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Bibliometric Analysis Of Travelling Salesman Problem With Drones (TSP-D)

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ABSTRACT

The growing need for efficient package delivery systems in Last Mile Delivery (LMD) has attracted significant attention, bringing the Travelling Salesman Problem with Drones (TSP-D) to the forefront of scholarly research. The research under consideration generated a surge in scientific output across various domains, including economics, industry, and logistics, owing to the potential benefits it presents. The primary objective of this study is to compile, organize, and analyze the literature on TSP-D in the context of LMD. A comprehensive bibliometric analysis scrutinized the progress made in this field during the period spanning 2017 to 2024. The study encompassed an extensive analysis of a corpus of 2,397 scholarly publications, yielding numerous intriguing conclusions derived from a meticulously constructed framework. This review addresses inquiries about the most prevalent research categories on resolving TSP-D, focusing on exact and metaheuristic approaches.

Keywords: *Combinatorial optimization, drones, LMD, metaheuristics, TSP-D.*

1. INTRODUCTION

The emergence of e-commerce and mobile shopping has simplified the process of purchasing and selling products; however, it is also increasing the pressure on the logistics industry to adapt to evolving demands Urban congestion is a significant obstacle for on-demand delivery services, complicating timely deliveries during peak traffic hours. The LMD issue, which is the final stage in the supply chain where goods are transported from distribution centres to customers, is particularly difficult. This phase not only exacerbates traffic congestion and energy consumption in urban areas but also complicates logistics. The TSP-D expands the traditional Travelling Salesman Problem(TSP) by integrating ground vehicles and drones into the delivery network. The integration of a truck and a drone, as explored by [1] a novel planning challenge is referred to as the TSP-D. However, the effective execution of TSP D by [11] relies on the incorporation of cutting-edge technologies, it is underlined that several organizations are contributing technical and financial support to pilot three programs that investigate this possibility. Drones [15] are now commonly employed to aid truck deliveries, particularly in rural areas, reducing the reliance on manual labour. The TSP-D has become a notable paradigm [17] showing the opportunities inherent in technology-oriented logistics as various companies continue in their search for creative techniques to solve the LMD problem. This evolution shows when delivery prioritized sustainability and efficiency. TSP-D intends to speed cargo delivery and vehicle return to the central depot.

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2. METHODOLOGY

The construction of this bibliometric analysis adherence to a series of formal procedures, commonly referred to as a research protocol. The present study aims to elucidate the various phases that constitute the procedure in a comprehensive manner. The present discourse [22] aims to delineate a comprehensive framework for conducting a systematic literature review. This framework includes five steps : (i) the identification and establishment of research inquiries, (ii) the formulation of an appropriate search key, (iii) the judicious selection of scientific databases, (iv) the establishment of inclusion and exclusion criteria, and (v) the meticulous reporting of the various phases involved in the survey This structured approach ensures a thorough exploration of existing knowledge. Therefore, the first step is to make it clear what the goal of this study is: to look at all the research that has been done on TSP-D issues over the last 20 years. Furthermore, the main goal of our study is to outline the main types of problems that are usually dealt with, along with the LMD and TSP-D methods that are used to solve them. In addition, we want to find the most common types of study in the literature. This will include both theoretical and experimental methods. We'd also like to know which groups and countries are most interested in this new model. The focus of this inquiry is on the significant research initiatives that have been conducted in the field of LMD in the twenty-first century. To be more precise, it pertains to the methodical examination of the existing body of knowledge regarding a subject through the use of TSPD. In the pursuit of this stated objective, a demanding empirical investigation has been conducted, wherein a wide range of configurations have been thoroughly examined, surpassing the mere combination of logical operators with topical keywords. The preliminary objective of the current study is to thoroughly examine and subsequently resolve the research questions (RQ) that arise from the research problem under consideration. The five research questions (RQ) that emerged are as follows:

RQ1: "What is the progression of the study?"

RQ2: "What kind of problem are the most preferred ones by authors?"

RQ3: "What kind of optimization method are the most preferred ones by authors?"

RQ4: "Which are the most cited papers of the field?"

3. ANALYSIS OF GATHERED PUBLICATIONS

3.1 Collection and Publication Timeline.

To construct a bibliometric analysis, it is imperative to develop appropriate keywords that can be effectively utilized in the search engines of digital scientific databases. The composition of a comprehensive systematic literature review necessitates the inclusion of inclusive keywords. In pursuit of this objective, a rigorous empirical investigation has been conducted, wherein diverse configurations have been examined, surpassing the rudimentary amalgamation of logical operators in conjunction with topical keywords. Using keywords is an effective strategy to expand research outcomes. The search includes journal titles, author names, article titles, and abstracts. Furthermore, these tags can be used for extensive text searches. Subject terms are critical in supporting a targeted search, allowing the retrieval of documents allocated a specific term by an experienced indexer. The TSP is a well-known optimization problem in the field of operations research. Depending on the difficulty, the TSP reduces trip time or vehicle distance. The TSP focuses on finding the most efficient route for a vehicle, aiming to optimize resources. The TSP is a mathematical method for finding the most efficient route between multiple destinations, aiming

to minimize the total distance travelled. As a consequence, including the TSP in the search query will surely improve the precision of the search results. Table 1 shows the subsequent keyword.

Table 1 Subsequent keywords used in different publishers' databases.

Publisher	No of Papers	Search Key
Scopus	1310	”Travelling-AND Salesman*-AND Problem- AND Drones*” OR ”TSP-D” OR ”Last-mile-delivery”
Clarivate Analytics -Web of Science	1087	(Travelling) AND (Salesman) AND (Problem) AND (Drones) OR (TSP-D) OR (Last-Mile Delivery)

3.2 Analysis of the Contributions Gathered.

The subsequent section is dedicated to the exposition and scrutiny of the assemblage of scholarly articles that make a substantive contribution to this bibliometric analysis. In response to research question 1 (RQ1) i.e. “What is the progression of the study?”, it is evident from the data presented in Table 2 that the trajectory of the study exhibits a clear upward trend, with a noticeable rise observed from the year 2017 through 2023.

Table 2 Timeline of the collected papers for both Scopus and Web of Science.

Year	No of Papers
2017	47
2018	137
2019	237
2020	337
2021	469
2022	577
2023	582
2024	11

Moreover, it is worth noting that larger-scale studies tend to yield more robust and dependable outcomes due to their reduced margins of error. Since the inception of the year 2017, a mere 17 publications were produced, which have now remarkably escalated to a staggering total of 582 by the year 2023 whereas there are 11 publications in the year 2024. In Table 3, the categorization of publications is predicated upon their respective types, wherein the most prevalent form of publication is represented by journal articles, boasting a cumulative count of 1836. Additionally, conference papers exhibit a notable presence with a total of 444 publications. While pre-printed papers and other sources merely provide an approximate count of 111 papers each. Furthermore, it is worth noting that the proceedings comprise a mere six publications.

Table 3 Details of the whole collection of papers gathered.

Type of Publication	No of Papers
Article	1836
Conference Paper	444
Pre-printed and others.	111
Proceedings	6

3.3 Types of Problems Studied.

Based on the data presented in Table 4, it can be inferred that a total of 700 papers, accounting for 29.20% of the identified literature, have been specifically developed to address the TSP. Most of the aforementioned scholarly works employ the canonical iteration of the problem at hand. With respect to the inquiry posed in research question 2 (RQ2) i.e." What kind of problems are the most preferred ones by authors? 'An analysis of the data showcased in Table 4 reveals that the pattern of the study encompasses a variety of challenges, such as the Multiple Travelling Salesman Problem with Drones (MTSP-D), Flying Sidekick Travelling Salesman Problem (FSTSP), Multiple Flying Sidekick(MFSTSP), TSP, and the TSP-D. The MTSP-D is the most studied, with 285 publications out of 700 papers.

Table 4 Types of problems studied.

Types of Problems Studied	No of Papers
MTSP-D	285
FSTSP	215
MFSTSP	163
TSPD	37

The MTSP-D encompasses a total of 285 papers. For the MTSP-D, consider a hypothetical scenario in which a map is depicted, featuring numerous cities, a central depot, and a multitude of salesmen (or vehicles) in addition to drones. The proposed solution entails the identification of optimal routes for each salesman and the utilization of drones to enhance the efficiency of city visits. One of these assumptions is that each customer within the problem domain must be visited precisely once, either by a truck or by a drone. It is imperative to note that a predetermined quantity of drone stations possesses the capability to be activated. Every drone station has the same number of identical drones of the same type and size. Drones must stay within their operational range during tours. After their voyage, the subject's battery and cargo will be replaced quickly. This study examines the MTSP-D. This case involves multiple trucks and drones. In this scenario, drones can start their excursions from a truck or depot and return to the same, another, or the depot. The formulation of this paper fails to incorporate any cost considerations. Specifically, the operational expenses associated with drone stations are non-existent. Figure 1 displays the efficient path for MTSP-D [14].

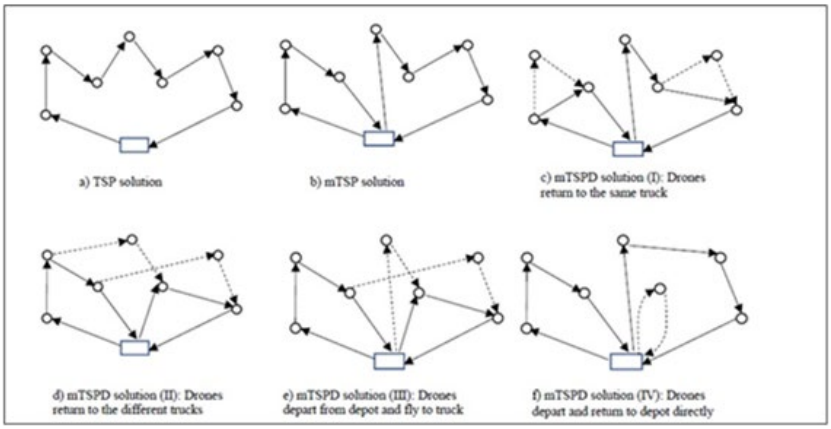

Figure 1. The efficient path solutions for mTSPD.

In contrast, the FSTSP has been the subject of 215 papers in total. The FSTSP pertains to a cohort of customers, wherein each individual necessitates precise servicing by either a delivery truck

managed by a driver or a drone that functions in synchronization with the truck. Due to constraints like the drone's restricted cargo capacity, the necessity for parcel signatures, or unsafe drone landing spots, some client requests cannot be fulfilled using the drone. The FSTSP model as proposed by [10] encompasses a singular truck and drone tandem configuration. Its primary objective is to optimize the allocation of customers and the routing of both vehicles, with the ultimate goal of minimizing the overall delivery completion times for a given set of customers. Figure 2 shows the FSTSP method that works best.

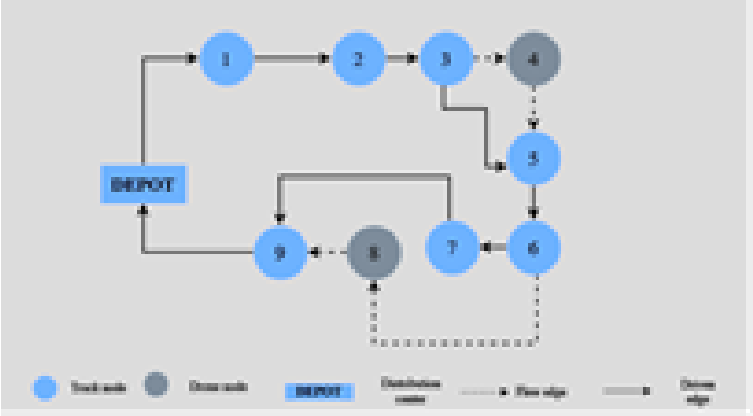

Figure 2. The efficient path solutions for FSTSP.

In addition, job scheduling on several computers forms a difficult optimization challenge known as the MFSTSP. This covers modelling chores including launching and collecting drones, delivery times, drone battery drain, truck, and drone synchronization, and multiple drone management. [21] the article presents the MFSTSP, which aims to effectively distribute small goods to geographically scattered consumers utilizing a fleet of drones and a delivery truck. Every drone can depart from the truck to deliver a package, then go back to either pick up another parcel or relocate to another launch spot. The aim is to maximize the use of trucks and drones to finish deliveries and go back to the depot in the shortest period possible.

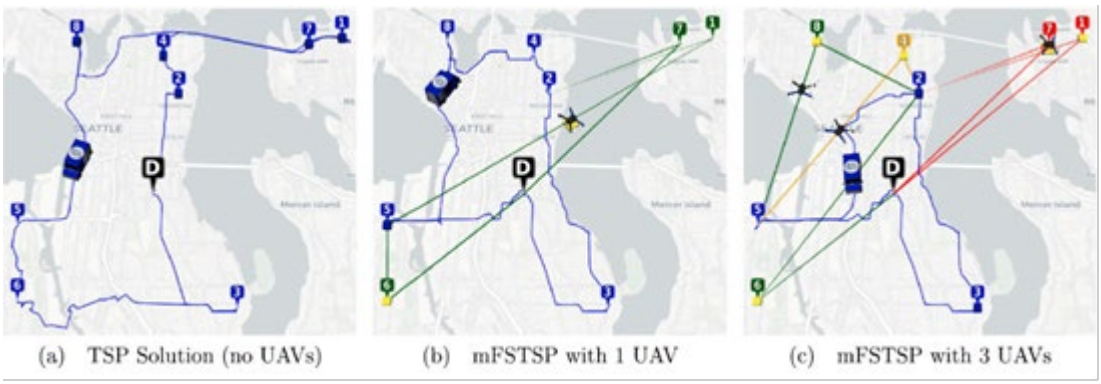

Figure 3. The efficient path solutions for MFSTSP with and without.

Just 37 papers have examined the TSP-D. Questioning if a deterministic algorithm can match the efficiency of a nondeterministic one in Poisson time, [28] proposed the TSP-D as a P vs NP problem. This characterization is based on a formal model, much like Turing's 1936 machine. The TSP-D aims to reduce travel time such that a truck or drone visits every destination. With each consumer served once by either vehicle, constraints include ignoring drone collection, delivery, and refuelling times. The drone cannot stop halfway or serve multiple clients; both the truck and drone must start and end at the depot. Since it controls travel quickly, the TSP-D ensures all customer destinations are visited by truck or drone. Starting and terminating at the depot, the

problem ignores additional restrictions like refuelling and serving each client once. One drone will be part of a fleet of similar delivery vans that will bring packages to a certain group of customers. Each customer can only be served by a drone, a car driven by a person, or another truck. Interestingly, only 700 papers were used for benchmarking. The others were meant to solve and study real-world problems. The TSP-D will be able to get more things to customers and lower its costs by using both vehicles and drones. When trying to solve NP-hard problems like TSP-D, one of the best ways to go is to use metaheuristics. Figure 4 shows an example of a delivery that was made with the help of a drone.

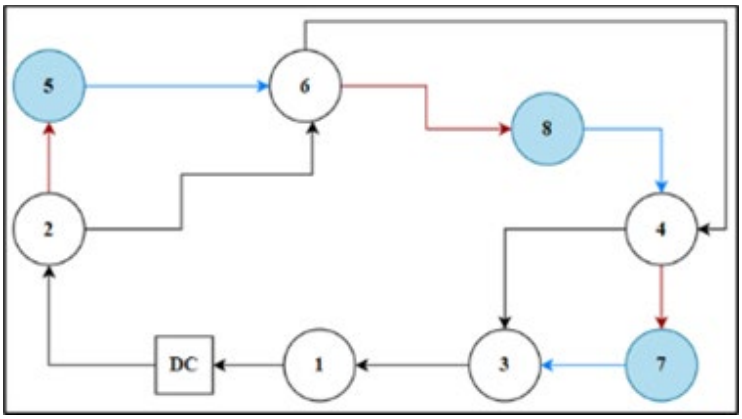

Figure 4. The efficient path solutions for TSP-D.

If the point is white, this customer is served by a truck. If the point is blue, it means that a drone is working for the client. This map shows the roads that cars take. The red line shows the drones' route, and the blue line shows their route to arrive. Moreover, the literature on TSP-D variations is restricted to 700 papers. The data suggests that just 30% of papers have been counted. Scopus search results are refined to Engineering and Computer Science to get more accurate results for the study field under consideration. A brief review of all TSP versions is in Table 5.

Table 5 Summary of the Variants of the Travelling Salesman Problem.

Variants of TSP	Optimization Objectives	Delivery Scenario	Complexity	Coordination
TSP-D	TSP-D combines a truck and a drone to deliver packages efficiently, aiming to reduce delivery time.	TSP-D is suitable for scenarios where a single vehicle and drone, or a small fleet, can handle delivery requirements.	Less complicated, as it involves optimizing the route for a single salesman and drone	Focuses on optimizing the route for a single salesman and drone.
MTSP-D	Minimizes the total distance travelled by all salesmen and drones, considering unique delivery requirements.	Ideal for multiple salesmen or vehicles with distinct delivery locations, commonly seen in larger logistics operations	Complexity arises from managing and coordinating routes for multiple salesmen and drones.	Coordination is used to optimize delivery routes for the fleet.
FSTSP	Minimizes total distance travelled by	Suitable for scenarios involving	Simpler version of MFSTSP, focusing on a	Optimizes routes for a single salesman

	the salesman and drones for cost-effective delivery.	a single vehicle with drones, or a small fleet.	single salesman and drones.	and accompanying drones.
MFSTSP	Minimizes the total distance travelled by all salesmen and drones, considering specific delivery demands.	Ideal for situations with multiple salesmen or vehicles, each with its own delivery locations, often found in larger operations.	More complex, as it involves coordinating routes for multiple salesmen and drones.	Coordination optimizes routes for the entire fleet of salesmen and drones.

Figure 5 and Table 6 show the subject areas available for selection, although only two major domains were chosen. Figure 6 and Table 7 of the Web of Science (WoS) show that Engineering, Operations Research Management Science and Transportation Science Technology were analyzed. Scopus and WoS supplied 700 papers, a significant fraction of the 2397 papers found following a more precise search.

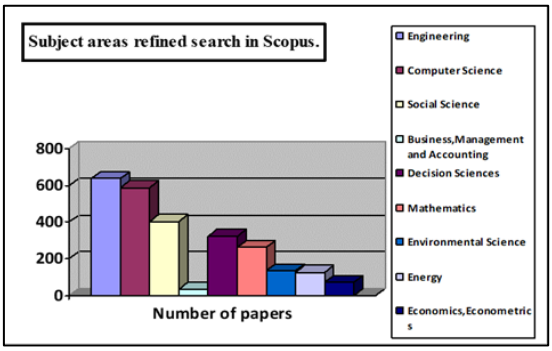

Figure 5. Bar Chart on Scopus Subject areas.

Table 6 Subject areas refined search in Scopus.

Subject Areas in Scopus	Number of Papers
Engineering	636
Computer Science	588
Social Science	402
Business, Management and Accounting	37
Decision Sciences	324
Mathematics	262
Environmental Science	136
Energy	129
Economics, Econometrics	72

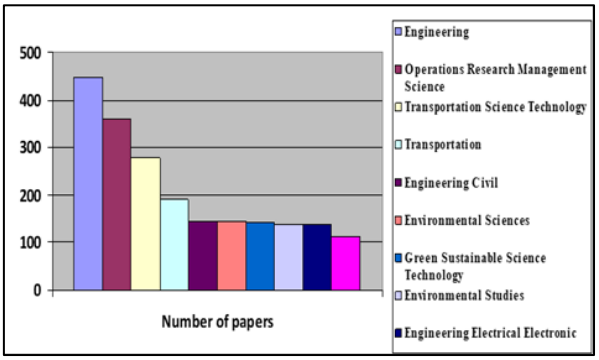

Figure 6. Bar Chart on WoS Research areas.

Table 7 Research Areas in Web of Science (WoS).

Research Areas in WoS	Number of Papers
Engineering	447
Operations Research Management Science	362
Transportation Science Technology	280
Transportation	190
Engineering Civil	145
Environmental Sciences	145
Green Sustainable Science Technology	142
Environmental Studies	140
Engineering Electrical Electronic	139

3.4 Types of Preferred Optimization Methods.

This paper analyses optimization methods, focusing on the exact method, machine learning metaheuristics, hybrid, and hybrid exact metaheuristics. This analysis seeks to offer a comprehensive comprehension of the qualities, advantages, and limitations of various approaches by thoroughly examining their subtleties. This study aims to provide a comprehensive analysis of the existing literature in order to elucidate the theoretical foundations and practical implications of these phenomena. The information presented in Table 8 provides a clear answer to research question 3 (RQ3) i.e. “What kind of optimization method are the most preferred ones by authors?'', whereby the authors preferred exact methods over machine learning and metaheuristics, with exact methods comprising 227 papers, machine learning comprising approximately 220 papers, and hybrid metaheuristics comprising 123 papers, with hybrid exact and metaheuristics comprising 74 papers, and hybrid exact metaheuristics covering approximately 36 papers.

Table 8 Type of optimization method.

Type of optimization method	Number of publications
Exact method	227
Machine Learning	220
Metaheuristics	123
Hybrid metaheuristics	74
Hybrid exact method and metaheuristics	36

A vehicle and drone operating concurrently can maximize delivery routes by utilizing [25] advanced problem-solving approach's branch-and-price method. This strategy is intended for tackling difficult projects and improves delivery speed and cost-effectiveness. The approach was applied to the TSP-D by using ng-route flexible and dynamic programming to dynamically generate paths and streamline the process. In sophisticated last-mile delivery scenarios, the method improves processing efficiency and scalability. Besides, Ant Colony Optimization (ACO) by [8] is a population-based meta-heuristic inspired by the foraging behaviour of real ant colonies where ants interact by utilizing pheromone trails. Artificial agents also known as "ants" in this method consistently create solutions to optimization problems using a stochastic methodology. Each ant gradually generates a solution based on pheromone intensity and a set of heuristic rules which are changed to reflect the quality of the solutions found. ACO has been modified to maximize several goals including minimizing overall travel distance, balancing workloads, and following limitations including capacity and time windows in the framework of the MTSP. This work by [4] addresses the TSP-D using the metaheuristic Greedy Randomized Adaptive Search Procedure (GRASP) technique. The method starts with building an initial truck path with a conventional TSP solution and then divides it into truck and drone nodes to get an initial TSP-D solution. Two local search variants—Hill Climbing Local Search (HCLS) and Local Search with Simulated Annealing (SA)—along with GRASP help to maximize this solution. Both types use a self-adaptive neighbourhood selection mechanism that alternately between Swap and TwoOpt motions depending on their success rates. Tested on benchmark datasets, the suggested GRASP approach showed similar performance with state-of-the-art algorithms and occasionally exceeded them. The paper emphasizes the efficiency of the self-adaptive search for neighbourhoods and proposes more enhancements utilizing more iterations and investigation of other neighbourhood forms. Apart from that,[12] work describes the GRASP, a multi-phase iterative technique aimed at solving the TSP-D.

GRASP consists of two main phases: the building phase and the local search phase. Whereas for the hybrid metaheuristics publications, Combining Variable Neighbourhood Search (VNS) and Simulated Annealing (SA) in the paper by [20] improves solution quality and search efficiency. To diversify the search process, the VNS-SA algorithm takes advantage of the systematic neighbourhood change strategy of VNS. Simultaneously, SA is used as a local search heuristic inside the VNS framework; it lets the algorithm escape local optima by accepting poorer solutions in first iterations and progressively improving the solution as the temperature parameter lowers. VNS's exploration powers and SA's intensification mechanism help this hybrid approach to be robust in solving combinatorial optimization problems. The TSP-D is solved in the paper [29] utilizing hybrid metaheuristics and exact methods. The solution method breaks out the problem into two decision phases: planning drone dispatches and choosing and sequencing consumers served by the truck using a mixed-integer programming formulation. They apply a Benders-type decomposition method enhanced with valid inequalities from optimal solutions and enhanced optimality cuts based on t-shortcut and t-reduction ideas. This hybrid method generates an efficient solution approach for the TSP-D by combining the strengths of metaheuristics for diversification and exact methods for precise solution refinement.

3.5 Number of Citations.

According to Research Question 4 (RQ4) i.e. "Which are the most cited papers of the field?''. The article that has received the most citations is the one that was published in 2017 by Dorling et al. and titled "Vehicle Routing Problem with Drone." This particular paper has had a total of 565 citations during its existence as depicted in Table 9.

Table 9 Top authors and number of citations.

Top 10 Authors	Number of citations
[9]	565
[23]	403
[1]	348
[12]	261
[5]	192
[16]	175
[18]	148
[7]	129
[26]	111
[30]	99

Moreover, Figure 7 below presents in a graphic form a comprehensive map illustrating the research terrain of the Travelling Salesman Problem (TSP) and other issues.

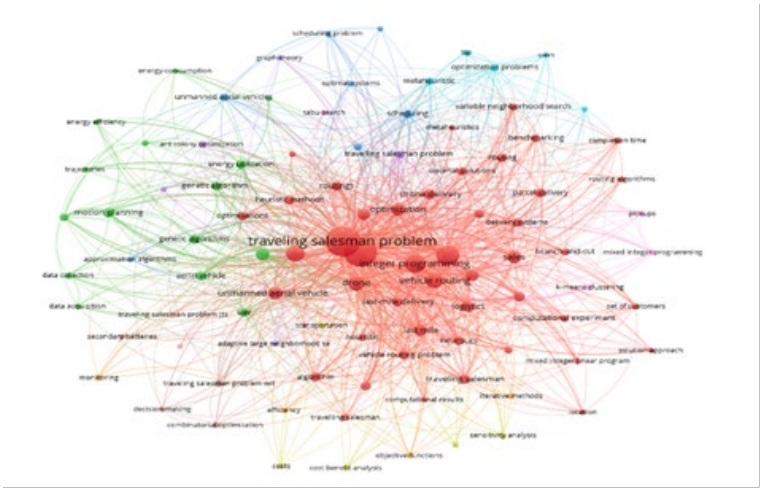

Figure 7. Scopus Vos Viewer Map.

The size of the nodes shows their frequency or importance in the research; they reflect distinct ideas and keywords. Furthermore, this study reveals other groupings. There are researchers in TSP and optimization, genetic algorithms, and energy economy. There also is a cluster dedicated to addressing scheduling and optimization issues. Some other groups investigate fascinating subjects including truck routing, drone delivery, and last-mile delivery.

This intricate network emphasizes the broad spectrum of research in this discipline by demonstrating the connections among various optimization techniques and applications with TSP. Table 10 displays the links and interactions between the TSP-D and the field of LMD according to the Scopus data.

Table 10 Vos Viewer based on Scopus.

Top 10 Keywords	Number of citations
Travelling salesman problem	161
Drones	143
Trucks	73
Integer programming	61
Antennas	47
Vehicle routing	38
drone	35
Unmanned aerial vehicle	27
Sales	27
Optimization	29
Last mile	24
Vehicle routing problem	22
Logistics	24
Unmanned aerial vehicle(UAV)	25
Heuristic algorithm	23
Vehicle routing problem	15
Drone delivery	18
Heuristics	15
Unmanned vehicle	14

There is a strong emphasis on drones being used for surveillance and delivery. This interest is clearly shown by the 143 citations that highlight the potential of drone technology. Truck routing, which has received 73 citations, holds great importance in the field of logistics and transportation. The importance of mathematical techniques in optimization is highlighted by integer programming, which has been cited sixty-one times. Antennas play a crucial role in communication and logistics, as indicated by 47 citations. Furthermore, vehicle routing has garnered significant attention, as evidenced by the 38 citations it has received. It's stimulating to take into account the growing number of citations for drones, unmanned aerial vehicles, and drone delivery. Unmanned Aerial Vehicle(UAV) technology has received a significant amount of attention. Extensive research has been conducted on the vehicle routing problem, general optimization, and last-mile delivery to enhance logistics and distribution efficiency. Numerous citations demonstrate this. Researchers observed that heuristic algorithms (23 citations) and heuristics (15 citations) are often employed to approximate difficult issues like the TSP. This field cites technological advances, mathematical methodologies, and logistics and transportation applications. The interconnections and correlations between the data acquired from the Web of Science (WoS) show with the TSP-D. The TSP-D is a combinatorial optimization issue whereby a truck and a drone cooperate to deliver goods to consumers. Reducing the whole delivery time is the main objective of this problem. NP-hard, a computationally difficult problem, is the one whose optimal solution is determined. Therefore, their scale limits the capacity of one to address problems optimally. Metaheuristics are a class of algorithms with intelligence and adaptability that have shown their effectiveness in several related problem areas. The data from the Web of Science shows the TSP-D relationships. These links are incomplete because the data includes its colonies. Trucks and drones must be coordinated to deliver supplies to customers in the TSP-D. The best answer is notoriously difficult to compute. Thus, metaheuristics address current conditions. Metaheuristics have shown exceptional intelligence and flexibility in a wide range of problem domains. Building the colony requires several Web of Science (WoS) journals and publication references. We show the network of notable TSP and associated study writers. The relationships between network nodes demonstrate author cooperation or co-authorship of research papers. The nodes' size can reflect the level of influence or the number of citations for each author. It is evident from the distinct clusters that specific authors frequently collaborate.

Authors can be identified based on their level of cooperation using clusters of different sizes and unconnected nodes. This suggests that some authors may have more specialized areas of expertise. This network map provides a comprehensive view of the interconnections and collaborative patterns among researchers in the TSP domain. It highlights the significant contributors and their extensive networks of collaboration. In addition, the number of citations per paper has been restricted to only two to make it easier to gather a larger number of interconnected data colonies, as shown in Figure 8.

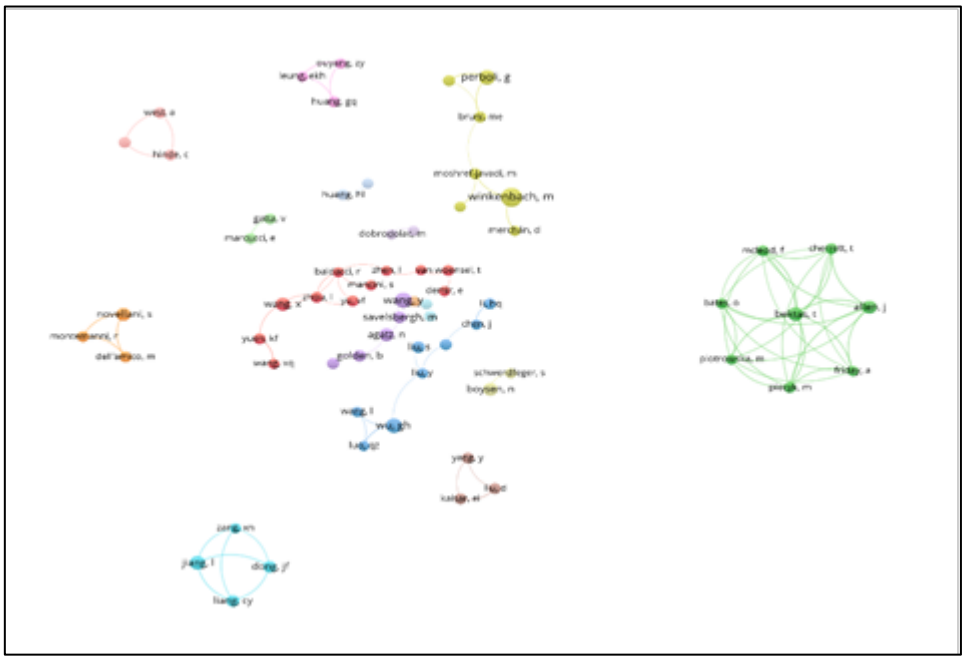

Figure 8. WoS Vos Viewer Map.

Table 11 provides a thorough overview of eminent academics together with information on the citations their works have attracted. It mostly concentrates on the top Travelling Salesman Problem (TSP) and related disciplines researchers. The outstanding 16 citations by [13] have greatly helped the field. The other top two entries, [6] and [16] show that they have earned great esteem for their contributions based on their 15 and 14 citations respectively. Notable also with 11 citations are [19] and [27]. With 10, 9, 9, and 8 citations, [3] referenced several times in the paper and produced consistent research output. Both with 7 citations, [2] and [16] have made significant contributions. [32] have added five citations. Among these, [13] stand out with 13 and 11 references. The way references are distributed highlights the cooperative nature of this field of research, in which numerous authors usually cooperate to contribute to the body of knowledge in logistics and optimization.

Table 11 Vos Viewer based on WoS.

Top 10 Authors	Number of citations
[16]	14
[6]	15
[19]	11
[19]	11
[3]	10
[3]	9
[3]	9
[3]	8
[2]	7
[13]	16
[16]	7
[31]	13
[13]	13
[31]	9
[19]	5
[24]	10
[13]	11
[27]	11
[27]	11

3.6 Summary of the Reviews.

In summary, it is pertinent to acknowledge that the meta-analysis undertaken on the amalgamated corpus of scholarly articles has yielded comprehensive insights into the five designated research inquiries delineated. Upon thorough examination and analysis of the aforementioned RQs, it is now within our purview to proffer a comprehensive response to the research questions posited in the context of this bibliometric analysis. These research questions, being the primary focal point of the study, serve as the principal objective that this scholarly endeavour seeks to achieve. The present discourse endeavours to present a comprehensive analysis of the most frequently cited authors, as elucidated in Table 9. This tabular representation serves to underscore the salient aspects that have been extensively examined and expounded upon in the course of this bibliometric analysis. Furthermore, it is noteworthy to highlight that the TSP-D has garnered considerable attention and has been the focal point of extensive research endeavours pertaining to routing problems over an extended period. Subsequently, the domain of LMD has emerged as the subsequent area of interest, albeit to a lesser extent, in terms of scholarly investigations.

4. CONCLUSION

This study comprehensively examines the literature on TSP-D and LMD. This endeavour involves a bibliometric analysis aimed at analyzing and synthesizing the research endeavours undertaken in these specific areas of interest. The temporal scope examined within the confines of this scholarly document encompasses seven consecutive years, during which an extensive corpus of 2397 publications was meticulously scrutinized and analyzed. In simple terms, by methodically evaluating and assessing various methodologies, scholars can gain valuable insights into their strengths and weaknesses and determine whether they can combine or modify methods to take advantage of their best features. The No Free Lunch theorem [31] is a profound and thought-provoking reminder that optimization solutions are difficult to find and have no universal answer.

Scholars are driven to develop and refine methods to better understand and solve the TSP-D. Drones have been extensively studied in modern logistics systems. This research focuses on using drones to transport small, light goods.

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