

A Literature Review on Electric Vehicle Routing Problem: Supply Chain Management Perspective

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ABSTRACT

In the modern world of technology and innovation, electric vehicle (EV) integration into supply chain management has gained much interest as a feasible way to address the problems connected with freight transportation. The Electric Vehicle Routing Problem (EVRP) is carefully examined in this paper, which covers crucial aspects such as EVRP variations, optimization strategies, infrastructure development, and sustainability issues. Alongside specialized and efficient algorithms such as Ant Colony Optimization (ACO) and modified NSGA-II for multi-objective optimization, variants such as Vehicle Routing Problem with Pickup and Delivery (VRPPD), Time Windows (VRPTW), and Capacitated Routing Problem (CVRP) are inspected. To outplay issues with range restrictions, charging time, and cost, the study insists the critical roles that battery technology, effective charging techniques, and infrastructure expansion play. In order to promote green supply chain techniques, route optimization and truckload consolidation are stressed. Furthermore, new developments such as 5G connectivity and driverless EVs are recognized as revolutionary for EVRP. This work synthesizes impactful studies to discover research gaps and recommends future possibilities, such as accommodating multi-objective models and hybrid metaheuristic techniques to fulfill environmental and operational objectives in EVRP. This paper offers an intensive framework for enhancing EV routing research and practice in the context of supply chain management. The study's research requires the inclusion of the inevitability of transforming more conventional VRP variants to their electric equivalents by adding charging station adaptability to existing EVRP models and creating accurate algorithms for optimal routing solutions. The paper also identifies a shortage of research on multi-objective models that take resilience, social, and green elements into priority, as well as hybrid and advanced metaheuristic algorithms. Hence, new models and algorithms are needed to handle the issues posed by emerging technologies namely 5G connection and driverless cars. Furthermore, governments and the business sector are not working together to establish comprehensive charging infrastructure for effective EV routing. The results show how crucial Electric Vehicle Routing Problems (EVRP) are becoming to supply chain management, signifying the necessity of refined optimization techniques, reliable charging infrastructure, and environmentally friendly procedures. The study is to fill in knowledge gaps and improve optimization models for electric vehicle routing that is both operationally and environmentally efficient with refined performance.

Keywords: Electric Vehicle routing problem (EVRP), Freight transportation, Logistics distribution, Algorithms



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1. Introduction:

Hydrocarbon-based fuel generates Greenhouse Gases (GHG), which plays a significant role in global warming and climate change, as well as air pollution, which is detrimental to human health (Schiffer and Walther, 2017). As per the Environmental Protection Agency (2018), transit generated 28.5% of US greenhouse gas discharges. The combustion of transport fuels accounted for 25% of total emissions in 1998, according to Eurostat. Emissions in 2017. In many countries, new eco-logical measures and laws have been adopted to decrease GHG emissions and fossil fuel consumption. Since 2013, electric vehicles (EVs) have achieved increasing attention due to their environmental advantages, including their low greenhouse gas emissions, less noise pollution, high energy efficiency, and less fuel costs (Desaulniers et al., 2016; Murakami, 2017). In addition to this, EVs also offer a number of benefits to electric grids. EVs are used by some of the world's largest express companies. The company announced earlier this month that it's getting 1,000 electric cars. A total of 63 electric cargo delivery vans will be introduced by DHL in the US in 2019, starting with 30 in

the San Francisco Bay Area. Earlier this year, JD.com announced it was switching to electric delivery vans. Electric vehicles still face different challenges (Schneider et al., 2014; 2018; Schiffer and Walther, 2017). The driving range so far is 200 km. A typical electric car has a shorter range than a similar gasoline-powered car. The cold can also reduce a vehicle's range. Electric vehicle drivers have to plan routes carefully to avoid running out of electricity. EVs also have a long charging time; the battery can take up to 8 hours to charge fully, and the charging time enlarges with age. Another obstacle is their elevated cost, especially the batteries. Last but not least, there's the backwardness of the charging framework, so EVs are hard to charge. Erdelic et al. (2019) examined variations of EVRPs and solution methodologies.

Since the Vehicle Routing Problem (VRP) was first introduced by Dantzig and Ramser in 1959, 25 out of 32 papers have been published on the topic. In basic VRP, multiple vehicle routes are used to lessen the cost of customer visits. Additionally, Toth and Vigo (2002), Golden et al. (2008), Eksioglu et al. (2009), and Breakers et

al. (2016) provide comprehensive overviews of VRPs. In contrast to VRPs, Electric Vehicle Routing Problems (EVRPs) have four major differences: 1) the location of charging stations or battery changing stations (Yang and Sun, 2015; Schiffer and Walther, 2017; Zhang et al., 2019); 2) establishing a policy for full or limited recharge (Keskin and Çatay, 2016; Sweda et al., 2017a, 2017b; Macrina et al., 2019a, 2019b); 3) charging functions (Montoya et al., 2017; Froger et al., 2019; Zuo et al., 2019); and 4) various types of charging stations. For the purposes of our study, we only take into account EV routing issues that are related to electric vehicles and charging stations. Previous studies have mainly focused on the routing problem of EVs but do not address the charging problem, so we do not discuss them here. According to Afroditi et al. (2014), there are relatively few references to EVRPs that consider industry constraints. A recent study by Erdelic et al. (2019) examined variations of EVRPs and solution methodologies. Generally speaking, there are two main streams of solution approaches: metaheuristics and exact algorithms. Since EVRP research is still in its early stages and there is a scarcity of relevant literature, related articles were reviewed in total for our inquiry. The residual of this essay is organized as follows:

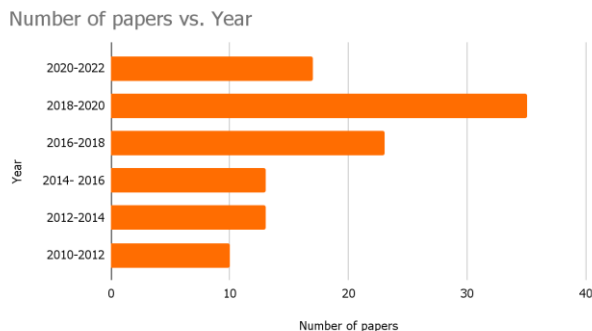


Fig- 1 Number of papers by year

We discussed our procedures in Section 2. Section 3 presents the EVRP Variants. Section 4's primary focus is on How Electric Vehicle Adoption Affects Supply Chain Performance. Section 5 discussed the Design and Implementation Factors for EVRP in Supply Chain Performance. Section 6 provides a summary of recent advancements and future directions for EVRP supply chain management research. Section 7 serves as the paper's final conclusion.

2. Methodology:

This study conducts a systematic evaluation of the literature based on specific search terms from numerous relevant searches. The methods and processes used in this study to get reliable results have chosen its new theme. The majority of businesses mostly depend on their supply chain, which bears a sizable portion of the total cost of their goods. As a result, supply chain management is becoming more and more important in modern business operations. The following research questions were developed in order to fulfill the study's objectives:

RQ1. Which are the primary variations that various studies take into account when linking environmental goals to the EVRSC area?

RQ2. What are the latest methods that are being used in the design and implementation of EVRP within a supply chain context?

RQ3. How do different routing strategies and algorithms address the unique characteristics and constraints of EVRP in supply chain management?

RQ4. What are the emerging trends and upcoming research directions in the context of EVRP from a supply chain management perspective?

Previous papers in EVRSC illustrate the need for this work. The general information in reviewed papers lacks a comprehensive study of EVRSC. The problem has been studied in detail from different angles. VRP reverse logistics has also been studied in other studies, focusing on specific variants. This study covers important aspects of the EVRP model, as opposed to the others, which only cover some aspects of environmental issues.

2.1 Sorting:

In this paper, we have analyzed impactful papers ranging from 2010-2023 where a graphical representation has been included. A moderate number of papers have been sorted out for gathering the pieces of information which were crucial for this paper. In terms of the screening process, necessary keywords had been used to find a moderate number of papers.

2.2 Screening:

Articles were screened according to their relevance to the Electric Vehicle Supply Chain. Based on the cost components, modeling framework, and solution strategy, a selection of papers was categorized and examined. Categorically, the papers were sorted by year.

2.3 Planning:

Hence, after reviewing those papers, the topic of this research paper was selected after reviewing the research questions and further research directions. When the part of planning arose, it was clear that the topic that has been chosen for the paper doesn't have much previous work, and so, for this paper, it was decided to take the topic further to derive a new solution and a better outcome.

3. Variants of EVRP:

There are several electric vehicle (EV) models on the market, each with special features and functions. Battery electric vehicles (BEVs), which have been fully propelled by electric motors and entirely run on rechargeable battery packs, are one common type. BEVs are the only EVs with zero tailpipe emissions and the greatest driving ranges, but they need access to a charging station in order to recharge (Qin et al., 2021). During acceleration, braking, and traveling at low speeds, the combustion engine receives assistance from the electric motor. HEVs, on the other hand, cannot be plugged in to charge and must instead recharge their smaller battery packs entirely through regenerative

braking (Erdelic et al., 2019). In fuel cell electric vehicles (FCEVs), energy is generated by hydrogen fuel cells and utilized to power the electric motor. (Hendrickson et al., 2015) proposed these variants:

- **Vehicle Routing Problem with Pickup and Delivery (VRPPD):** The goal of this problem is to figure out the best route for a fleet of vehicles to take when picking and dropping them off.
- **Vehicle Routing Problem with Time Windows (VRPTW):** This issue pertains to delivery at delivery sites.
- **Capacitated Vehicle Routing Problem (CVRP):** Deliveries are made in this situation with a restricted capacity.
- **Multi-Depot Vehicle Routing Problem (MDVRP):** It offers more routes and operates with more flexibility.

4. Impact of Electric Vehicle Adoption on Supply Chain Performance:

Many supply chain performance metrics could be greatly impacted by the usage of electric vehicles (EVs) in supply chain operations. Let's examine the effects in terms of price, effectiveness, environmental sustainability, client satisfaction, and brand perception.

4.1 Cost Repercussions:

The alternation to EVs can result in appreciable fuel and maintenance cost reductions for supply chain activities, which certainly helps to lower costs overall (Hendrickson et al., 2015). Supply chain activities may become more efficient and optimized as a result of the deployment of EVs. Furthermore, an additional benefit of incorporating EVs into intelligent logistics systems is enhanced load balance and route optimization, which amplifies operational effectiveness. Supply chain managers can possibly optimize delivery routes, cut down on idle time, and boost as well as enhance fleet efficiency by integrating real-time data, cutting-edge algorithms, and intelligent charging management (Erdelic et al., 2019).

4.2 Client Satisfaction and Service Quality:

Improved delivery times highlight the potential for EVs to provide faster and more steady deliveries due to their ever ready acceleration and responsiveness. With improved customer satisfaction particularly in industries, prompt delivery is crucial. Also, environmental consciousness appeal is important because it discusses how customers increasingly value companies that prioritize sustainable practices. Integrating EVs into the supply chain can attract environmentally conscious customers, leading to increased satisfaction and loyalty.

4.3 Green practises:

For green practice implementation, efforts to utilize alternative and greener fuel sources, such as biodiesel, electricity, ethanol, hydrogen, methanol, natural gas (liquid or compressed), and propane, are gaining significant attention as part of this multifaceted strategy. Reduction of resources, land use, acidification, harmful effects on ecosystems and people, noise pollution, and greenhouse gas (GHG) emissions are all repercussions of transportation's

dissenting environmental impact. Vehicle fuel consumption, influenced by several vehicles, environmental, and traffic-related factors, in addition to vehicle speed, load, and road gradient, directly associated with CO2 emissions. The importance of operations research methods in the field of Green Vehicle Routing Problems (GVRPs) has increased due to recent advancements in this field. With the launch of the Pollution-Routing Problem (PRP), an extension of the VRP with time windows (VRPTW), by Bektas and Laporte (2011), GVRP has witnessed some successful implementations. Decentralized and cross-commodity energy management has certainly a lot of potential to promote eco-friendly behaviors, especially when it comes to resolving the Electro Vehicle Routing Problem (EVRP). Energy consumption and emissions can be lessened by resource sharing and optimization in smart neighborhoods that integrate heating, cooling, and electricity. Decentralized energy systems are made possible by technologies like blockchain, artificial intelligence, and the Internet of Things. IoT facilitates wireless connection and interoperability, while AI optimizes energy use and routing. Blockchain has the potential as well as possibility to coordinate safe transactions, but there are organizational and technical issues to its diverse use. By accommodating more effective energy sharing and routing, successful implementations like those of Germany's and Finland's Clean Energy Package initiatives can improve EVRP solutions and lower total carbon footprints with VRPTW time frames.

4.4 Influence:

Strategic, tactical, and operational choices for long, medium, and short-term planning are all part of supply chain management. Network design and last-mile routing are examples of strategic decisions that impact each other. Consequently, modeling them independently may result in less-than-ideal results. One location routing issue (LRP) that has been tackled is the integrated modeling of these choices. To satisfy customer expectations, last-mile distribution has grown in importance and more work is required. Therefore, macro strategic decisions about network design should now consider the effects of logistics issues in the e-commerce era and the obvious last-mile responsibility. Since truck routing choices must be made quickly (weekly, daily, or even hourly), last-mile distribution and, by extension, first-mile pick-up is planned at the operational level (Arevalo-Ascanio et al., 2024).

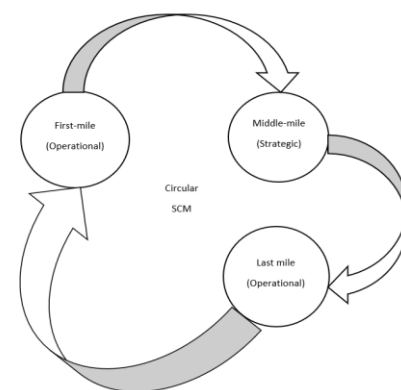


Fig 2: Supply network structure(Arevalo-Ascanio et al., 2024)

Furthermore, long-term effects on transportation costs and total inventory make the supply chain network design (SCND) decision a key influence on the supply chain's (SC) performance. By combining facility location decisions with inventory and routing decisions in SCND problems, businesses aim for a global and integrated system to develop a long-term strategy for designing and planning SC (Zheng et al., 2019).

5. Design and Implementation Factors for EVRP in Supply Chain Management:

Considerations regarding the successful and efficient planning and implementation of electric vehicle routes for logistical operations are included in the design and execution aspects for the Supply Chain Management (SCM) of the Electric Vehicle Routing Problem (EVRP). The "EVRP" version of the Vehicle Routing Problem (VRP) takes into account the special characteristics and constraints of electric vehicles, such as their limited range and the flexibility of charging facilities. Organizations can efficiently and successfully integrate EVRP into their supply chain management processes, optimizing electric vehicle routes in order to produce cost savings, lower emissions, and increased operational efficiency, by taking into consideration certain design and implementation elements.

5.1 Ant Colony Optimization:

ACO algorithms are being employed in this field to tackle the electric vehicle routing issue (EVRP) since it is generally known that they can solve challenging optimization problems. Although energy-efficient, electric cars come with new uncertainties because of a number of unknowable aspects. As a result, it is possible to determine a practical route for an electric vehicle (EV) to travel on a daily basis (if needed). Recharging station visits are also required. When EVs have recharging stations within their range, a look ahead technique is incorporated into the proposed ACO for EVRP (ACO-EVRP). Based on simulation results for many benchmark challenges, an Ant Colony Optimization for Electric Vehicle Routing Problem (ACOEVRP) technique may generate green routes for an EV fleet. After many changes to the traditional VRP, ant colony optimization (ACO) produces innovative results. The goal of ACO applications for commercial EVs is to determine the shortest path.

5.2 Scheduling of Multi-Objective optimal case for Battery Power Reverse Supply Chain:

For decision-makers with various needs, Pareto optimum solutions can be utilized to tackle complex-objective optimization problems. Whenever such a situation arises, we offer information and a point of reference. The target values should be raised or lowered because the objectives' influence causes some fluctuation. Due to its stability and wide variety of applications, for the purpose of solving multi-objective optimization problems, NSGA-II is

an appropriate non-dominated sorting genetic algorithm, but it has a propensity to prematurely converge.

Addressing the core location-routing challenge is getting more difficult and sophisticated. Gene coding, fitness function computation, selection, crossover, and mutation procedures are all part of the NSGA-II's basic operating method. To enhance NSGA-II, a multi-objective optimization model and an enhanced particle swarm optimization approach are applied. The opposite of forward logistics, reverse logistics, has recently drawn increased interest from corporations and academia. The environmental impact of power batteries must be taken into account during recycling, but so must the environmental impact of scheduling recycling. Location Allocation Problems (LAP) and Vehicle Routing Optimization Schemes (VRP) are used in scheduling recycling logistics systems.

Based on traits and goals such optimal path selection, total cost and delivery time, the current study developed an LRP (Logistic Resource Planning) model that aimed to lower the overall time and cost spent by the whole system. The researchers also took limitations into account, such as demand point satisfaction, and employed a variety of methods to resolve such issues, but solely took demand-side decision-making objectives into account. It is essential to carefully and concurrently research the decision-making goals of all stakeholders involved in power battery reverse LRP.

Deep discharge, physical sorting, crushing, metallurgical recycling, isolating cathode materials from aluminum foil, and deep discharge are all used to recycle for electric vehicle.

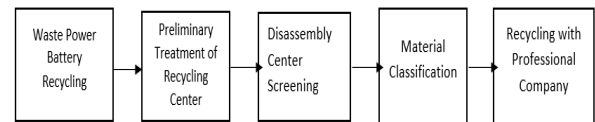
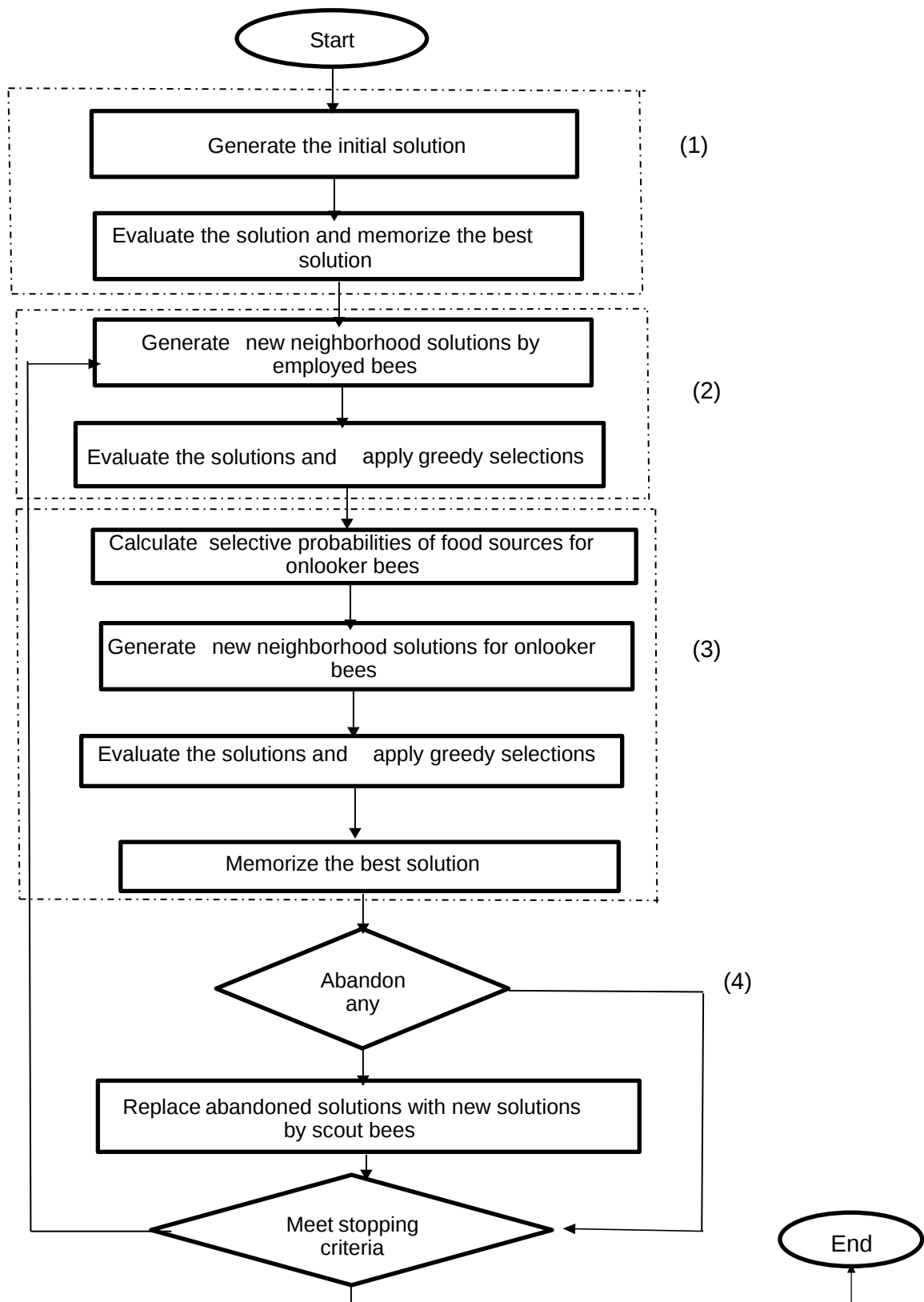


Fig 3: Battery recycling process (Agua et al., 2013)

5.3 Hybrid artificial bee colony algorithm:

Bee colonies are a classic example of swarm intelligence, and Karaboga (2005) developed the Artificial Bee Colony (ABC) algorithm based on them. It is evident that the ABC algorithm exhibits self-organization and task division throughout the whole search field. Its approach effectively mitigates the effects of both variety and intensification, showing that in order to enhance algorithm exploitation and yield more complex solutions, a complete analysis of the entire search space is required and also exploitation of the promising areas is properly arranged. With its reliable mechanism and simple implementation, ABC is very popular since it was introduced (Akay and Karaboga, 2012; Karaboga et al., 2012).

**Fig 4:** Shows ABC algorithm (Erdelic et al., 2019)

A flow chart of the ABC algorithm is shown in Fig. In the above description, there are four phases: (1) initialization, (2) employed bee phase, (3) onlooker bee phase, and (4) scout bee phase.

6. Emerging Trends and Future Research Directions in EVRP from a Supply Chain Management Perspective:

There have been notable shifts in supply chain management as a result of the popularity of electric cars (EVs). The increasing need for environmentally friendly transportation options has researchers and practitioners concentrating on the difficulties associated with effectively routing electric vehicles. Our objective is to answer Electric Vehicle Routing Problems (EVRPs) in order to create the best cost-effective, energy-efficient, and ecologically friendly routes for electric vehicles.

6.1 Integration with Emerging Tech:

From a supply chain management standpoint, more researchers can contribute to the development of EVRP in the future. For future investigation, there are four promising directions. Initially, we can take into account stations in the current models, increasing the flexibility of the transit. Second, by switching out CVs for EVs, practically all VRPs (vehicle routing issues) can be improved. As a result, we can try to convert further VRP variations to their electric equivalent. Finally, this survey revealed that there is little research on precise algorithms, and more scientists are required to develop the methods for the best possible resolution of the issue. Last but not least, with the advent of driverless cars and the 5G era, routing of EVs will face new issues, models, and algorithms (Qin et al., 2021). ECVs (Electronic Control Valves) are becoming increasingly popular due to their cost and the subsidies that governments around the globe offer. The charging infrastructure is also a shared responsibility between governments and private companies. The issue of vehicle routing must be resolved when creating routes for fleets of electronic control valves, or ECVs. An algorithm based on VRPs takes into account the limitations of Toth and Vigo (2014) discuss the driving range of ECVs and the likelihood of visiting recharging stations during a route. The literature has recently proposed several heuristics for solving such VRPs (e.g., Erdogan and Miller-Hooks 2012, Schneider et al. 2014, Felipe et al. 2014).

6.2 Dynamic and real time EVRP:

Future research has a great deal of potential. These changed models could be solved using stochastic or resilient operations research methods, for example. Additionally, Pareto fronts can be provided by multiple objectives, such as transportation-related solutions, fines, or storage. fees. Additionally, some presumptions may be relaxed, such as including fixed costs associated with operating cars. The proposed solution method phase I resolves constraints by classifying cars as freezers or refrigerators, but can be loosened using phase II model to produce two simpler models. Researchers have been most interested in the routing aspect of dynamic fleet management (Al Theeb et al., 2020). Performance and service levels in some applications can still be improved. For equipment maintenance services, for instance, the call center can plan

appointments with some flexibility. Therefore, the call center operator has the ability to determine or influence the time window. Therefore, a system that suggests convenient times for the company to respond to a customer request would be highly desirable in such cases. We can highlight the following for future research on solution procedures (Pillac et al., 2013). There are a few specific techniques for the GVRP, but for E-VRP and its extensions, there are very few precise procedures that have been offered. Only a few number of researchers were able to solve the problem with excellent quality in a reasonable length of time, despite the fact that many utilized population metaheuristics. Recent procedures employ complex problem-specific heuristics, so parallelizing them could reduce computation time (Erdelic et al., 2019).

6.3 Green Vehicle Routing Model

Green Vehicle Routing Problem (GVRP) as a means of achieving green logistics. As an extension of the classical Vehicle Routing Problem (VRP), the GVRP aims to minimize energy consumption while meeting loading requirements. Elements such as vehicle motion state, characteristic parameters, and real-time speed have an effect on GVRP complexity. While distance traveled is often considered as a key point of transport costs in VRP research, it is acknowledged that travel distance reduction alone may not guarantee the cost savings. Electricity is an important part of transport costs for Flexible Manufacturing Systems (FMS) fleets along with Automated Guided Vehicles (AGVs) (Sebastián Azuero-Ortiz et al., 2023a). To achieve green logistics, vehicle energy consumption, including fuel consumption and electric consumption, has been thoroughly studied using approaches such as the Green Vehicle Routing Problem (GVRP). A generalized Vehicle Routing Problem (GVRP) is an expansion of a classical Vehicle Routing Problem (VRP), with the motivation of minimizing the energy consumption. GVRP complexity is determined by factors such as vehicle motion state, characteristic parameters, and real-time speed. While distance traveled is often considered a key determinant of transport cost in VRP research, lessening travel distance alone may not guarantee cost reduction. Due to different kinds of vehicle speeds, motion states, and penalty costs resulting from time window constraints, this occurs. It is well known that Flexible Manufacturing Systems (FMS) fleets with Automated Guided Vehicles (AGVs) consume significant amounts of energy. Energy consumption of vehicles, including fuel consumption and electric consumption, has been intensely studied in recent years, primarily using approaches like the Comprehensive Modal Emissions Model (CMEM), which forecasts both energy consumption and emissions at the individual vehicle level. A focus of GVRP research aligned with sustainable development is the shift towards electric vehicles. EVRP and EVRP with time windows (EVRPTW) are mentioned as crucial research directions, considering speed-varying travel range, electricity consumption, fuel consumption rates, and customer satisfaction levels. Various studies are referenced that integrate factors like electric vehicle idle time, recharging time, battery management techniques, and optimizing AGV task scheduling and energy consumption (Hendrickson et al., 2015). Modeling energy consumption needs to consider some metrics such as electric

consumption, fuel consumption, speed, vehicle characteristics, and travel distance. Also, the text elaborates that current GVRP research focuses mainly on multiple vehicle route planning and scheduling for outdoor logistics, with limited exploration of GVRP in FMS. We do this by noticing various states of the vehicle's motion. Overall, the provided text has outlined the motivation for GVRP, highlighting related studies, and identifies gaps and research directions in the field of energy-efficient vehicle routing, concentrating on the Live Modal Emissions Model (CMEM), which predicts energy consumption and emissions for individual vehicles as well as fleets. Electric vehicles are aligned with sustainable development in GVRP research. The Electric Vehicle Routing Problem (EVRP) and EVRP with time windows (EVRPTW) has been mentioned as key research aspects, based on factors such as speed-varying travel range, energy consumption, and fuel consumption rates. Various studies are referenced that integrate the aspects such as electric vehicle idle time, recharging time, battery management techniques, and optimizing AGV task scheduling and energy consumption. In energy consumption modeling, metrics such as electric consumption, fuel consumption, speed, vehicle characteristics, and travel distance are crucial. GVRP research currently concentrates predominantly on multiple vehicle route planning and scheduling in terms of outdoor logistics, with limited exploration of GVRP for FMS. According to some researchers (Sebastián Azuero-Ortiz et al., 2023b), present models do not fully consider AGV energy consumption characteristics, being focused on a steady speed or managing batteries. The proposed model is designed to enhance and optimize the entire transport process, based on the current research status. It is accomplished by accounting for the various motion states of the vehicle. Hence, the provided text describes the motivation for the GVRP, highlights the relevance of relevant studies, and identifies gaps and areas for further research relating to the field of energy-efficient vehicle routing.

7. Result & Discussion

From a supply chain management standpoint, more researchers can contribute to the development of EVRP in the future. For future investigation, there are four promising directions. Initially, we can take into account stations in the current models, increasing the flexibility of the transit. Second, by switching out CVs for EVs, practically all VRPs (vehicle routing issues) can be improved. As a result, we can try to convert further VRP variations to their electric equivalent. Finally, this survey revealed that there is little research on precise algorithms, and more scientists are required to develop the methods for the best possible resolution of the issue. Last but not least, with the advent of driverless cars and the 5G era, routing of EVs will face new issues, models, and algorithms (Qin et al., 2021). ECVs (Electronic Control Valves) are becoming increasingly popular due to their cost and the subsidies that governments around the globe offer. The charging infrastructure is also a shared responsibility between governments and private companies. The issue of vehicle routing must be resolved when creating routes for fleets of electronic control valves, or ECVs. An algorithm based on VRPs takes into account the limitations of Toth

and Vigo (2014) discuss the driving range of ECVs and the likelihood of visiting recharging stations during a route.

8. Conclusion:

This paper aims to conduct a systematic review of recent and innovative papers in various scientific journals on the electric vehicle routing supply chain context, which has received a lot of attention over the past ten years. To find out if further study is necessary, impactful papers were selected, reviewed, classified, and evaluated, providing an in-depth review of a larger number of articles. We used those papers for literature review but due to some limitations and some short guidelines from conference authority, we tried it within little format/ short referencing. EVRP issues are a constant topic of discussion in this paper. We examine various dimensions to provide a more accurate picture of the future. There is also a potential path forward towards innovative modeling, advanced unknown analysis, and consideration of new sustainability parameters. Methodological approaches based on hybrid algorithms and new metaheuristic algorithms are also feasible. Multi-objective optimization models should be considered in some EVRP variants, and objective functions should incorporate green, social, and resilience. EVRP research has grown rapidly in recent years. Furthermore, a detailed analysis based on factors which affects supply chain design and routing strategies effectively should be discussed as future investigations.

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