods with the least amount of waste.
- Circular Economy Approaches: Investigate into the ways that perishable food supply chains can incorporate circular economy principles. Examine ways to maximise product returns, recycling, and repurposing to cut down on waste in general.
- Ethical Considerations and Fairness: Investigate the ethical implications of perishable food supply chain optimisation. Examine how these methods can encourage equitable resource distribution and reduce food waste while taking social and economic equity into account.
- Human-centred Optimization: Investigate how optimisation strategies can be created with a human-centered focus, taking into account the welfare of supply chain operations workers and making sure that optimisation efforts do not adversely affect their way of life.

5. Conclusion

In conclusion, this systematic literature review explored optimisation methods in depth with regard to perishable food supply chains, placing special emphasis on the contribution of data analytics to efficiency improvement, waste reduction, and sustainability. The results of this review have illuminated the complex world of optimisation strategies and their management of perishable food products.

The review showed the variety of optimisation techniques, from mathematical models to simulation-based methods, heuristic algorithms, and even sophisticated data analytics techniques. Each technique category displayed distinctive advantages and disadvantages, frequently making it more appropriate for particular supply chain stages. The comparative analysis carried out in this study offered insightful information on the trade-offs and applicability of various techniques, guiding both practitioners and researchers.

The undisputed benefit of optimisation in enhancing supply chain operations is at the heart of these findings. Stakeholders can lessen the difficulties posed by the perishable products' sensitivity to time and the complexity of their handling by utilising optimisation techniques. Furthermore, the incorporation of data analytics emerged as a crucial facilitator, enabling predictive insights to support well-informed decision-making.

However, the review also identified a few issues that demand attention. The difficulty of optimising perishable food supply chains is highlighted by the computational complexity of some techniques, data quality issues, and the need for flexible strategies in the face of changing demand patterns.

This systematic literature review's contribution to the field combines a wide range of studies and provides a synthesised understanding of the uses of optimisation techniques and their results in perishable food supply chains. This review lays the groundwork for future investigations into these problems by highlighting gaps, trends, and difficulties.

Finally, improving the operational efficiency of perishable food supply chains through the use of data analytics-driven techniques is a practical way to advance the sustainability of food distribution. The knowledge gained from this review will act as a compass for practitioners and researchers navigating the complexities of supply chain optimisation in the context of perishable goods as the perishable food industry continues to develop.

The optimisation journey within perishable food supply chains holds the promise of unlocking cutting-edge solutions that minimise waste, enhance profitability, and ensure the availability of high-quality products to consumers while reducing the environmental impact. This will be accomplished through the collaboration of academia, industry, and technology.

The potential held by optimisation in perishable food supply chains is barely scratched by the investigation carried out in this review. We hope that this endeavour encourages additional research, collaboration, and innovation, accelerating the development of sustainable and effective practises in this important area.

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