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Bibliometric exploration of generalized Lindley distributions: a meta-analytical approach

Abstract

This meta-analysis provides a detailed bibliometric overview of the research landscape surrounding generalizations of the Lindley distribution, aiming to capture the depth and breadth of scholarly activity in this evolving field of statistical modelling. By systematically analysing a wide range of academic sources, including journal articles and related literature, the study identifies prevailing research themes, influential publications, and leading contributors who have shaped the domain. Utilizing established bibliometric techniques, it quantifies the impact of individual works, examines patterns of collaboration among researchers, and maps the geographical distribution of research output across the globe. The analysis also highlights emerging areas of interest, uncovers shifts in research focus over time, and brings attention to seminal studies that have driven theoretical and applied advancements. Through this comprehensive approach, the study not only documents the progression of knowledge on Lindley distribution generalizations but also offers valuable insights into current trends and potential future directions, thereby contributing meaningfully to the broader statistical and mathematical sciences literature.

Keywords: lindley distribution, bibliometric analysis, web of science, generalizations

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Introduction

The Lindley distribution, known for its unique blend of flexibility and tractability, has become a powerful tool in statistical modelling across various fields. However, the pursuit of enhancing its capabilities has led to the development of numerous generalizations, each designed to address specific data characteristics or analytical challenges Tomy.[1] This research paper dives deep into the world of Lindley distribution generalizations, using a unique bibliometric approach. We explore how researchers have expanded upon the classic Lindley distribution to tackle diverse data challenges, revealing key trends, prominent researchers, and promising directions for future exploration.

The Lindley distribution, introduced in 1958 by Dennis V. Lindley, is a versatile probability distribution finding applications in various fields like lifetime data analysis, Economics, and signal processing Lindley.[2] Its research journey can be broadly divided into three phases:

Initial explorations (1958-1980s): During this stage, the emphasis was on comprehending the essential characteristics of the Lindley distribution, encompassing its density function, moments, and hazard function. Research delved into its connections with established distributions such as gamma and exponential distributions. Initial practical applications surfaced in the examination of waiting times and service intervals within queuing systems.[3]

Generalizations and extensions (1990s-2010s): Recognizing constraints inherent in the one-parameter Lindley distribution, researchers aimed to enhance its versatility through the introduction of generalizations and extensions. Noteworthy instances encompass the two-parameter Lindley distribution, which incorporates an additional parameter, affording greater control over skewness and tail behaviour,[4] the discrete Lindley distribution designed for modelling count data, and compound Lindley distributions that amalgamate the Lindley with other distributions to represent more intricate data structures.[5] These innovative approaches significantly broadened the scope of the Lindley distribution, finding applications in diverse fields such as insurance claim frequency, gene expression analysis, and hydrological data modelling.[6]

Recent developments and future directions (2010s-present): The current landscape has witnessed a shift in focus towards enhancing Lindley-based models through robust estimation, refined inference methods, and computational considerations. Ongoing research delves into the Lindley distribution's role in Bayesian inference and its efficacy in modelling censored and missing data. Noteworthy applications on the horizon involve the modelling of reliability data, financial returns, and environmental processes.[7] A closer look at specific adaptations and variations of the Lindley distribution reveals areas of significant research interest. The Beta-Lindley distribution, for instance, amalgamates the flexibility of the beta distribution with the right-skewed nature of the Lindley, proving valuable in modelling income data and rainfall time series.[8,9] The Marshall-Olkin-Lindley distribution introduces an additional shape parameter, making it particularly advantageous for analysing lifetime data characterized by increasing or decreasing hazard rate.[10] The Kumaraswamy-Lindley distribution combines the Kumaraswamy distribution's capability to model bounded data with the right skewness of the Lindley, finding applications in modelling income inequality and survival times.[11]

The dynamic evolution of the Lindley distribution, marked by its distinctive properties and broad applicability, remains a catalyst for ongoing research. Its adaptability renders it an asset for statisticians and researchers aiming to model various real-world phenomena. A grasp of its historical progression and current advancements enables an appreciation of its versatility, paving the way for anticipating its potential in addressing future challenges in data analysis and modelling.

This paper offers insights into the overall research growth in the domain of Lindley distribution generalizations, employing bibliometric analysis as a systematic and scientific method for examining books, documents, and articles. The analysis offers a detailed comprehension of evolving patterns in the performance of articles and journals, collaboration dynamics, and crucial components within research endeavours. Utilizing metrics such as the most relevant sources, documents, highly cited articles, and influential authors, the study aims to enhance understanding of the conducted research. Additionally, data visualization is employed to present the most used keywords in the study. The structure of the paper involves outlining the methodology, detailing the steps in data extraction from Web of Science, and providing an in-depth discussion of the bibliometric analysis.

Methodology

Bibliometric analysis, a widely utilized method for investigating extensive scientific data, involves a three-part methodology: data extraction from a database, subsequent data analysis, and ultimately reporting and visualizing the findings. Bibliometric analysis is a quantitative method used to evaluate and measure various aspects of scholarly publications, including books, articles, and other forms of written communication.[12] This type of analysis involves the statistical examination of bibliographic information to gain insights into patterns, trends, and the impact of academic research

In this study, data acquisition was accomplished by entering specific keywords into the search tab of the Web of Science (WoS) databases. The bibliometric investigations were carried out utilizing version 4.1.0 of the Bibliometrics R package.[13] Various metrics were employed in the study, encompassing research growth, identification of the most prolific and extensively cited authors, assessment of high-demand research fields, identification of top journals, country-based analysis, institution-based analysis, and recognition of highly impactful publications in the realm of Lindley distribution generalizations research. These analyses are particularly valuable in the fields of science, technology, and medicine, where citation patterns and research impact are often critical indicators of academic success and contributions to knowledge.

Bibliometric analysis

In this paper, bibliometrics is employed for carrying out two primary analyses, namely Descriptive Analysis and Network Analysis. The initial section presents the results of the descriptive analysis, involving commonly used keywords, analysing the chronological evolution of publications, determining the journals with the highest publication output, identifying authors with significant contributions, and analysing the most frequently cited documents. The subsequent section delves into the network analysis, specifically focusing on examining relationships and patterns in the occurrence of keywords andinvestigating collaborative networks among authors, institutions, or countries.

Descriptive analysis of Bibliometric data

We present the following discoveries below: an overview of overall findings, a yearly breakdown of publication counts illustrating the longitudinal distribution of publications, papers with the highest citation counts, authors with the most prolific output, journals with the highest citation per paper, institutions with the highest citation per document, and countries demonstrating the highest publication productivity.

Overview of the data: For this investigation, we considered 803 documents retrieved from 219 sources, collectively authored by 1424 individuals, sourced from the Web of Science (WoS) database. Table 1 furnishes a comprehensive overview of each document under scrutiny in our study on the generalizations of the Lindley Distribution. The table includes details such as the total number of articles and encompasses 9525 references spanning the years 2005 through 2025.

Annual scientific production: Table 2 and Figure 1 provide a comprehensive overview of the annual growth in the number of academic studies dedicated to the generalizations of Lindley Distributions from 2005 to 2025. The data reveals a noteworthy progression in research activity over the specified period. In 2018, a total of 46 studies were conducted on this subject. The subsequent year, 2019, witnessed a modest increase to 53 studies. The momentum continued in 2020, with the number of studies reaching 59. A substantial surge occurred in 2021, as the research output soared to 93 papers. The following year, 2022, saw a continuation of this upward trend, with 105 papers contributing to the academic discourse. In 2023, the number remained significant at 108 papers.

Table 1 Overview of the data

Main information about data	Result
Time span	2005:2025
Sources (Journals, Books, etc)	219
Documents	803
Annual Growth Rate %	5.28
Document Average Age	5.68
Average citations per doc	13.68
References	9525
Keywords Plus (ID)	882
Author's Keywords (DE)	2295
Authors	1424
Authors of single-authored docs	84
Single-authored docs	105
Co-Authors per Doc	3.12
International co-authorships %	41.22
Article	776
Article; early access	12
Article; proceedings paper	5
Article; retracted publication	5
Correction	1
Editorial material	2
Review	2

Table 2 Annual scientific production

Year	Articles	Year	Articles
2005	5	2016	28
2006	7	2017	48
2007	6	2018	46
2008	10	2019	53
2009	9	2020	59
2010	10	2021	93
2011	14	2022	105
2012	15	2023	108
2013	14	2024	100
2014	31	2025	14
2015	28		

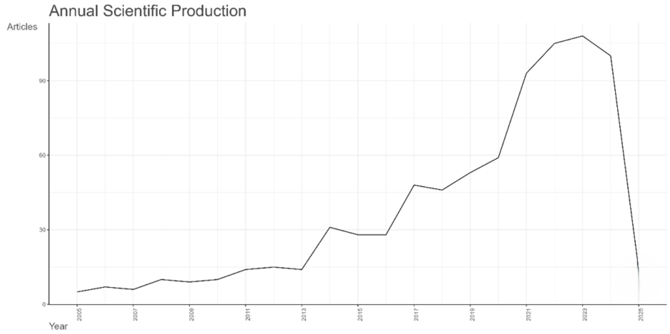

Figure 1 Annual scientific production.

Citation: Tomy L, Jose M, Mathew S, et al. Bibliometric exploration of generalized Lindley distributions: a meta-analytical approach. *Biom Biostat Int J.* 2025;14(2):53‒59. DOI: 10.15406/bbij.2025.14.00434

These findings underscore the sustained and growing interest in the generalizations of Lindley Distributions, emphasizing the ongoing relevance and importance of this research topic within the academic community.

Most relevant sources: Table 3 provides a detailed breakdown of the most significant sources of documents in the field of Generalizations of Lindley distribution. Notably, the leading journals contributing to this area are Journal of Statistical Computation and Simulation, Communications in Statistics-Simulation and Computation and Communications in Statistics-Theory and Methods. Specifically, these three journals stand out as the top publishers of articles related to the topic.

Table 3 Most relevant sources

Most relevant journal	Articles
Journal of Statistical Computation and Simulation	58
Communications in Statistics-Simulation and Computation	49
Communications in Statistics-Theory and Methods	43
Journal of Applied Statistics	37
Mathematics	36
Symmetry-Basel	21
Axioms	20
Aims Mathematics	16
Entropy	16
Hacettepe Journal of Mathematics and Statistics	15
Mathematics And Computers in Simulation	15
Computational Statistics	13
Mathematical Problems in Engineering	12
Journal of King Saud University Science	11
Quality and Reliability Engineering International	11

Further analysis reveals that the Journal of Applied Statistics, along with Mathematics, closely follow with 37 and 36 publications, respectively. The substantial output from these journals underscores their importance in disseminating research on the Generalizations of Lindley distribution. The detailed information presented in Table 3 highlights the prominence and diversity of sources shaping the academic discourse on Generalizations of Lindley distribution.

Analysing the production of sources over time is a frequently employed method to gain detailed insights into trends, growth, and variations in the number of academic journals within a specific period, with a focus on the field of generalizations of Lindley Distribution. Figure 2 is employed to visually represent the intricate pattern derived from this analysis, offering a detailed illustration of how the production of sources in the realm of generalizations of Lindley Distribution has evolved over the specified timeframe. This detailed examination allows researchers, publishers, and academics to discern patterns, identify areas of growth, and observe any notable changes in the scholarly output within this domain.

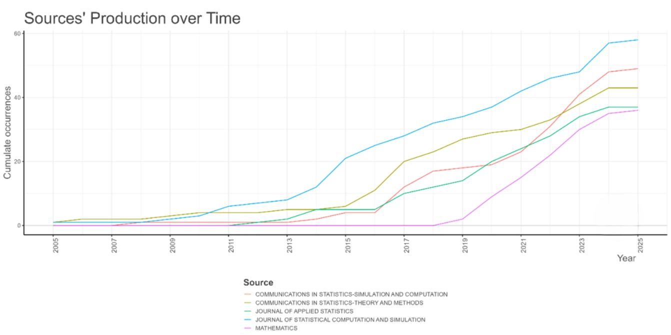

Figure 2 Sources' production over time.

The impact factor serves as a gauge to determine the relative significance or influence of a scholarly journal within its academic domain. This numerical metric is derived from the frequency of citations that articles from the journal receive in other scholarly publications over a defined period. Scholars and institutions typically employ a combination of metrics and qualitative assessments to comprehensively evaluate the scholarly impact of both journals and individual articles. Meanwhile, the h-index, g-index, and m-index stand as citation metrics employed to assess the productivity and influence of a researcher's scholarly contributions. Each of these indices offers a unique perspective on the citation performance of an individual researcher or a journal. In Table 4, various impact factors of pertinent journals are illustrated, providing a detailed overview of their influence within the academic landscape.

Table 4 Journal local impact

Journal	h-index	g-index	m-index
Journal of Statistical Computation and Simulation	19	30	0.905
Journal of Applied Statistics	16	24	1.143
Communications in Statistics-Theory and Methods	14	22	0.667
Communications in Statistics-Simulation and Computation	13	20	0.722
Mathematics and Computers in Simulation	10	15	0.556
Symmetry-Basel	9	13	1.125
Computational Statistics	8	13	0.571
Energy Conversion and Management	8	8	0.889
Mathematics	8	12	1.143
Statistical Papers	8	9	0.533
Accident Analysis and Prevention	7	10	0.467
Entropy	7	13	0.538
Hacettepe Journal of Mathematics and Statistics	7	11	0.583
Journal of Computational and Applied Mathematics	7	8	0.7
IEEE Access	6	8	1
Journal Of King Saud University Science	6	8	0.75
Quality Technology and Quantitative Management	6	9	0.5
Statistics	6	9	0.5
AIP Advances	5	7	1.667
Axioms	5	8	1

Top productive and highly cited authors: Within the Web of Science Core Collection, a total of 803 publications have been documented, showcasing contributions from a pool of 1424 distinct authors. For a more granular understanding, Table 5 & 6 dedicated to outlining the top contributing authors and most local cited authors shedding light on the specifics of their individual publication counts. Notably, Nassar M, Dey S, and Bakouch HS have demonstrated a notable prolificacy, leading the list with the highest numbers of publications.[14]

Delving into the assessment of author influence, a methodical approach was adopted by sorting authors based on the total number of citations garnered across all their published papers. In this regard, Mazucheli J and Menezes Afb have emerged as the most influential authors, each amassing a commendable 44 citations.

Table 5 Top contributing authors

Authors	Articles	Authors	Articles
Nassar M	25	Afify AZ	13
Dey S	23	Hassan AS	13
Bakouch HS	22	Kizilaslan F	13
Gui W	20	Nadarajah S	13
Elgarhy M	16	Alotaibi R	12
Elshahhat A	16	Aslam M	12
Gemeay AM	16	Chesneau C	12
Altun E	14	Eliwa MS	12
Ghitany ME	14	Ismail AA	12
Tripathi YM	14	Alizadeh M	11

Table 6 Most Local Cited authors

Author	Local citations
Ghitany ME	52
Mazucheli J	46
Kundu D	46
Menezes Afb	44
Chakraborty S	38
Nassar M	38
Dey S	37
Kumar D	32
Afify Az	31
El-Morshedy M	28
Eliwa Ms	28
Altun E	27

Most cited papers: The title of the top cited paper "Lindley Distribution and Its Application" by Ghitany et al.[15] explores the mathematical properties, estimation techniques, and real-world applications of the Lindley distribution, demonstrating its superiority over the exponential distribution in certain cases. The Lindley distribution, a mixture of exponential and gamma distributions, is unimodal, positively skewed, and has an increasing hazard rate, making it more flexible for modelling lifetime data. The authors derive its moments, cumulants, failure rate, mean residual life, and entropy measures, showing that it better captures aging effects than the exponential model. Maximum likelihood estimation (MLE) is used to estimate the distribution's parameter, though it is positively biased but asymptotically normal. A Monte Carlo simulation study validates the estimation accuracy, while a real-world application using bank customer waiting times confirms that the Lindley model fits the data better than the exponential distribution, as shown by log-likelihood values and goodness-of-fit tests (P-P and Q-Q plots). These findings establish the Lindley distribution as a more effective alternative to the exponential model in reliability and survival analysis.

The paper "Bayesian Inference and Life Testing Plan for the Weibull Distribution in Presence of Progressive Censoring" by Debasis Kundu (2008) focuses on Bayesian estimation of the shape (α) and scale (λ) parameters of a Weibull distribution when data are progressively censored. Since a continuous conjugate joint prior for both parameters do not exist, the study assumes a log-concave prior for α and a Gamma prior for λ. Due to the complexity of obtaining closed-form Bayesian estimates, the paper employs Lindley's approximation and Gibbs sampling (MCMC) to compute Bayes estimates and credible intervals. The performance of Bayesian estimates is compared with maximum likelihood estimators (MLEs) through Monte Carlo simulations, showing that Bayesian estimators, especially with informative priors, have lower mean squared errors (MSEs) and more precise interval estimates. The study also evaluates different progressive censoring schemes, which allow removal of test units at varying failure times, and proposes two Bayesian-based optimal censoring criteria—one based on the variance of the p-th quantile estimate (C1) and another integrating overall posterior variance (C2). The results suggest that opposite-type II censoring schemes provide more information about the tail behaviour of the Weibull distribution, making them preferable in certain reliability studies. Finally, the methodology is validated using a real-world dataset, reinforcing the advantages of Bayesian approaches in reliability analysis and life testing.

One of the most cited papers "Power Lindley Distribution and Associated Inference" by Ghitany et al.[4] (introduces and studies the Power Lindley (PL) distribution, a two-parameter generalization of the Lindley distribution aimed at increasing flexibility in modelling data. The authors derive its probability density function (PDF), hazard rate function, moments, skewness, kurtosis, and quantile function, showing that it can exhibit a wider range of distributional shapes compared to the standard Lindley model. They explore maximum likelihood estimation (MLE) for parameter estimation and conduct Monte Carlo simulations to assess the bias, mean squared error (MSE), and confidence interval coverage of the estimators. Additionally, they present three different algorithms for random data generation from the Power Lindley distribution. The study concludes with an application to real-world data (tensile strength of carbon fibres), where the Power Lindley distribution demonstrates a superior fit compared to other common two-parameter distributions such as exponential, gamma, Weibull, and Gompertz distributions, as confirmed by likelihood values and goodness-of-fit tests (Table 7).

Table 7 Most cited document

Paper	DOI	Total citations
Ghitany ME, 2008, Math Comput Simul-A	https://doi.org/10.1016/j.matcom.2007.06.007	455
Kundu D, 2008, Technometrics	https://doi.org/10.1198/004017008000000217	222
Ghitany ME, 2013, Comput Stat Data Anal	https://doi.org/10.1016/j.csda.2013.02.026	221
Ghitany ME, 2011, Math Comput Simul	https://doi.org/10.1016/j.matcom.2010.11.005	123
Al-Mutairi DK, 2013, Commun Stat-Theory Methods	https://doi.org/10.1080/03610926.2011.563011	121
Gomez-Deniz E, 2011, J Stat Comput Simul	https://doi.org/10.1080/00949655.2010.487825	120
Gomez-Deniz E, 2014, Insur Math Econ	https://doi.org/10.1016/j.insmatheco.2013.10.017	112
Jung C, 2019, Renew Sust Energ Rev	https://doi.org/10.1016/j.rser.2019.109290	112
Mazucheli J, 2019, J Appl Stat	https://doi.org/10.1080/02664763.2018.1511774	105
Liu Cc, 2008, J Math Psychol	https://doi.org/10.1016/j.jmp.2008.03.002	105
Bakouch HS, 2012, J Korean Stat Soc	https://doi.org/10.1016/j.jkss.2011.06.002	104

Citation: Tomy L, Jose M, Mathew S, et al. Bibliometric exploration of generalized Lindley distributions: a meta-analytical approach. *Biom Biostat Int J.* 2025;14(2):53–59. DOI: 10.15406/bbij.2025.14.00434

Table 7 Continued....

Geedipally SR, 2012, Accid Anal Prev	https://doi.org/10.1016/j.aap.2011.07.012	100
Casella G, 2009, Ann Stat	https://doi.org/10.1214/08-AOS606	90
Mazucheli J, 2011, Comput Meth Programs Biomed	https://doi.org/10.1016/j.cmpb.2011.03.006	83
Ghitany ME, 2008, Math Comput Simul	https://doi.org/10.1016/j.matcom.2007.11.021	79
Ghitany ME, 2015, Commun Stat-Simul Comput	https://doi.org/10.1080/03610918.2013.767910	78
Krishna H, 2011, Math Comput Simul	https://doi.org/10.1016/j.matcom.2011.07.005	78
Fraser Das, 2011, Stat Sci	https://doi.org/10.1214/11-STS352	78
Jodra P, 2010, Math Comput Simul	https://doi.org/10.1016/j.matcom.2010.09.006	77
Heo JH 2019, Water	https://doi.org/10.3390/w11071475	74

Word cloud: Figure 3 illustrates a word cloud depicting terms commonly found in articles related to the generalizations of Lindley Distribution. Word clouds serve as visual representations mapping frequently occurring words in articles, utilizing varying colours and sizes to reflect their frequency. While the arrangement of words may seem somewhat random, the central positioning and larger size of the most significant terms enhance their visibility.

Figure 3 Word cloud.

According to the data, the most frequently occurring term in publications pertaining to the generalizations of Lindley Distribution is "Lindley distribution," occupying the top position. Following closely, "model" secures the second spot, and "inferences" claims the third position. This visual representation offers a quick and engaging overview of the key themes and emphasis within the body of literature on this specific topic.

Countries scientific production: The data extracted from the Web of Science provides a comprehensive overview of the top 20 countries that exhibit noteworthy productivity in terms of publications within the specialized field of generalization of Lindley distribution, as detailed in Table 8. A thorough analysis of the data indicates that Egypt takes the lead on this list with an impressive total of 419 publications.

Table 8 Countries Scientific production

Country	No. of publications
Egypt	419
Saudi Arabia	386
India	336
China	208
Iran	173
Usa	171
Turkey	168
Brazil	146
Pakistan	97
Spain	61

Table 8 Continued....

Chile	40
France	40
South Korea	38
Uk	38
Jordan	35
Canada	30
Kuwait	30
Australia	29
Malaysia	29
Tunisia	23

Saudi Arabia follows closely, securing the second position with 386 publications, showcasing a substantial contribution to the academic output in this specific domain. India and China also feature prominently in this list, ranking third and fourth with 336 and 208 publications, respectively. This detailed examination not only highlights the productivity of these countries but also underscores their significant contributions to the body of knowledge surrounding the generalization of Lindley distribution (Table 9).

Table 9 furnishes information about the country of the corresponding authors

Country	Articles
India	96
Saudi Arabia	91
Egypt	88
China	70
Iran	65
Turkey	65
USA	53
Brazil	35
Pakistan	19
Spain	18

Network analysis

This section focuses on the network analysis of bibliometric data, a valuable technique that offers insights into the relationships and connections among various elements within a corpus of scholarly literature. Key metrics, including country-wise collaboration, collaboration network analysis, co-citation network, and co-occurrence network, were employed for this analysis.

Countries collaboration: Country-wise collaboration in bibliometric analysis refers to the systematic examination of collaborative patterns between different countries within the context of scholarly research. This involves scrutinizing instances where researchers, institutions, or academics from one country collaborate with those from other nations on academic endeavours such as research projects, publications, or collaborative studies.

Table 10 presents an overview of country-wise author collaborations. Notably, Egypt and Saudi Arabia lead the list with 98 collaborations, underscoring their prominent role in collaborative research efforts. Following closely, Saudi Arabia and India have 18 collaborative papers, while Egypt and India contribute 15 publications. These findings highlight the cross-boundary significance of the topic, emphasizing its relevance and collaborative nature across different geographical boundaries.

Table 10 Country wise collaborations

From	To	No. of collaborative works
Egypt	Saudi Arabia	98
Saudi Arabia	India	18
Egypt	India	15
Saudi Arabia	Pakistan	15
Egypt	Pakistan	12
Saudi Arabia	Jordan	11
Egypt	Turkey	9
Saudi Arabia	Turkey	9
Brazil	Chile	8
Egypt	Iran	8

Collaboration network: Collaboration Network Analysis involves a thorough and systematic examination of collaborative networks within the scholarly community. This analysis often centres on studying collaborations among authors, institutions, or a combination of both. The goal is to understand the structure and dynamics of collaborative relationships, mapping the connections that form when individuals or entities work together on academic endeavours such as research projects, publications, or joint studies.

Collaborative analysis focused on authorship was conducted, and the outcomes are illustrated in Figure 4. The nodes and links in Figure 4 represent authors and their co-authorships, respectively. Additionally, the size of the text corresponds to the frequency of publications. The network map reveals the presence of two distinct clusters, indicating robust collaboration among these authors. Particularly noteworthy is the prominent cluster featuring collaboration between "Nassar M" from Zagazig University, Egypt, and " Bakouch HS " from Faculty of Sciences, King Abdulaziz University, Jeddah, Saudi Arabia.

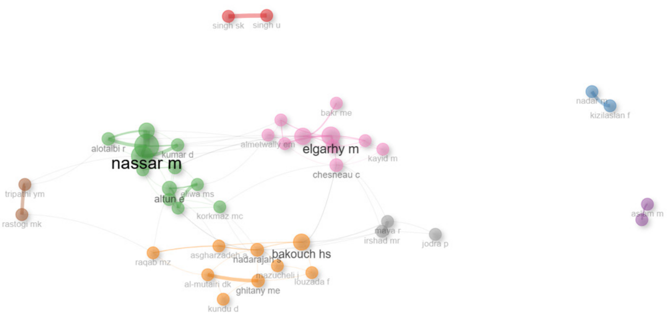

Figure 4 Collaboration Network.

Co-citation network: Co-citation Network Analysis involves the examination of relationships between documents based on their shared citations. This metric explores instances where two or more documents are frequently cited together by other scholarly works. In a co-citation network, nodes represent individual documents, and links between nodes indicate that these documents are co-cited, reflecting a connection in the intellectual structure of the literature.

Co-occurrence network: Co-occurrence Network Analysis entails scrutinizing how frequently keywords are jointly present in documents within an academic collection of materials. This metric aims to discern recurring patterns where specific keywords share appearances, indicating thematic or conceptual connections. In a co-occurrence network, nodes symbolize keywords, and the links connecting nodes signify instances where these keywords co-occur in the same documents. Over time, the insights gleaned from the co-occurrence network can shed light on the evolution of research topics. Shifts in the frequency and patterns of keyword co-occurrence may signify changes in research focus, methodologies, or the emergence of innovative subfields. Figure 6 illustrates the co-occurrence network map for the exploration of generalizations of the Lindley Distribution. Notably, the terms "Parameters," "model," and "inference" emerge as the most recurrent words in the documents.

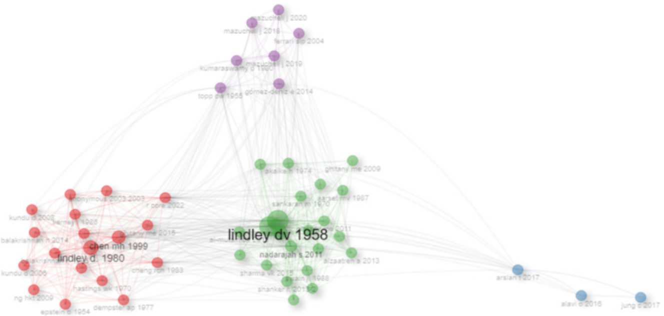

Figure 5 Co-citation Network.

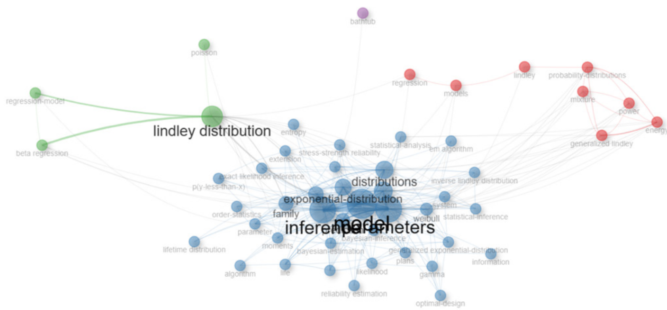

Figure 6 Co-occurrence Network.

Areas of potential use for the generalized versions of the Lindley Distribution

The Generalized Lindley distribution (GLD) shines due to its versatility, making it a powerful tool across diverse fields. It particularly excels in modelling skewed data, especially when it comes to lifespans. Compared to other popular choices like gamma or Weibull, GLD offers more nuanced insights into the lifespans of machinery, components, and even biological organisms. In hydrology and environmental studies, GLD tackles right-skewed distributions, often with seasonal variations, seen in variables like rainfall amounts. Its flexibility extends to the world of finance, where it can predict claim sizes in insurance portfolios and capture unusual patterns in asset returns. The medical and biological fields also benefit from GLD's capabilities. It can model the duration of treatments, track the progression of diseases, and analyse survival times in clinical trials. Even in social sciences and Econometrics, GLD helps unveil the complexities of income disparity, wealth distribution, and the duration of events like unemployment.

Generalized Lindley distributions, known for their flexibility in modelling non-negative, right-skewed, and heavy-tailed data, have found diverse applications in numerous domains. generalized Lindley

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distributions are used is reliability engineering and survival analysis. These distributions effectively model the time-to-failure of systems and lifetimes of biological organisms due to their ability to capture increasing, decreasing, and bathtub-shaped hazard functions. The exponentiated Lindley distribution and its variants have been applied to real-life survival datasets with significant success.[3,15]

In actuarial science, especially in modelling insurance claim amounts and risk analysis, generalized Lindley models can accommodate skewed and heavy-tailed loss data better than exponential or gamma distributions. Studies such as by Bakouch et al.[16] have shown the suitability of Lindley-type distributions in premium calculations and modelling claim sizes. Generalized Lindley models are frequently used in biostatistics, particularly in modelling patient survival times, waiting times, and recovery periods. The increased modelling capacity allows better fit for clinical and epidemiological data. The transmuted Lindley distribution has been shown to provide superior fits to cancer survival data.[17] These models are also useful in hydrology and environmental modelling, where variables like rainfall intensity, pollutant concentrations, or drought durations exhibit positive skewness and non-linear behaviour. Mazucheli et al.[18,19] used the generalized Lindley distribution in modelling extreme rainfall data in arid regions, highlighting its relevance in climate studies.

Conclusion

This study employs bibliometric analysis to conduct a comprehensive evaluation of the research landscape within the intersection of generalizations of the Lindley Distribution. The methodology encompasses data extraction from the Web of Science database, followed by thorough analysis and visualization techniques. This approach illuminates trends in articles and journals, collaborative patterns, and pivotal elements within the research domain. The descriptive analysis furnishes valuable insights into the data, presenting an overview of documents, their temporal growth, and influential sources. The paper provides an in-depth bibliometric analysis of research on the generalized Lindley distribution (GLD), mapping its evolution, key contributors, and global research trends. Using Web of Science (WoS) data from 2005-2025, the study analyses 803 documents from 219 sources, citing 9525 references, with a 5.28% annual research growth rate. The most active publishing journals are the Journal of Statistical Computation and Simulation and Communications in Statistics-Theory and Methods. Egypt (419 papers), Saudi Arabia (386 papers), and India (336 papers) lead in research output, with strong collaboration networks between Egypt-Saudi Arabia (98 collaborations) and Saudi Arabia-India (18 collaborations). Moreover, the network analysis reveals robust collaborations among authors, countries, and institutions.

In essence, this paper establishes a sturdy foundation for comprehending the dynamic landscape of generalizations of the Lindley Distribution. It underscores the significance of interdisciplinary research and collaboration in navigating the complexities of the digital era. The insights derived from this study are of immense value for researchers seeking to navigate and contribute to this evolving field. Generalized Lindley distributions, through their ability to accommodate diverse data structures, have become valuable tools across disciplines. Their adaptability in modelling skewed and heavy-tailed data, coupled with mathematical tractability, makes them a compelling choice for modern statistical modelling. Future work could explore even broader applications, particularly in finance and machine learning, where such distributions can model risk and uncertainty.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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