

Delivery By Drone: A Bibliometric Analysis

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Abstract: The world is living in an era of rapid technological development. This rapid evolution is having a profound impact on the business world, forcing many sectors to keep pace with change. Technological innovation is essential for efficiency, sustainability and competitiveness. One of the most prominent areas in this context is drone technology. Drones are attracting attention for both military and civilian applications, and one of the most important applications is drone delivery. This innovative mode of transport is being discussed by many sectors due to the benefits it offers and the risks it poses. In this study, a bibliometric analysis method was used to explore the issue of drone delivery in more depth. For the analysis, the Scopus database was searched and the publications obtained were evaluated using bibliometric methods such as basic statistics such as distribution by years and clustering relationships between words. The data used in the study covers the years 2012-2025, which shows that drone delivery is a relatively new area of research. However, the 1038 academic publications obtained show that interest in the topic is quite high. These publications appear in a total of 538 different sources and 2780 different researchers are working on drone delivery. In addition, the rate of international collaboration among authors is 22.45%. This rate indicates significant potential for collaboration for academics wishing to conduct research on a global scale. This review is a valuable resource for both researchers and policymakers, providing important insights into the field of drone delivery. At the same time, it contributes to the literature by highlighting general trends in the drone delivery sector.

Keywords: Drone, Drone Delivery, Transportation, Scopus

JEL Classification codes: 014, 033

INTRODUCTION

There are some studies that examine the issue of drones through bibliometric analysis. One of these studies focuses on drone journalism (Pathak, 2024). Another example explores the use of drones to facilitate agricultural practices (Gokool et al., 2023). These examples show that drone technologies have the potential to be used in many different areas.

Drone technology is exciting in many ways. They offer benefits such as rapid delivery of sensitive cargo such as medicines without disrupting traffic, environmentally friendly transport with low carbon emissions, reduced costs and access to hard-to-reach areas. Another important advantage is that they can be used effectively in disaster situations. Given all these features, drone technology is expected to become more widespread in the future. In particular, developments in the field of artificial intelligence could make this technology even more interesting. This research discusses the issue of drone delivery, identifies its basic characteristics and provides a theoretical contribution to the literature.

The Bibliometrix package in the R programming language was used to process the data imported from Scopus and to obtain bibliometric indicators to visualise the scientific, thematic and research evolution in the field of drone transport. These indicators include basic statistics, the evolution of the number of scientific publications over time, the most influential journals and institutions, the most cited studies at a global level, the most used keywords and collaborative networks between countries.

This research consists of five chapters in total. The first chapter contains the literature review, the second chapter contains the explanation of the methodology, the third chapter contains the research data, the fourth chapter contains the discussion, and the fifth chapter contains the results.

1 LITERATURE REVIEW

There are very few studies that address the issue of drones using bibliometric methods. Some examples of existing studies in this area are presented below:

- With the development of e-commerce, logistics companies need to rethink last-mile delivery. In this context, a delivery model is being explored that uses a combination of trucks and drones to minimise the challenges of last-mile delivery (Madani & Ndiaye, 2022).
- One of the technologies on the sustainable agriculture agenda is drone technology (Gamage et al., 2024).
- Drones can be used to make dendrometric estimates in forests (Silva et al., 2024).
- Drone technologies are important for sustainable logistics (Ferraro et al., 2024).
- The use of Unmanned Aerial Vehicles (UAVs) is growing rapidly, but there is still a lack of scientific research in this area. In this context, the mobility of UAVs will be analysed (Purtell et al., 2024).
- The use of drones is part of a revolution in urban logistics (Pérez Carrera et al., 2024).
- Drones can be used to monitor air quality. Since 2017, there has been an increase in the number of publications on air pollution, drones and sensors. Interest in this topic has increased over the last five years. Bibliometric reviews show that sensor technology is developing rapidly (Marin et al., 2023).

In addition to the studies mentioned above, there are other bibliometric studies that focus on drones in the analysis sections of the research. (1) In a study on animal-centred unmanned vehicle systems, it was observed that the terms "drone", "UAV" and "AUV" were mentioned with almost equal frequency. This situation shows that these technologies are prominent for exploration purposes in aquatic animal-oriented studies (X. Liu et al., 2025). (2) Drone technology can also be used to map mangrove forests (Y. Wu et al., 2025). (3) Drone technologies can also be used for shallow bathymetric mapping (He et al., 2024). (4) However, the unmanned aerial vehicles that have become popular for all these applications bring with them the problem of noise, and this is an important issue that needs to be addressed (Yang et al., 2024).

2 METHODOLOGY

2.1 Bibliometric analysis

Bibliometric analysis is used to analyse the scientific and thematic development of a scientific field (Bello-Yañez et al., 2025). Bibliometric methodology is an effective way of dealing with large data sets and plays an important role in revealing the overall perspective of a field.

Thanks to this analysis, it is possible to provide a comprehensive and in-depth view of all disciplines (Donthu et al., 2021).

Bibliometric analysis includes various analyses such as the number of publications by year, the number of citations received by the publications, the institutions interested in the subject, the countries of the authors and the co-occurrence of words (Sánchez-Cañón et al., 2025). As can be seen from these examples, bibliometric analysis offers the possibility of classifying and evaluating publications numerically.

Bibliometric analysis offers the possibility to visualise and evaluate collaborations between data. For example, collaborative networks between institutions and researchers can be analysed. In addition, by identifying the most popular journals in a field, researchers can make information about these journals a valuable resource for other researchers working on the same topic. The characteristics identified for a field serve as a guide for new studies. Bibliometric analysis is becoming increasingly popular, and even consultancies can use it to gain a competitive edge in the business world (Q. Liu et al., 2025).

2.2 Obtaining data

On 02.02.2025, the Scopus database was searched using the keywords ("drone delivery" OR "delivery drone" OR "drones delivery" OR "delivery drones"). The query returned 1038 publications.

The Scopus database was used in a study that examined drone technologies from a sustainable development perspective. The study analysed 278 publications covering the years 2014-2023 (Saini & Jain, 2023). This example shows that 1038 publications are sufficient for a bibliometric study.

2.3 Research questions

Toktaş et al. (2024) examined urban logistics from an environmental perspective through bibliometric analysis. Inspired by the research questions of this study, the questions of this research were defined. These are

- RQ1: What is the current state of research on drone transport?
- RQ2: What are the approaches to drone transport?

2.4 Why Scopus database?

The Scopus database can be used in bibliometric analysis studies because it has a data model suitable for bibliometric analysis. For example, it can be seen that this database is also preferred in bibliometric analysis studies carried out by Vinueza-Naranjo et al. (2025) and Bulto et al. (2025).

2.5 Software

In this research, the Bibliometrix library of the R programming language was used. This library, developed by (Aria & Cuccurullo, 2017), is widely used in academic research. It can be seen that the Bibliometrix library is used in academic studies carried out by Afonso et al. (2025) and Jia et al. (2025).

3 RESULTS AND DISCUSSION

This section addresses questions RQ1 and RQ2 and presents the current state of drone transport research by analysing and reporting the general statistics of the reviewed articles, publication years, publication sources, supporting institutions, most cited research, most used keywords and related countries.

3.1 Basic statistics

Basic statistics are presented in Table 1. Accordingly, drone survival is a new topic. Publications on this topic started in 2012. This situation provides an opportunity for academics who want to work in this field to gain an important position in the sector. There are 1038 publications from 582 different sources. This shows that there is widespread interest in the subject. The annual growth rate of publications is 26.39 and this level shows that this research area continues to attract rapid interest. 2780 researchers have an international collaboration rate of 22.45%. In addition, the culture of collaboration in the field is high.

Tab. 1 Basic statistics

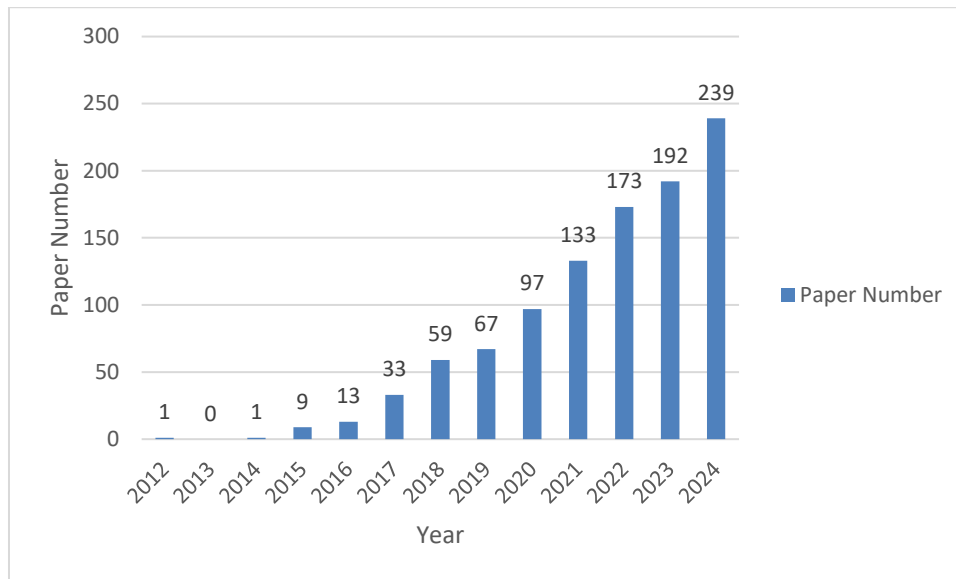
Description	Results	Description	Results
MAIN INFORMATION ABOUT DATA		AUTHORS	
Timespan	2012:2025	Authors	2780
Sources (Journals, Books, etc)	582	Authors of single-authored docs	66
Documents	1038	AUTHORS COLLABORATION	
Annual Growth Rate %	26.39	Single-authored docs	77
Document Average Age	3.34	Co-Authors per Doc	3.63
Average citations per doc	17.33	International co-authorships %	22.45
References	30508		
DOCUMENT CONTENTS			
Keywords Plus (ID)	5457		
Author's Keywords (DE)	2358		

Source: These data were obtained by the author using the Bibliometrix package

3.2 Number of publications per year

Figure 1 shows the annual distribution of publications on drone transport in the Scopus database. Although the history of publications on the subject is still young, it can be seen that it is developing rapidly. This situation offers important opportunities for both researchers and the drone industry. Researchers and industry representatives conducting studies on drone technologies are likely to attract interest from both the academic and business communities.

Fig. 1 Number of publications per year



Source: Scopus, 2025

3.3 Most relevant sources

Table 2 lists the sources with the highest number of publications on drone transport. The journal "Drones" stands out as the source with the most publications in this area. This journal and others on the list are also potential sources of publications for researchers interested in drone transport.

Tab. 2 Most relevant sources

Sources	Articles
Drones	35
Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	27
Transportation Research Part C: Emerging Technologies	19
Expert Systems with Applications	17
IEEE Transactions on Intelligent Transportation Systems	15
Lecture Notes in Networks and Systems	14
Computers and Industrial Engineering	13
Transportation Research Part E: Logistics and Transportation Review	13
Sustainability (Switzerland)	12
ACM International Conference Proceeding Series	11

Source: These data were obtained by the author using the Bibliometrix package

3.4 Most relevant affiliations

Table 3 shows the organisations most supportive of drone transport research and the countries to which these organisations belong. Organisations in Singapore, China and the USA show a strong interest in this area. Australia and Japan also stand out alongside these countries. It is likely that these countries will take the lead in drone transport in the future and make a bigger name for themselves.

Tab. 3 Most relevant affiliations

Affiliation	Country	Articles
Nanyang Technological University	Singapore	31
Tsinghua University	China	30
National University of Singapore	Singapore	29
Purdue University	USA	23
The University of Sydney	Australia	23
Carnegie Mellon University	USA	22
Hefei University of Technology	China	19
University Of Sydney	Australia	19
Central South University	China	16
Ritsumeikan University	Japan	16

Source: These data were obtained by the author using the Bibliometrix package

3.5 Most global cited documents

Table 4 shows the most cited studies. The most cited study on drone transport examines the issue of vehicle routing. There are two other studies in this area that address this issue. Popular studies tend to focus on optimisation, innovation and efficiency.

Tab. 4 Most global cited documents

Author	Title	Total Citations	TC per Year	Normalized TC
(Dorling et al., 2017)	"Vehicle Routing Problems for Drone Delivery"	891	99.00	15.66
(D. Wu et al., 2015)	"...digital manufacturing and design innovation"	585	53.18	7.58
(Stolaroff et al., 2018)	"...gas emissions of drones for commercial package delivery"	374	46.75	7.61
(Sacramento et al., 2019)	"...vehicle routing problem with drones"	321	45.86	6.85
(Mourelo Ferrandez et al., 2016)	"Optimization of a truck-drone ..."	270	27.00	8.30

Author	Title	Total Citations	TC per Year	Normalized TC
(Kitjacharoenchai et al., 2019)	"...traveling salesman problem with drones ..."	264	37.71	5.63
(Poikonen et al., 2017)	"The vehicle routing problem with drones ..."	252	28.00	4.43
(Chiang et al., 2019)	"Impact of drone delivery on sustainability and cost ..."	242	34.57	5.16
(Kellermann et al., 2020)	"Drones for parcel and passenger transportation ..."	225	37.50	8.78
(Aurambout et al., 2019)	"Last mile delivery by drones ..."	209	29.86	4.46

Source: These data were obtained by the author using the Bibliometrix package

3.6 Most frequent words

Table 5 shows the 50 most frequently used words related to drone transport. When determining the frequently used words, drone-drones, delivery drone-delivery drones, "unmanned aerial vehicle-uav, unmanned aerial vehicle-uavs, internet of things-iot and drone delivery-drone deliveries" were taken as synonyms.

In addition to general concepts, there are also specific terms that shed light on the topic of drone transport. For example, last-mile delivery, optimisation, parcel delivery, routing, e-commerce, IoT, genetic algorithm, humanitarian logistics, urban air mobility, energy consumption and city logistics. These concepts are important to provide an overview of the drone transport literature and to show the areas of interest in the literature.

Tab. 5 Most frequent words

SN	Words	Occurrences	SN	Words	Occurrences
1	drone delivery	222	26	reinforcement learning	11
2	drone	195	27	transportation	11
3	unmanned aerial vehicle	154	28	blockchain	10
4	last-mile delivery	55	29	privacy	10
5	delivery drone	38	30	security	10
6	optimization	31	31	city logistics	9
7	logistics	30	32	dynamic programming	9
8	delivery	26	33	deep learning	8
9	vehicle routing problem	26	34	drone delivery service	8
10	routing	24	35	drone routing	8
11	parcel delivery	20	36	drone technology	8
12	path planning	19	37	robust optimization	8
13	e-commerce	18	38	smart cities	8

SN	Words	Occurrences	SN	Words	Occurrences
14	internet of things	17	39	variable neighborhood search	8
15	last mile delivery	16	40	artificial intelligence	7
16	genetic algorithm	15	41	autonomous drone	7
17	vehicle routing	15	42	drone delivery system	7
18	covid-19	13	43	simulation	7
19	heuristics	12	44	skyway network	7
20	humanitarian logistics	12	45	truck-drone delivery	7
21	machine learning	12	46	uas	7
22	traveling salesman problem	12	47	collision avoidance	6
23	urban air mobility	12	48	deep reinforcement learning	6
24	energy consumption	11	49	drone routing problem	6
25	quadcopter	11	50	drone service	6

Source: These data were obtained by the author using the Bibliometrix package

3.7 Collaboration network

Table 6 shows the results of the collaboration network analysis by country. In this analysis the following values were used: network layout "automatic layout", clustering algorithm "walktrap", normalisation "association", number of nodes "50", repulsion force "0.1", remove isolated nodes "yes", minimum number of edges "1".

According to the country cooperation network analysis, the most influential country is the USA. The second most influential country is China and the third is Korea. The three most influential countries are in cluster two. The other members of this cluster are Japan, Singapore, Canada, Hong Kong, Thailand and Mozambique.

Group 7 is also noteworthy. This group is headed by India, the United Kingdom and Germany. They are followed by the Netherlands, the United Arab Emirates, Turkey, Finland and Austria.

Ghana, Ireland, Egypt, Colombia and Rwanda formed a separate group and did not interact with other countries.

Tab. 6 Collaboration network

Node	Cluster	Betweenness	Closeness	PageRank	Node	Cluster	Betweenness	Closeness	PageRank
Saudi Arabia	1	60.229	0.012	0.027	Germany	7	20.498	0.012	0.031
Tunisia	1	7.505	0.01	0.018	Netherlan ds	7	5.962	0.012	0.022

Node	Cluster	Betweenness	Closeness	PageRank	Node	Cluster	Betweenness	Closeness	PageRank
Jordan	1	0	0.01	0.008	United Arab Emirates	7	2.377	0.012	0.016
USA	2	428.994	0.017	0.148	Turkiye	7	0	0.01	0.018
China	2	93.873	0.014	0.084	Finland	7	0.528	0.011	0.013
Korea	2	12.948	0.012	0.033	Austria	7	0.064	0.009	0.007
Japan	2	0.239	0.009	0.007	Malaysia	8	9.27	0.011	0.018
Singapore	2	9.475	0.011	0.04	Indonesia	8	0.237	0.01	0.009
Canada	2	60.646	0.013	0.038	Pakistan	8	4.553	0.011	0.014
Hong Kong	2	12.966	0.012	0.027	Italy	9	115.575	0.014	0.05
Thailand	2	0.024	0.011	0.017	Australia	9	49.192	0.013	0.029
Mozambique	2	0	0.01	0.006	Brazil	9	0.628	0.01	0.011
Switzerland	3	5.538	0.01	0.015	France	9	16.191	0.012	0.026
South Africa	3	4.3	0.011	0.012	Iran	9	0.056	0.011	0.01
Czech Republic	3	0.561	0.009	0.01	Portugal	9	8.663	0.012	0.018
Hungary	4	4.489	0.009	0.011	Sweden	10	0.849	0.011	0.012
Slovakia	4	1.449	0.009	0.007	Poland	10	3.025	0.01	0.013
Greece	5	9.168	0.01	0.015	Qatar	10	0.193	0.01	0.007
New Zealand	5	0.354	0.009	0.006	Ghana	11	0	0.01	0.006
Spain	6	1.948	0.011	0.012	Ireland	12	9.278	0.009	0.011
Belgium	6	1.025	0.01	0.012	Colombia	13	0	0.008	0.005
India	7	97.808	0.013	0.035	Egypt	14	2.68	0.008	0.01
United Kingdom	7	79.644	0.014	0.054	Rwanda	15	0	0.008	0.005

Source: These data were obtained by the author using the Bibliometrix package

In this section, the literature is reviewed in relation to the most frequently used words in the publications on drone transport in Table 5 and Table 6. As a result of the review, the trends identified in the literature are discussed.

Drone technologies can be used in many different areas. Another important issue surrounding drone technology is safety. Examples of these applications are presented below:

- Drone technologies can be used in many different areas:

- Drone technology can be used to study air pollution (Liao & Kim, 2024).
- Artificial intelligence and drone technology could revolutionise farming (Slimani et al., 2024).
- The use of drones offers significant benefits in modern agriculture. It promotes environmentally friendly practices, increases productivity and contributes to sustainable food production (Patil et al., 2024).
- The global agricultural drone market is expected to be worth \$5.7 billion in 2025 (Chandel et al., 2024).
- Landslide mapping is an important application that can benefit from drone technologies to monitor and analyse landslides (Ilinca & Şandric, 2025).
- Drones, big data and artificial intelligence will be crucial in future urban firefighting applications (Song & Xu, 2023).
- Drones can be used in natural disasters, for example to monitor flooding (Iqbal et al., 2023).
- The use of drones in emergency medical services offers significant opportunities (Pulsiri & Vatananan-Thesenvitz, 2021).
- Drone technology has also brought with it some risks.
 - Cybersecurity procedures and legislation are very important in drone technologies (Bhattacharya et al., 2023).
 - This is why scientists need to continue to discuss the risks of drone use (Tubis et al., 2024):
 - Drone technologies should be assessed in separate military and civilian categories.
 - Risk assessment methodologies for drone technologies should be identified.
- Countries in publications on drones:
 - The countries with the highest number of publications on the relationship between drones and the environment are the US, China and the UK (Suryani et al., 2023).
 - In Malaysia, drone technology is mainly used in agriculture and mapping (Gohari et al., 2023).

According to the literature, drone technologies have the potential to be used in many areas. Examples include air pollution monitoring, agriculture, firefighting, urban logistics, e-commerce logistics, last-mile delivery and mapping. However, there are risks associated with the use of drones that need to be further investigated by scientists. In this context, drone technologies should be evaluated in two separate categories: military and civil. It is also important to develop appropriate policies to address the risks of drones. As in this study, the US and China are among the most prominent countries in various drone studies.

CONCLUSION

Drone technologies are being used in many areas. Interest in these technologies is growing due to their speed, efficiency, cost advantage, environmental impact, accessibility and future potential. Due to the importance of the topic, this study examines drone transport using a

bibliometric analysis method. This study reveals the basic dynamics of the drone transport literature and makes a theoretical contribution to the literature.

This research seeks to answer questions RQ1 and RQ2. Accordingly:

RQ1: Although the literature on drone transport is still new, it is developing rapidly. The 1,038 publications obtained from the Scopus database are included in 582 different sources, indicating that the topic is attracting widespread interest. There are 2,780 researchers working in the field of drone transport and the rate of international collaboration is 22.45%. Research on the topic started with only one publication in 2012, but has shown a remarkable increase, reaching 239 publications in 2024. The general trend shows that the topic is attracting more and more attention. The journal "Drones" is the source of most publications and "Nanyang Technological University" in Singapore stands out as the institution supporting the most publications.

RQ2: In the analysis of drone transport, in addition to general concepts, some terms specific to the field attract attention. For example, last mile delivery, optimisation, package delivery, routing, e-commerce, IoT, genetic algorithm, humanitarian logistics, urban air mobility, energy consumption and urban logistics. These terms are very important to provide an overview of the literature on drone transport and to show the areas of interest in the literature. According to the country analysis, the USA, China and Korea stand out. These countries and others that stand out for their research have the potential to have a say in the drone transport sector.

This research shows that although the topic of drone transport is new, it has attracted a great deal of interest. The literature on drone transport is closely related to e-commerce, urban logistics and last-mile delivery. Technologies such as artificial intelligence and IoT are frequently mentioned in the literature. Drone transport offers important opportunities in current discussions on the economic agenda, such as sustainability, efficiency and energy.

In disaster logistics, drone technologies are essential to reach inaccessible areas and deliver products without getting stuck in city traffic. E-commerce is growing by the day, and drones are on the agenda as an interesting option for last mile delivery. In addition, drones offer an important alternative in terms of sustainable living, energy efficiency and cost reduction.

In this study, only the Scopus database was used because it provides sufficient data for bibliometric analysis. However, the research can be updated by collecting data from different databases. In addition, the focus of the research can be changed by changing the keywords used to search for publications. Finally, the content of the research can be enriched by using different bibliometric analysis methods.

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