Visualization and mapping of research topics sustainable transportation model for livestock folding container ship as sea toll supports

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Abstract
A study analyzed research on transportation models for livestock folding containers in relation to sea toll support, utilizing Crossref data and the Publish or Perish 8 software. Searches with keywords "livestock folding container" and "sea toll" from 2014 to 2023 yielded 1,000 publications across 18 document types. The data was categorized and analyzed in Microsoft Excel, with visualization conducted using VOSviewer. Results indicated a steady increase in research topics related to livestock folding containers and sea tolls since 2018. David C. Barret emerged as the most prolific author with 45 publications, while Stephen C. Bishop received the highest citations, totaling 124. The United Kingdom was identified as the leading country in this research area. Key institutions contributing significantly included the Central University of Tamil Nadu, Los Alamos National Lab, and the Scottish Center for Production Animal Health. Consistent research themes since 2018 included container, cargo, livestock, toll, Northern Sea Route, ship, vessel, transportation, sea transport, and container transportation. This study highlights the growing interest in optimizing livestock transport through innovative container designs and efficient sea toll strategies.

Keywords: livestock folding container; sea toll; VOSviewer.

1. Introduction

Implementing the sea toll concept provides opportunities to enhance welfare within Indonesian society, especially for those residing in less developed areas, isolated regions, remote territories, and border areas. President Joko Widodo introduced the idea of the maritime toll logistics system. This plan aims to connect major ports across the Indonesian archipelago. By strengthening the connections between various maritime ports, cargo transportation can be facilitated even to distant locations. Furthermore, this initiative aims to achieve price uniformity for logistics services throughout Indonesia's regions. The sea toll has been designed to enhance the movement of passengers and goods, thereby reducing transportation and logistics costs and ultimately lowering the prices of goods (Soedarno et al., 2020).

Generally, 'livestock container' refers to a facility or enclosure used to transport or store livestock animals such as cattle, sheep, goats, and pigs. The design of these containers aims to provide a safe and comfortable environment for the animals during travel or temporary storage. Another variation is the 'folding container,'

a type of container that can be folded or flattened when not in use, making it more space-efficient for storage or return. This container model is often used in various sectors to transport goods and can be made from materials such as metal, plastic, or fabric. With this concept, the 'livestock folding container' is a portable shipping container specifically designed to transport livestock animals, which can be transformed by folding when not needed. Such container models are highly useful in the field of livestock farming, as they allow farmers or animal owners to carry the container to different locations.

Mapping the research topics of livestock folding containers and sea tolls is highly significant because, up to this point, bibliometric visualization and mapping of livestock folding containers and sea tolls based on Crossref data have never been undertaken. The visualization and mapping study of the transportation model for livestock folding container ship as sea toll support aims to (1) identify the annual trends in research topics related to livestock folding container and sea toll, (2) identify the most prolific authors in the livestock folding container and sea toll research topics, (3) identify the most productive countries in livestock folding container and sea toll research, (4) determine co-authorship networks of organizations or affiliations in livestock folding container and sea toll publications, (5) generate co-citation network maps of journals within the livestock folding container and sea toll research topics, (6) create co-occurrence network maps of research topics in livestock folding container and sea toll based on keywords.

2. Literature Review

2.1. Sea toll

Sea toll is a concept aimed at improving the logistics transportation process in Indonesia, which is currently being vigorously implemented. As a result, the distribution of goods (especially foodstuffs in Indonesia) is expected to become more streamlined, leading to more equitable prices of essential commodities throughout the entire region of Indonesia. The Indonesian populace needs to understand that the concept of sea toll does not entail building toll roads on the sea. Rather, it involves unobstructed shipping routes that connect nearly all ports across Indonesia (Sutini, 2022). The ships used in the sea toll program typically have an average Gross Registered Tonnage (GRT) of 2000 tons, aiming to enable their access to remote ports across the entirety of Indonesia (Hakim, 2016).

A sailing route is a voyage plan or passage planning, outlining the course of the journey from the departure port to the destination port, taking into consideration navigation systems, with the shortest and quickest route that ensures safety, security, effectiveness, and efficiency (Nurzanah, 2020). The goal of an optimal sailing route is to navigate from the destination port to the arrival port in support of sea toll, utilizing the shortest and safest route.

2.2. Livestock folding container

Fundamentally, to create a foldable livestock container for inter-island animal transportation, reference is made to the AMSA (Australian Maritime Safety Authority) standard container design, which has been applied for shipping animals like cattle, camels, horses, and other livestock. This specialized foldable container resembles a portable enclosure that can be loaded onto ships, lifted onto container trucks, and folded when not in use, reducing the required storage space for the container (Subiyantoro & Achmadi, 2016).

2.3. Science mapping

Scientific mapping is very useful for knowing the development of literature about the development of science that is reviewed because scientific mapping aims to build a bibliometric map describing how certain disciplines, scientific domains, or research areas are conceptually arranged, intellectually, and socially (Cobo et al., 2011). Using the science mapping method, the development of science can be mapped properly, and this map can change and develop along with the development of science itself. The science mapping approach displays scientific research's structural and dynamic aspects; it is a spatial representation of how disciplines, fields, and writers relate to one another (Rodr\'\iguez-Bol\'\ivar et al., 2018).

Nowadays, many computer applications can be used for science mappings, such as CiteSpace (2003), Science of Science Tool (2009), VOSviewers (2010), and SciMAT (2012) (Chen & Chen, 2013). In this study, the mapping process used VOSviewers software. VOSviewers is one of the computer applications considered capable and widely used in processing metadata sourced from Scopus. VOSviewer establishes a network of scientific publications, journals, researchers, research organizations, countries, keywords, or terms. VOSviewers can create maps based on network data and visualize the maps in the form of network visualization, overlay visualization, and density visualization (Van Eck & Waltman, 2017).

2.4. GIS for mapping and monitoring potential Farming using the k means method

The potential number of livestock in the Wonogiri district can be mapped by clustering using the K-means method, making it easier to see livestock distribution. Monitoring the condition of livestock, which includes the total number, number of births, number of outbreaks of disease, and number of deaths, can be done through a geographic information system that has been successfully built so that Wonogiri BPS officers find it easier to do so monitor livestock potential and community gain informative information. Based on the shortcomings and limitations of the system and the results of this research, it is recommended:

GIS coverage can be expanded in Regency and throughout Indonesia, where it is found in interconnected systems between regions. GIS can be developed not only by increasing potential livestock to be known but also as a forum to share information with each other to increase potential regional farms.GIS coverage can not only be expanded by mammals and birds but also by all kinds of animals. The determination of the initial centroid value should be arbitrarily random but using a special method. The final conclusion from the clusterization results should be that special methods should be used, not only based on expert intuition. (Pratopo & others, 2018).

3. Research Methodology

The study was conducted through a literature search based on Crossref data using the assistance of Publish or Perish 8 software, utilizing the keywords "livestock folding container" and "sea toll" within the time range from 2014 to 2023. The search yielded 1000 publications, comprising 18 document types, as shown in Table 1.

Table 1: Distribution of documents on the research topics of livestock folding containers and sea toll.

Document Type	Documents	Percentage (%)
Journal-article	587	58.7
Book-chapter	187	18.7
Proceedings-article	70	7
Reference-entry	56	5.6
Report	35	3.5
Book	11	1.1
Peer-review	11	1.1
Component	11	1.1
Posted-content	10	1
Proceedings	5	0.5
Monograph	5	0.5
Other	5	0.5
Edited-book	2	0.2
Journal-issue	1	0.1
Book-part	1	0.1
Reference-book	1	0.1
Dataset	1	0.1
Database	1	0.1
Total	1000	100

The search results data of 1000 documents were categorized based on predefined criteria in alignment with the research objectives and were analyzed using Microsoft Excel. Meanwhile, for visualizing and mapping the results retrieved from Crossref, the Visualization Of Similarity (VOS) Viewer was used to examine co-authorship based on affiliations or institutions, co-citation network maps of livestock folding container and sea toll publications, and co-occurrence network maps of research topics related to livestock folding containers and sea toll based on keywords.

4. Finding and discussion

4.1. Annual publication trends of the research topics on livestock folding containers and sea toll

The publication trends of the research topics on foldable livestock containers and sea toll based on years can be observed as depicted in **Figure 1**. Publications related to livestock folding containers and sea tolls first appeared in 2017 and were titled "Container Shipping Network Efficiency Comparison in Indonesia: Nusantara Pendulum and Sea Tollway." Between the years 2015 and 2017, the number of publications on the topics of livestock folding containers and sea toll experienced a decrease (below 100 documents). It wasn't until 2018 that research topics related to livestock folding containers and sea toll began to increase steadily up to the present. There was a significant increase in publications on livestock folding containers and sea toll research topics in 2019, with 51 publications.
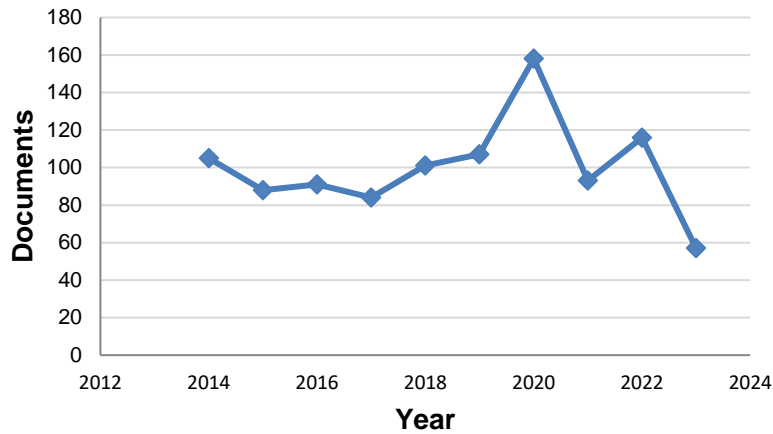
Figure 1. Annual publication trends of research topics on livestock folding containers and sea toll.

4.2. Ten most prolific authors on livestock folding containers and sea toll research topics

The results of the VOSviewer analysis of authors' contributions to the discussed topics, the ten most prolific authors can be observed in Table 2, the ten authors with the highest number of citations in Table 3, and the top 20 documents with the highest number of citations in **Table 4.**

Table 2: Ten most prolific authors on the research topics of livestock folding containers and sea toll

Authors	Publications
David C. Barret	45
April Taylor	20
David Rendle	12
Ricard Laven	11
David Barret	10
James Breen	10
Peter de Tender	8
John Carr	7
Russel Parker	7
Liu Yuan	6

Table 3: Ten authors with the highest number of citations on the research topics of livestock folding containers and sea toll

Authors	Citations
Stephen C. Bishop	124
Saber Qanbari	109
Amir Hossein Gharehgozli	108
Dusan Ku	60
S.C. McClelland	55
Craig Martin	47
Hui Zhao	45
Carolina Figueroa	35
K.A. Saravanan	33
Morten Svindland	32

Table 4. The top 20 documents with the highest number of citations on the research topics of
livestock folding containers and sea toll

Documents	Publication year
Genomics and disease resistance studies in livestock	2014
Mapping signatures of positive selection in the genome of livestock	2014
Sea container terminals: New technologies and OR models	2015
Container relocation problem with time windows for container departure	2016
Type and number of environmental impact categories used in livestock life cycle assessment: A systematic review shipping container	2018 2016
Study on China-EU container shipping network in the context of the Northern Sea Route	2016
Coinfection takes its toll: Sea lice override the protective effects of vaccination against a bacterial pathogen in Atlantic salmon	2017
Selection signatures in livestock genome: A review of concepts, approaches, and applications	2020
The environmental effects of emission control area regulations on short sea shipping in Northern Europe: The case of container feeder vessels	2018
Economic feasibility of an NSR/SCR-combined container service on the Asia-Europe lane: a new approach dynamically considering sea ice extent	2018
LNG-fuelled container ship sailing on the Arctic Sea: Economic and emission assessment	2020
Perceptions of antibiotic use in livestock farming in Germany, Italy, and the United States	2020
Scheduling of container-handling equipment during the loading process at an automated container terminal	2020
Berth allocation in container terminals that service feeder ships and deep-sea vessels	2016
Hematological changes and plasma fluid dynamics in livestock during thermal stress and response to mitigative measures	2018
The feeder network design problem: Application to container services in the Black Sea region	2014
Energy-Saving Potential and an Economic Feasibility Analysis for an Arctic Route between Shanghai and Rotterdam: Case Study from China's Largest Container Sea Freight Operator	2018
Combinable containers: A container innovation to save container fleet and empty container repositioning costs	2019
A simulation optimization method for deep-sea vessel berth planning and feeder arrival scheduling at a container port	2020

4.3. The ten most productive countries publishing research on livestock folding containers and sea tolls

The search results indicate that 56 countries have published research findings on livestock folding containers and sea tolls. The most productive country in terms of publishing research on livestock folding containers and sea tolls is the United Kingdom. Detailed information on the top ten productive countries publishing research on livestock folding containers and sea tolls can be found in **Table 5.**

Table 5. Ten most productive countries publishing research on livestock folding containers and sea tolls

Countries	Publications
UK	299
USA	148
Denmark	84
China	76
Spain	46
India	41
Indonesia	40
Germany	27
Rusia	25
France	22

4.4. Co-authorship network of organizations or affiliations in publications on livestock folding containers and sea tolls

The visualization of the co-authorship network of organizations or affiliations, as shown in **Figure 2**, reveals that these institutions do not collaborate with each other in publishing research on livestock folding containers and sea tolls. Meanwhile, Table 6 presents the top 10 institutions with the highest citations and document counts.

Figure 2. Co-authorship network of organizations or affiliations in publications on livestock folding containers and sea tolls

Table 6: The top 10 institutions with the highest citations and document counts
on livestock folding containers and sea tolls

Organization	documents	citation
Professor of Bovine Medicine, University	33	5
Editorial board member	13	1
Professor of bovine medicine, Product	9	1
Consultant editor	9	0
Central University of Tamil Nadu	4	0
European specialist in equine internal	4	2
Los alamos national lab	4	0
Howells veterinary services	3	0
Scottish center for production animal	2	5
Veterinary surgeon and consultant	2	2

4.5. Co-citation network map of journals in the research topics of livestock folding containers and sea tolls

The visualization results of co-citation in publications related to livestock folding containers and sea tolls, based on publication sources using VOSviewer software, reveal the presence of 18 items grouped into 5 clusters, as shown in **Figure 3**. Among the 18 items, it is evident from Table 7 that the European Journal of Operational Research, OR Spectrum, Transportation Research Part E: Logistics, and Transportation Science have the highest total link strength.
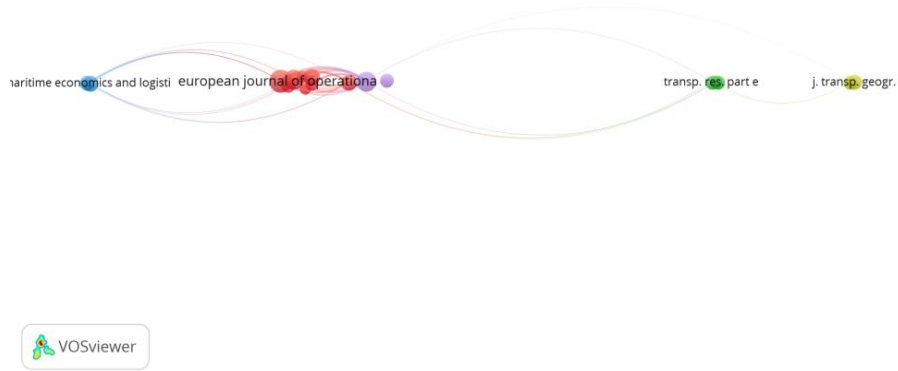
Figure 3. Co-citation network analysis map based on sources.

Table 7: The top ten journals with the highest total link strength in the research topic of livestock folding containers and sea tolls.

Sources	Citation	Total Link Strength
European journal of operational research	72	2815
Or spectrum	57	2815
Transportation Research Part e: logistic	58	2794
Transportation Science	40	1936
Computers and operation research	23	1340
J. Climate	38	1216
Maritime policy and management	34	1116
Geophys	24	1012
Nature	55	1001
Transportation Research Part B: methodological	20	994

4.6. Co-occurrence network map of research topics on livestock folding containers and sea tolls based on keywords

The analysis of keyword co-occurrence using VOSviewer software reveals the utilization of 70 keywords in publications related to livestock folding containers and sea tolls, distributed across 4 clusters, as depicted in **Figure 4**. Table 8 presents the top 10 most frequently used keywords in the research topic of livestock folding containers and sea tolls. Overlay analysis indicates that keywords present in the research topic of livestock folding containers and sea tolls, such as 'container,' 'cargo,' 'livestock,' 'toll,' 'northern sea route,' 'ship,' 'vessel,' 'transportation,' 'sea transport,' and 'container transportation,' have been explored from 2018 to the present.
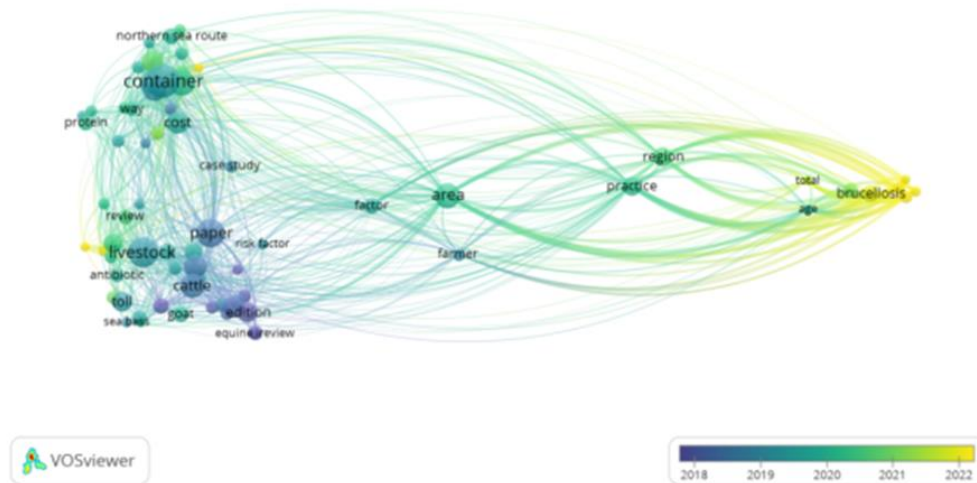
Table 8: The top ten keywords frequently used in the research topic of livestock folding containers and sea tolls

Keyword	Occurrences	Total Link Strength
Container	117	384
Livestock	94	420
Paper	86	430
Port	73	331
Area	67	910
Ship	62	346
Cattle	61	278
Management	55	218
Vessel	52	294
Transportation	51	524

This research shows that people prefer sea transportation using folding container ships as a mode of shipping animals. It is more time efficient in loading and unloading time, shipping time, and ship waiting time, and it is simpler if they send animals in small quantities. Need to wait a long time at the port. This research will continue to create more varied folding animal containers.

5. Conclusion and Further Research

Starting from 2018, research topics related to livestock folding containers and sea toll have shown a consistent increase up to the present. The most prolific author in publishing research on livestock folding containers and sea tolls is David C. Barret, with 45 documented publications, while the author with the highest number of citations is Stephen C. Bishop, with 124 citations. The most productive country in publishing research on livestock folding containers and sea tolls is the United Kingdom. Institutions such as Professor of Bovine Medicine, Editorial Board Member, Consultant Editor, Central University of Tamil Nadu, European Specialist in Equine Internal, Los Alamos National Lab, Howells Veterinary Services, Scottish Center for Production Animal, and Veterinary Surgeon and Consultant are among the leading contributors in publishing research on livestock folding containers and sea toll. Research topics such as container, livestock, toll, Northern Sea Route, ship, vessel, transportation, and container transportation have been consistently studied since 2018 up to the present. As of the writing of this paper, no identified work has modeled transportation for livestock folding container ships as a support for sea toll. The results are expected to expand knowledge, and future researchers will be able to identify and fill gaps in research areas that require further investigation to complement the existing research literature.

Acknowledgments

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