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Review

Third-Party Reverse Logistics Selection: A Literature Review

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Abstract: *Background*: This literature review delves into the concept of 'Third-party Reverse Logistics selection', focusing on its process and functionality using deterministic and uncertain decision-making models. In an increasingly globalized world, Reverse Logistics (RL) plays a vital role in optimizing supply chain management, reducing waste, and achieving sustainability objectives. Deterministic decision-making models employ predefined criteria and variables, utilizing mathematical algorithms to assess factors such as cost, reliability, and capacity across various geographical regions. Uncertain decision-making models, on the other hand, incorporate the unpredictability of real-world scenarios by considering the uncertainties and consequences of decision making and choices based on incomplete information, ambiguity, unreliability, and the option for multiple probable outcomes. *Methods*: Through an examination of 41 peer-reviewed journal publications between the years 2020 and 2023, this review paper explores these concepts and problem domains within three categories: Literature Reviews (LR), Deterministic Decision-Making (DDM) models, and Uncertain Decision-Making (UDM) models. *Results*: In this paper, observations and future research directions are discussed. *Conclusions*: This paper provides a comprehensive review of third-party reverse logistics selection papers.

Keywords: reverse logistics; third-party selection; sustainability; green logistics; decision-making models

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1. Introduction

In recent years, there have been emerging and significant challenges to businesses using, and the management of, Reverse Logistics (RL), where the growth in e-commerce and online retailing businesses has prioritized an increased emphasis on sustainable growth. In recent times, the increased focus on sustainable development and creating an efficient circular economy has created a responsibility for companies and third-party selectors to prioritize the entire lifecycle of their manufactured products [1,2]. The responsibility refers to a streamlined process of maximizing value recovery of End-Of-Life (EOL) products through efficient designing, operating, and process controlling and creating an interchangeable flow of products between customers, suppliers, and manufacturers, while minimizing the environmental impacts by encouraging cautious recycling and ensuring proper disposing of non-recyclable products. [3]. Over many decades of development of RL, there has been the deployment of effective frameworks and models to address the practical scenario and complexities of the RL process as many organizations and manufacturers are striving for better supply chain operations to meet the responsibilities of sustainable growth.

RL is an essential type of supply chain that can reduce a lot of waste generated from the disposition of products. Sustainable growth and RL help achieve efficient remanufacturing processes and play pivotal roles in having closed-loop supply chains, stimulating the recovery and recycling of products and reducing harmful wastes. This inadvertently involves sustainable growth and sets a positive notion socially, environmentally, and economically [4]. While many traditional third-party RLs are selected based on cost, the integration of social, environmental, and economic considerations in the decision-making processes of RL has proven to generate a new leap in revenue streams, while receiving tax-free incentives from governments, receiving subsidies, and finding more cost-saving opportunities [5]. However, many challenges are associated with RL, and it becomes an increasingly challenging objective to incorporate sustainable growth. This means that sustainable growth must adhere to strict regulatory policies and legislations as environmental, economic, and social concerns are critical and can differ based on the influence of geopolitics, region, and demographics [6].

To tackle the challenges related to sustainability and RL, it can be beneficial to assign third-party reverse logistics providers, as the logistics of return flow requires an infrastructure specialized with systems, decision-making models, algorithms, and equipment that can process the flow of RL efficiently. Many industries may not possess the technical expertise to manage a diverse supply chain that can incorporate a sustainable RL, and hence it is beneficial to select third-party RL providers that can tackle the sophisticated responsibility of backward flows of products. Outsourcing such tasks saves industries extra resources to implement a system to save money on infrastructure and reduce any extra complexities to incorporate a new system. Because of the above points, it is valuable to analyze the third-party reverse logistics selection papers in a literature review paper and discuss future research directions. It is noticeable that the previous literature review papers in this area are old, and their taxonomies are different from our paper. The main objectives of this paper are to analyze third-party reverse logistics selection papers and provide related observations and find future research directions. The research questions are as follows: (a) What is the problem domain in this area? (b) What techniques have been used in this research topic? (c) What observations and insights can be obtained from reviewing the papers in this field?

This literature review paper provides a comprehensive overview of scholarly works and research conducted in the field of RL focusing on third-party RL selection. Many factors influencing the selection of third-party RL such as methodologies and decision-making models are addressed in this survey. The search strategy was to find peer-reviewed journal papers about third-party RL selection. We selected the papers that proposed multi-criteria decision-making models and methods in this field. Forty-one peer-reviewed papers found by searching through widely acknowledged publishers and their websites such as Elsevier (ScienceDirect), Taylor & Francis, and Google Scholar were reviewed. One of the main research contributions of this paper is selecting recent papers, from 2020 to 2023 (unlike the other papers in this field). First, we found related papers published in 2023 and 2022, and we analyzed them. They were not enough to find valuable insights. So, we expanded the research to 2021 and 2020. After analyzing them, we noticed that we could obtain some valuable observations and insights. Another main research contribution of this paper is analyzing recent papers based on types of decision-making techniques and sources of uncertainty. Other papers have not considered these points. In addition, the taxonomy of this paper is new, and it is not like other literature review papers in this area. The "Third-Party Reverse Logistics Selection" topic is the major term in this literature review paper, which was used as a keyword to find journal publications from 2020 to the present. We used Third-Party Reverse Logistics Selection, Third-Party Reverse Logistics + Selection, Reverse Logistics, and Third-Party Selection to search the papers. To extract the data and synthesize key findings, techniques, and results, some sections were created based on the taxonomy. These sections include some tables such as problem domain and techniques. Then, the papers were categorized in those tables. We assessed the quality of the selected articles. We evaluated the rigor of the research methods used in every study and their relevance to the topic. The taxonomy, observations and related recommendations, and conclusions are discussed in the next sections.

2. Taxonomy

Two areas of research were identified to categorize the literature review survey in this paper. The first key area is the problem domain and the relevant references related to the topic, and the second one is based on the decision-making models that have been utilized in the field of operations research. We created this taxonomy based on the types of papers in the field of third-party reverse logistics selection, after finding and reading several articles on this subject. This taxonomy is useful to analyze the 'Third-Party Reverse Logistics Selection' problem from conceptual and mathematical standpoints.

2.1. Problem Domain

Table 1 comprises the problem domain and the related references based on Literature Reviews (LR), Deterministic Decision-Making (DDM) models, and Uncertain Decision-Making (UDM) models, which are three subsections of the problem domain in this study. These categories will help us analyze the papers carefully.

Table 1. Problem domain and related references.

Problem Domain	References
Literature Reviews (LR) (9)	Aguezzoul [1], Zhang et al. [7], Abid and Mhada [8], Ni et al. [9], Wijewickrama et al. [10], Chen et al. [11], Dabees et al. [12], Sar and Ghadimi [13], Trang and Li [14]
Deterministic Decision-Making (DDM) models (16)	Budak [15], Xing et al. [16], Zarbakhshnia et al. [17], Abdel-Basset et al. [18], Jauhar et al. [19], Mishra and Rani [20], Sarabi and Darestani [21], Bali et al. [22], Gholizadeh et al. [23], Matsui [24], Panghal et al. [25], Singh et al. [26], Wu et al. [27], Kannan et al. [28], Kilic et al. [29], Nosrati-Abarghooee et al. [30]
Uncertain Decision-Making (UDM) models (16)	Dutta et al. [31], Govindan and Gholizadeh [32], Gu et al. [33], Qian et al. [34], Sharma et al. [35], Sharma and Darbari [36], Stekelorum et al. [37], Wang et al. [38], Chen et al. [39], Pourmehdi et al. [40], Mishra et al. [41], Mohammadkhani and Mousavi [42], Qureshi [43], Song et al. [44], Du [45], Reddy et al. [5]

2.1.1. Literature Reviews

Many authors have published literature review papers in the academic field of supply chain management and operations research, but there are only a handful of authors who have specifically written papers related to RL through third-party selection. Aguezzoul [1] published a literature review paper about Third-Party Reverse Logistics (3PRL) providers, highlighting the criteria and methods used in the decision-making process. Sixty-seven articles published between 1994 and 2013 were mentioned in that paper, with specific context related to factors such as region, industry, and third-party logistics activities. There are 11 key criteria for this 3PRL selection, with factors such as cost, relationship, services, and quality related to 3PRL. Multi-Criteria Decision-Making (MCDM) techniques, statistical approaches, hybrid methods, and mathematical programming were discussed in that paper.

Most specifically, Zhang et al. [7] reviewed the details of RL supplier selection. This literature review article presents 41 articles published between 2008 and 2020, proposing a three-stage decision-making framework for RL supplier selection. They highlighted findings including the widespread and prominent use of MCDM methods, understanding the scope of RL supplier selection, sustainability in their process approach, and using innovative Artificial Intelligence (AI) methods. Further research and gaps in the field were highlighted as well.

Regarding the literature view paper published by Abid and Mhada [8], their study most specifically revolves around simulation optimization models applied in RL. Since decision-making models are among the deciding factors of selection to understand complex and uncertainty issues, the authors explored the study of simulation-based optimization techniques to find available resources in their literature reviews, such as various research design and methodologies used in RL literature. They explored different areas of RL and where it can be implemented.

Ni et al. [9] analyzed 162 papers between 1998 and 2001 in their literature survey to identify six key areas of RL related to collecting, assembling, remanufacturing, recycling, and disposing of EOL electronic products or E-waste. They found unique areas of research related to RL such as legislation and policies related to the logistics selection, RL network design solutions, RL systems evaluation and frameworks, and consumer E-waste return behaviors. These areas were conceptualized and constructed into a framework to explore the limitations of RL logistics and narrow the research gaps for future research agendas. In the literature survey paper written by Wijewickrama et al. [10], the authors focused on 89 papers between 2000 and 2019, using several informative analysis methods. That paper is about Information Sharing (IS) in a Reverse Logistics Supply Chain (RLSC) of Demolition Waste (DW). It details the complex nature of the supply chain that IS in RLSC faces in DW. It highlights the need for a collaborative network, facilities by public and private institutions, and government facilities to improve the complex nature of this RL. A conceptual framework with decision-making methods was proposed to guide organizations to formulate information.

Sar and Ghadami [13] focused on variants for vehicle routing problems in RL. They took information from 109 relevant articles. They covered modeling approaches, solution methods, and environmental and social sustainability. While, in the most recent literature review by Trang and Li [14], they have laid out the offering insights given by academics and practitioners regarding Reverse Supply Chains (RSC) for waste management involving vehicles that have reached their end of life. Using May-rings models and PRISMA 2020, they selected 151 papers out of 10,140 papers related to the topic and categorized the contents based on the stages, types, countries, and stakeholders. Models such as Mixed-Integer Linear Programming (MILP) and Analytic Hierarchy Process (AHP) were used to make decisions for certain RSC management.

2.1.2. Deterministic Decision-Making Models

A deterministic decision-making model is a structured model where the outcomes are determined by a pre-defined set of inputs, where certain limitations for data are set in place. This decision-making model does not have any source of variability or uncertainty, provided the inputs and conditions for the model are always predictable, consistent, and real. Decision-making models, which are deterministic, are not affected by variable factors, as most factors and equations related to the model are well defined with certain conditions. However, implementing such a model in real-life scenarios can be challenging as it does not account for the probable and complex causes in a real-life decision. Regarding our findings for Third-Party Logistics (3PL) selection for RL, the decision-making model may involve factors such as residual costs, refurbishment costs, transportation costs, quality and quantity of a service or product, and environmental considerations.

In the paper written by Jauhar et al. [19], the decision-making model implemented is a combination of Data Envelopment Analysis (DEA) and Differential Evolution (DE) algorithm. The goal was to understand the challenges of selecting third-party RL partners to assign orders for End-Of-Life (EOL) cellphone products. These techniques are used in two phases where the DEA was utilized to figure out the efficiency of the inputs and outputs at the same time, while the second phase used the efficiency data to evaluate the order allocation through multi-objective models. These deterministic models help select 3PRL providers and how to effectively allocate them. Mishra and Rani [20] considered an integrated approach by using Combined Compromise Solution (CoCoSo) and Criteria

Importance Through Intercriteria Correlation (CRITIC) to evaluate a decision-making problem related to sustainable third-party reverse logistics providers for the Indian electronics industry. The CoCoSo approach in this scenario found a 'compromising' solution to tackle conflicting objectives in a deterministic manner, whereas CRITIC was used to measure the weights of criteria based on their importance and priority.

Singh et al. [26] described the use of a deterministic MCDM model for examining the performance of third-party service providers. These models are MOORA and COPRA models, called 'Multi-Objective Optimization based on Ratio Analysis' and 'Complex Proportional Assessment' models, respectively. These models were applied to evaluate the operational, financial, and integrated performances of 3PL service providers, providing deterministic performance measures. Nosrati-Abarghooee et al. [30] proposed a multi-objective model for a healthcare system to manage waste. They also applied the Monte Carlo simulation technique to analyze the results. They solved the model using a goal programming approach.

2.1.3. Uncertain Decision-Making Models

Uncertain decision-making models are models for making decisions when the outcomes are uncertain. The complexities of real-world situations where information is unclear, uncertain, and based on probabilities can be addressed with a structured approach to the uncertain decision-making model. Potential outcomes and choices can be recognized through the model by incorporating its associated probabilities.

In the paper written by Govindan and Gholizadeh [32], the uncertain decision-making model is based around a scenario-based decision-making model, which focuses on the real-life complexities of creating an adaptable ELV in Iran. To encompass actual and uncertain decision-making models, the Cross-Entropy (CE) algorithm was utilized for robust optimization of the RL network. It enabled a sustainable approach to be taken by decision-makers to minimize the total costs of environmental and social implications.

The uncertain decision-making model in the paper written by Qureshi [43] was used to determine the process of evaluating and selecting Third-Party Logistics Service Providers (3PLSP) for a strategic supply chain advantage. Fuzzy-based Analytic Hierarchy Process (AHP) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) were used to choose the most suitable 3PLSP. These models can come in handy in situations where there is uncertainty about outcomes and preferences to multiple criteria and objectives. Song et al. [44] focused on a combination of multiple intuitionistic fuzzy MCDM methods for the selection of Third-Party Reverse Logistics Service Providers (3PRLPs). The authors mentioned that decision-makers can have subjective and objective preferences for their system, so the 3PRLP selection involves multiple criteria and varying forms of processes that involve uncertainty in criteria evaluation, weighting, and combination.

Based on the papers explained and all the other papers that incorporate the use of uncertain decision-making models, those models always address the complexities of real-life decision-making scenarios. They effectively allocate resources, handle costs, and respond to market competitions, reinforcing flexible strategies and decision making in dynamic supply chain environments. Table 2 contains extensive information regarding uncertainty sources that are present in some applications of decision-making processes and models in this field. Data/Information and expert opinion are important sources of uncertainty in this area.

Table 2. The references and uncertainty sources.

Source of Uncertainty	References
Data/Information and evaluation performance (17)	Zarbakhshnia et al. [17], Abdel-Basset et al. [18], Dutta et al. [31], Govindan and Gholizadeh [32], Jauhar et al. [19], Ni et al. [9], Qian et al. [34], Sarabi and Darestani [21], Sharma et al. [35], Stekelorum et al. [37], Wang et al. [38], Mishra et al. [41], Singh et al. [26], Song et al. [44], Qureshi [43], Wu et al. [27], Du [45]
Expert Opinion (11)	Zarbakhshnia et al. [17], Sarabi and Darestani [21], Sharma and Darbari [36], Gu et al. [33], Wang et al. [38], Bali et al. [22], Mishra et al. [41], Pourmehdi et al. [40], Qureshi [43], Song et al. [44], Dabees et al. [12]
Resources and Cost (4)	Sharma and Darbari [36], Stekelorum et al. [37], Gholizadeh et al. [23], Panghal et al. [25]
Technological Infrastructure (6)	Xing et al. [16], Dutta et al. [31], Gu et al. [33], Panghal et al. [25], Kilic et al. [29], Trang and Li [14]
Regulatory Policies (3)	Gu et al. [33], Kannan et al. [28], Trang and Li [14]
Demand (4)	Gholizadeh et al. [23], Reddy et al. [5], Qureshi [43], Trang and Li [14]

Sources of uncertainty in many different criteria lie in the application of decision-making models, resolving and creating assumptions for concepts within the context of real-world scenarios. Uncertainty is defined as the lack of knowledge about the probabilities of the future state of events created from singular or multiple undefined sources [46]. Various factors can affect the outcomes of models and analysis (whether it be certain or uncertain). Therefore, some common sources of uncertainty in decision-making models may include incomplete information and ambiguity, subjectivity, variability and complexity, and simplification of certain models because of future uncertainties, assumptions, and risks. Human errors and other external factors can be big sources of uncertainty in many decision-making models.

In this study, different sources of uncertainty were discovered when considering several research papers related to third-party reverse logistics selection. They include as follows:

Data/information and evaluation performance: Decision making relies on data that are available, reliable, and accessible to work with. Sometimes, these data can appear incomplete, inaccurate, or outdated for the specific problem. Uncertain conclusions or evaluations can arise from this missing information.

Expert opinion can play a crucial role in decision making as it involves multiple people making several choices. When there is a need to make complex choices, judgments can vary from person to person, as the expertise and thought processes of people can be biased and subjective. This leads to a source of uncertainty as it degrades expert quality, decreasing the power of collective expertise and reducing the convergence of a decision-making process [47].

Cost and resources have a profound hand in determining certain decision-making processes. In RL, if the resources needed to undergo the logistics process are insufficient according to a certain decision-making model, then they may become a loss initiative for companies to sustain such a logistics process. Hence, it is important to reduce any sources of uncertainty for resources and costs to give a clear picture of the capacity that can be sustained for the selectors. A resource impact model can better understand the relationship between decision making and resources, enhancing decision support systems [48].

Some of the least prominent sources of uncertainty found in this literature review study are technological infrastructure, regulatory policies, and demand.

2.2. Decision-Making Techniques

The decision-making techniques used in many relevant papers are categorized in Table 3, where the references are paired with the techniques used in the decision-making process. Some decision-making methods and techniques used are unique to certain problem domains and criteria, while some authors have utilized hybrid techniques to solve complex problems. Hybrid techniques have become very popular recently.

Table 3. Arrangement of the papers according to the operations research techniques.

Techniques	References
Agglomerative Hierarchical Clustering	Dutta et al. [31]
Analytic Hierarchy Process (AHP)	Trang and Li [14], Abdel-Basset et al. [18], Qureshi [43]
Analytical Network Process (ANP)	Gu et al. [33], Song et al. [44]
Cross-Entropy (CE) Algorithm	Govindan and Gholizadeh [32], Gholizadeh et al. [23]
Combined Compromise Solution (CoCoSo)	Mishra and Rani [20]
Combination Evaluation	Song et al. [44]
Evaluation Based on Distance from Average Solution (EDAS) method	Mishra et al. [41]
Fermatean Fuzzy Set	Mishra et al. [41]
Fuzzy AHP (Analytical Hierarchy Process)	Zarbakhshnia et al. [17], Wang et al. [38]
Fuzzy Interpretive Structural Modeling (ISM)	Sharma and Darbari [36]
Fuzzy Set Qualitative Comparative Analysis (fsQCA)	Stekelorum et al. [37]
Fuzzy Matrix Impact of Cross Multiplication Applied to Classification (MICMAC) Analysis	Sharma and Darbari [36]
Fuzzy Measure/Fuzzy Logic	Dutta et al. [31], Qureshi [43], Dabees et al. [12]
Fuzzy Integral	Dutta et al. [31], Dabees et al. [12]
FUZZY TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution)	Sharma et al. [35]
Fuzzy Analytical Network Process (FANP)	Pourmehdi et al. [40]
Fuzzy Best–Worst Method	Sarabi and Darestani [21]
Fuzzy Goal Programming Method	Nosrati-Abarghooee et al. [30]
Fuzzy Visekriterijumsko Kompromisno Rangiranje (in Serbian) (F-VIKOR)	Wang et al. [38]
Game Theory	Matsui [24]
Graph Theory and Mixed Approach (GTMA)	Bali et al. [22]
Genetic Algorithm	Gholizadeh et al. [23]
Grey-DEMATEL (The Decision-Making Trial and Evaluation Laboratory)	Dutta et al. [31]
Grey Relational Analysis	Dabees et al. [12],
Hierarchical and Interactive Quality Function Development (QFD)	Dabees et al. [12]
Improved Benders Decomposition (IBD)	Reddy et al. [5]
Inter-Criteria Correlation (CRITIC) method	Mohammadkhani and Mousavi [42], Mishra et al. [41]
Interpretive Structure Modeling (ISM)	Pourmehdi et al. [40], Wu et al. [27]
Improved Augmented Epsilon Constraint (AUGMECON-2)	Budak [15]
Intuitionistic Fuzzy Entropy	Song et al. [44]
Kendell Compatibility Test	Song et al. [44]
Kano Model–Decision-Making Trial and Evaluation Laboratory–Technique for Order of Preference by Similarity to Ideal Solution (Kano-DEMATEL-TOPSIS) 'Hybrid' Model	Du [45]
Explanatory Factor Analysis (EFA)	Panghal et al. [25]
Linguistic Pythagorean hesitant Fuzzy MULTIMOORA	Chen et al. [39], Sarabi and Darestani [21]
Linguistic Pythagorean Hesitant Fuzzy Set (LPHFS)	Chen et al. [39]

Table 3. *Cont.*

Techniques	References
Matrice d'Impacts Croisés Multiplication Appliquée à un Classement (MICMAC)	Wu et al. [27]
Monte Carlo Simulation Method	Nosrati-Abarghooee et al. [30]
Multi-Attribute Group Decision Making (MAGDM)	Mohammadkhani and Mousavi [42], Zarbakhshnia et al. [17]
Mixed-Integer Linear Programming (MILP)	Kilic et al. [29], Nosrati-Abarghooee et al. [30]
Mixed-Integer Non-Linear Programming (MINLP)	Gholizadeh et al. [23]
Multi-Objective Mixed-Integer Programming (MOMIP)	Kannan et al. [28]
Multi-Period Multi-Objective Mixed-Integer Nonlinear Programming (MP-MOMINLP)	Budak [15]
Multi-Objective Optimization based on Ratio Analysis coupled with Complex Proportional Assessment in Multi-Criteria Decision Making (MOORA-COPRA MCDM)	Singh et al. [26]
Multi-Objective Optimization based on Ratio Analysis-Grey (MOORA-G)	Zarbakhshnia et al. [17]
Prospect Theory and Choquet Integral with 'Benefits-Opportunities-Costs and Risk (PTC-BOCR)	Qian et al. [34]
Response Surface Method	Gholizadeh et al. [23]
Sensitivity Analysis	Mishra and Rani [20]
Stochastic programming, Stochastic multi-objective programming, Dynamic programming	Abid and Mhada [8]
Spherical Fuzzy Analytical Hierarchy Process (SF-AHP)	Kilic et al. [29]
Singe-Valued Neutrosophic Sets (SVNS)	Mishra and Rani [20], Dabees et al. [12],
Stackelberg Game Model	Xing et al. [16]
Spearman Consistency Test	Song et al. [44]
Visekriterijumsko Kompromisno Rangiranje (in Serbian) (VIKOR)	Mohammadkhani and Mousavi [42]
Taguchi Method	Gholizadeh et al. [23]
Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)	Abdel-Basset et al. [18], Qureshi [43]
Triple Bottom Line Approach	Dabees et al. [12]
Weighted Sums	Jauhar et al. [19]
ε-constrained	Jauhar et al. [19]

3. Observations and Related Recommendations

Observations and related recommendations are provided in this section and the details are discussed.

3.1. Most Popular Domain

As discussed, three domains were considered in this literature review paper. Deterministic Decision-Making (DDM) models (39% of the papers) and Uncertain Decision-Making (UDM) models (39% of the papers) were the most popular domains. The smallest percentage was related to Literature Reviews (22% of the papers).

3.2. Most Popular Uncertainty Source

According to Table 2, there are 45 total sources of uncertainty, of which some sources of uncertainty are repeated in several categories. Among them, the most popular source of uncertainty is data/information and evaluation performance (37% of the papers). The others include expert opinion (24%), resources and cost (9%), technological infrastructure (14%), regulatory policies (7%), and demand (9%).

3.3. Most Popular Method

Based on the information listed in Table 3, several methods have been successfully applied for third-party reverse logistics selection. However, two unique models, CRiteria Importance Through Intercriteria Correlation (CRITIC) and Analytic Hierarchy Process (AHP) are the most popular methods in the references in Table 3. CRITIC is a unique method that is used to assign the weights of objectives to criteria that will be used to make decisions. It considers the distinction and the conflict within the structure for a decision-making problem [49]. AHP is a multi-criteria decision-making method used for ranking a set of alternatives to select the best alternative from the foregone selection. Decision criteria are paired with important weights and are used to define the overall goal of the selection.

3.4. Most Popular Applications

Table 4 includes the papers based on different industries and applications. Based on the applications, most papers in this field were found to have studied automotive and electronics, green and sustainability, and waste management. More focus was given to these industries because of the emerging business standards revitalized around sustainable growth. Automotive and electronic industries always strive for newer, more efficient remanufacturing processes, as there is an emerging change for electric cars to be more streamlined and efficient, and electrical devices to be more reliable, long-lasting, and costing less to produce. These factors encourage sustainable growth and boost industries heavily invested in waste management and green initiatives [4].

Table 4. Applications of the models.

Applications	References
Automotive Industry	Chen et al. [39], Govindan and Gholizadeh [32], Zarbakhshnia et al. [17], Trang and Li [14], Abdel-Basset et al. [18]
Electronics and Cellphone Industry	Jauhar et al. [19], Kannan et al. [28], Bali et al. [22], Mishra and Rani [20], Matsui [24]
Food Processing Industry	Panghal et al. [25]
Green and Sustainable Industry	Dabees et al. [12], Stekelorum et al. [37], Mohammadkhani and Mousavi [42], Gholizadeh et al. [23], Qian et al. [34], Xing et al. [16]
Healthcare Industry	Nosrati-Abarghooee et al. [30]
Mining Industry	Gu et al. [33], Pourmehdi et al. [40], Sarabi and Darestani [21]
Waste Management and Recycling Industry	Ni et al. [9], Reddy et al. [5], Kilic et al. [29], Nosrati-Abarghooee et al. [30], Wu et al. [27], Budak [15], Gholizadeh et al. [23], Matsui [24]
Retail Industry	Sharma et al. [35], Trang and Li [14]
E-Commerce Industry	Dutta et al. [31], Wang et al. [38]
No Specific Industry	Song et al. [44], Qureshi [43], Sharma and Darbari [36]

3.5. List of Publications

The names of the journals are mentioned in the information provided in Table 5. Many papers and studies related to the topic 'Third-Party Reverse Logistics Selection' are prominently published in journals such as '*Journals of Cleaner Production*' and '*Computers & Industrial Engineering*'.

Table 5. The list of journals.

	Number of Papers			
Journal	**LR**	**DD**	**UD**	**Total**
Applied Soft Computing		3		3
Cleaner Logistics and Supply Chain			1	1
Cleaner and Responsible Consumption		1		1
Computers & Industrial Engineering	1	2	2	5
Expert Systems with Applications			1	1
European Journal of Operational Research		1	1	2
Information Sciences			1	1
International Journal of Logistics Research and Applications	1			1
International Journal of Production Economics			1	1
International Journal of Sustainable Engineering	1			1
Journal of Ambient Intelligence and Humanized Computing			1	1
Journal of Cleaner Production	1	6	2	9
Journal of Enterprise Information Management	1			1
Mathematics			1	1
Omega	1			1
Processes	1			1
Resources, Conservation and Recycling	1			1
Resources Policy			1	1
Sustainability	1	1	2	4
Supply Chain Forum: An International Journal		1		1
Systems			1	1
Transportation Research Part E: Logistics and Transportation Review		1	1	2
Total	9	16	16	41

3.6. Classification of the Articles Based on Year

In Table 6, all the reviewed papers are classified based on the year in which they were published, and separated into three domains. Papers published after 2020 were considered in this literature survey, with most papers published in the year 2021. All papers categorized in the domains are limited from 2020 to 2023, with only one literature survey paper published in 2014, which is relevant for the classification. Figure 1 shows the distribution of the articles.

Table 6. Classification of the papers based on year.

	Number of Articles			
Year	**LR**	**DDM**	**UDM**	**Total**
2014	1			1
2020	1	3	1	5
2021	3	4	8	15
2022	1	5	6	12
2023	3	4	1	8
Total	9	16	16	41

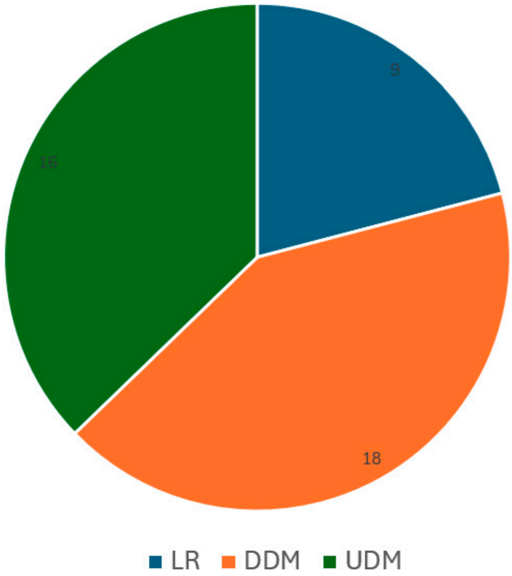

Figure 1. The distribution of the articles.

4. Conclusions

This comprehensive literature review paper has shed light on some critical insights of third-party RL selection in achieving sustainable growth, particularly in the automotive, green management, and waste management industries. The effort to create an efficient circular economy and the responsibilities toward achieving the end-of-life cycle of the products have given rise to the need for effective and sustainable RL practices.

In this literature review paper, deterministic decision-making models that rely on structured data and predefined inputs were discussed, offering optimal solutions based on established criteria. These models are utilized in problems where variables and conditions are well defined, to help optimize resource allocations, cost management, and other factors that influence RL decisions. Whereas an uncertain decision-making model tackles the complexity and unpredictability of inherent RL scenarios. Incomplete information, expert opinions, regulatory policies, and demand fluctuations all rely on indeterministic variables or probabilities to understand risk tolerance levels for decision-making processes, providing a figurative insight into a practical situation. Literature review papers, decision-making methods and techniques, and observations and recommendations have also been discussed in this paper. There are several recommendations for future research in this field, as follows:

(a) Hybrid models: Since there is a multifaceted, unpredictable nature for the selection of a third-party RL provider, in the future, there should be an increased utilization of hybrid decision-making models. Combining several sources of uncertainty using hybrid models can provide a comprehensive perspective that can include both structured data and uncertainties present in RL situations.

(b) Real-time data analytics: Recently, the application of real-time data analytics and the recent emergence of Artificial Intelligence (AI) can make the decision-making process much faster and more efficient. It can help change current market conditions, customer behavior, and predict regulatory shifts for the selection of a third-party RL provider. In addition, machine learning models can be combined with the MCDM models in this field.

(c) Numerous new MCDM models have been developed and applied in the field of supplier selection. These new models can be applied to select third-party RL providers.

(d) Jauhar et al. [19] considered order allocation for the first time in this field. There are several future research avenues to explore order allocation with third-party RL provider selection.

(e) There are future research opportunities related to the criteria for third-party RL provider selection. More comprehensive frameworks including criteria and sub-criteria focusing on environmental criteria can be developed.
(f) In the future, it will be valuable to apply systematic literature reviews, such as Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

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