

<sup>1</sup>Rajesh Prabhakar  
Kaila  
<sup>2</sup>Girish Kumar Painoli  
<sup>3</sup>Shaik Mahaboob Syed  
<sup>4</sup>Rajyalaxmi M  
<sup>5</sup>S. Venkata Ramana  
<sup>6</sup>Deepika Krishnan  
<sup>7</sup>Ravi Kumar  
Bommiseti

## Disasters and Supply Chain Disruptions: Analysing Information Sharing Patterns on following the Google News Baltimore Disaster through Topic Modelling



**Abstract:** - Information Sharing on Google News which is extensively used platform regularly and particularly during disasters such as Baltimore Shipping Disaster have a significant impact on global supply chains. The study based on random selection of Google News articles particularly related to topic “Impact of Baltimore Disaster on Global Supply Chains” and text analysis is conducted using Graphic Network analysis and Topic Modelling using Latent Dirichlet Allocation method. Information sharing on Google News is highly effective and related to the topic of Baltimore disaster impact on supply chains on which businesses can make critical decisions.

**Keywords:** Topic Modelling, floods, earthquakes, tsunamis, pandemics

### I. INTRODUCTION

A cargo ship collided with Baltimore's Francis Scott Key Bridge, causing it to collapse and potentially leading to the deaths of six construction workers. The ship, named Dali, had issued a distress call moments before the crash due to a loss of power. The impact of the ship, given its considerable weight, caused the bridge to break and fall into the water rapidly. This collapse is expected to create significant logistical challenges, halting ship traffic at the Port of Baltimore and causing disruptions to cargo and commuter transportation. The Port of Baltimore is a crucial hub for East Coast shipping, with the bridge spanning the Patapsco River, a vital route for large cargo ships reaching the Chesapeake Bay and the Atlantic Ocean.

The blockage of vessel traffic at the Port of Baltimore is anticipated to have a widespread impact, particularly on the global automotive and coal supply chains, as operations at the port may remain suspended for months. The automotive industry and coal markets are likely to bear the brunt of the incident, which involved a container ship colliding with the world's third-longest truss bridge. This disaster underscores the vulnerability of global supply chains, especially in the face of geopolitical conflicts, natural disasters, and industrial disruptions, which can significantly challenge supply chain stability and contribute to inflationary pressures.

The fallout from the incident is expected to affect auto markets, particularly major car exporters in the Asia-Pacific region such as China and Japan, which heavily rely on imports through the Port of Baltimore. Additionally, the coal market is poised to experience significant disruptions, as over a quarter of U.S. seaborne coal exports pass through the port. This disruption, which accounts for about 1.5% of the global coal trade, could lead to shifts in global coal trade dynamics reminiscent of past changes in supplier relationships due to geopolitical factors. Google is committed to supporting open access to information and Google News provide public and organizations diverse high quality information about incidents and relies on high quality journalism for this. Google News is a search engine that collects and combines news from thousands of sites across the

<sup>1</sup> Visiting Faculty - BITS Pilani WILP Programs, Email- rajesh.prabhakar@gmail.com, Orcid ID: 0000-0002-1958-6190

<sup>2</sup>Faculty of Management, Economics and Commerce, ITM Vocational University, Vadodara, Gujarat-391760, Email: gkpainoli@gmail.com, Orcid ID: 0000-0001-8199-4825

<sup>3</sup>Department of Management Studies, VFSTR Deemed to be University, Vadlamudi, Guntur – 522213, India, drsms\_mgt@vignan.ac.in, Orcid ID: 0000-0003-2182-1230

<sup>4</sup>School of Business, SR University – Warangal – Telangana, Pincode – 506371, rajyalaxmi.m@sru.edu.in, Orcid ID: 0000-0002-5401-274X

<sup>5</sup>KLU Business School, Koneru Lakshmaiah Education Foundation, KL (Deemed to be University), Green Fields, Vaddeswaram, A.P. – 522302, dr.venkataramana1@gmail.com, Orcid ID: 0000-0002-0199-3206

<sup>6</sup>Symbiosis School of Banking and Finance, Symbiosis International, Pune – 412115, Email ID: krizdeepz@gmail.com, Orcid ID: 0000-0002-1471-6953

<sup>7</sup>Corresponding Author: PG Department of Business Administration and Dean – R&D Cell, Maris Stella College, Vijayawada, India - 520 008, E-mail – ravi9949418650@yahoo.com, Orcid ID: 0000-0003-1675-2058.

Copyright © JES 2024 on-line : journal.esrgroups.org

world and makes them available to all. Information sharing through specialized articles from trusted sources provide a reliable information which is critical during disruptions caused by disasters.

## II. LITERATURE REVIEW

Research on the impact of disasters on supply chains and strategies to mitigate these impacts has been ongoing. Literature primarily focuses on natural disasters such as floods, earthquakes, tsunamis, and pandemics due to their unpredictability and significant potential impact on supply chains. However, there is a growing recognition of the need to also assess the impacts of man-made disasters like terrorist attacks, wars, and fires. The Baltimore Disaster, being a man-made disaster, underscores the importance of understanding the differences and similarities in impacts and policy responses between natural and man-made disasters for effective supply chain resilience planning.

---

Bibliometric analysis indicates impact of disasters on supply chains lead to supply shortages, transportation, distribution, production and operations disruptions and also has financial implications like revenues and inventory costs [1]. Analyse the impact of over 3,500 disasters on more than 100,000 firm-year observations over 15 years and results indicate that disasters impact all sectors within a supply chain. Study also suggested a supply chain-wide mitigation strategy rather than a company-specific one. Most of the research is focused on covid 19 related supply chain disruptions [2]. Highlighted covid 19 triggered lockdowns in major manufacturing hub China which severely affected production and transportation globally [3]. Study highlighted importance of information sharing, collaborative communication using ICT capabilities critical for handling supply chain disruptions and develop strategies for mitigating disruptions [4].

Importance of Information Sharing & Collaborative Communication during Supply chain disruptions is acritical part of organizational decision making. Tao et al. found timing and severity of the transportation disruption affect a supplier's decision based on suppliers sharing private information along with public information help in mitigating disruptions effectively. Highlights the considerable amount of recent research focused on crisis management within supply chains, particularly emphasizing proactive strategies. While there has been significant attention on addressing external crises, such as natural disasters, less attention has been paid to managing crises like manmade disasters like accidents, supplier bankruptcy or the loss of key clients. This presents a novel and complex area that warrants further exploration and investigation [5].

Various obstacles to flow of information, lime accessibility issues, data inconsistency, source reliability issues, media trust and reliability. Study also focuses on impact of information flow related issues and impact on organization decision making [6]. Information sharing other aspects like organizational integration and training also important to mitigate supply chains disruptions effectively [7]. Disaster scenarios, supply chain collaboration is strengthened by several key components, including effective communication, mutual dependence, information sharing, informal financial support, and trust. These elements work together to bolster the resilience of supply chains, allowing them to better withstand and recover from disruptions caused by natural disasters. [8]

## III. RESEARCH METHODOLOGY

The study randomly selected and scraped text content from multiple articles on Google News using Python. Sample of 20 articles exclusively related to Baltimore Disaster and its impact on Supply chains were scraped. Text pre-processed using python libraries like nltk, requests, bs4, etc. and converted pre-processed text into Document Term Matrix. A Term Document Matrix (TDM) is a sparse two-dimensional matrix derived from a text corpus. Its rows represent individual terms, while its columns represent documents. Each entry in the matrix (i, j) indicates the frequency of term i appearing in document j.

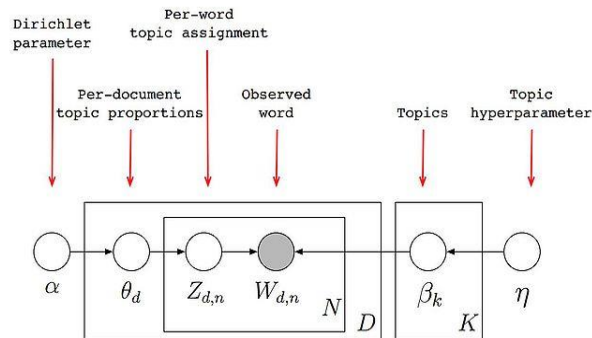
## IV. Network Analysis Using Graph Approach

Graph network analysis is a method used to study relationships and interactions between entities represented as nodes in a graph. It involves examining the connections, patterns, and properties within the graph to gain insights into the underlying structure or behaviour of the system. This analysis can involve various techniques such as identifying central nodes, detecting communities or clusters, measuring network properties like centrality or connectivity, and exploring the flow of information or influence within the network. Graph network analysis finds applications in diverse fields including social networks, biological networks, transportation networks, and supply chain networks, among others. The extraction of graphs of similarities from the text-data represented on the form of a hypergraph. The mining of informative short paths in these graphs and analysis of these graphs use the degree and betweenness centralities [9]. Co-occurrence graphs offer several advantages. They can simplify the complexity of textual data by transforming it into a structured format, making it easier to analyse and interpret. Additionally, they enable the application of graph-based algorithms and techniques for various natural language processing tasks, such as keyword extraction, document summarization, and sentiment analysis [10].

## V. TOPIC MODELLING LATENT DIRICHLET ALLOCATION

Topic modelling, particularly Latent Dirichlet Allocation (LDA), is a statistical technique used to uncover latent thematic structures within a collection of documents. LDA assumes that documents are generated from a mixture of topics, where each topic is a distribution over words, and each document exhibits multiple topics with varying probabilities. LDA works by iteratively assigning words to topics and documents to topic mixtures, aiming to maximize the likelihood of observing the given set of documents. Through this process, LDA identifies coherent groups of words (topics) that tend to co-occur across documents. These topics represent underlying themes or concepts present in the document collection.

LDA has numerous applications across various fields, including natural language processing, information retrieval, and computational social science. It enables tasks such as document clustering, topic summarization, sentiment analysis, and content recommendation. LDA also has its limitations and challenges. It assumes a fixed number of topics and does not capture temporal dynamics or document metadata. Additionally, interpreting the resulting topics can be subjective and may require human judgment. Despite these challenges, LDA remains a widely used and powerful tool for uncovering hidden structures in textual data [11, 12, 13, 14].

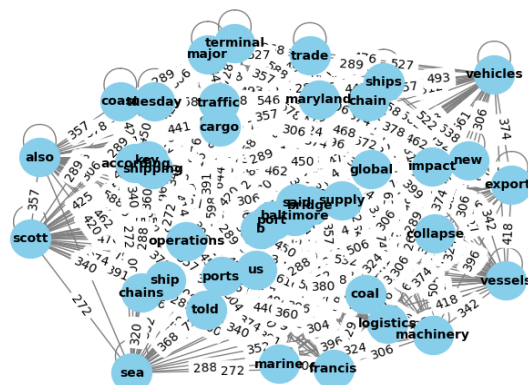


Graphical representation of LDA . Source: Hong 2018.

## VI. RESULTS AND FINDINGS

Post creation of corpus of words word tokenizer is implemented and corpus is converted into words. Stop words removed and frequency analysis of words done. Most frequent words identified to check for how effective pre-processing and word selection for Graph Network Analysis. co-occurrence network of high-frequency words refers to a graphical representation where nodes represent words, and edges (connections) between nodes represent the co-occurrence of words within a certain context or proximity in a text corpus. High-frequency words are those that occur frequently within the corpus and are often considered important for understanding its content. Baltimore, Collapse, Shipping, supply chain, major disaster, etc are frequent words and keywords. It identifies most frequent or central words within each cluster can aid in summarizing the main topics or themes present in the text corpus. Each number represents the strength or frequency of co-occurrence between the two corresponding words. Higher numbers indicate a stronger association or co-occurrence between the words.

Co-occurrence Network of High-Frequency Words

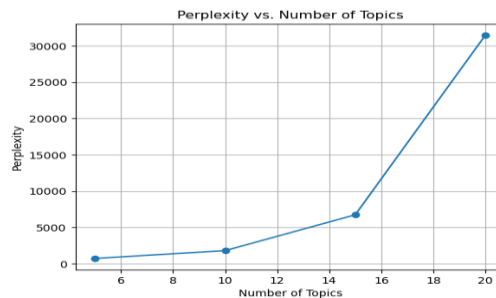


Topic Modelling using Latent Dirichlet Allocation (LDA) with Gibbs Sampling method was conducted on the document term matrix created from text corpus. Identifying the topics from corpus of words or document matrix is critical aspect of LDA. Topic 0 relates to supply chain disruptions at Baltimore port, Topic 1 relates to impact on global supply chains due to shipping traffic suspension, Topic 2 relates to impact on coal supply, Topic 3 relates to shipping transit, Topic 6 relates to disruptions, challenges and resilience in global supply chains, Topic 8 relates to bridge collapse impact and Topic 9 relates to importance of Baltimore port on global supply chains. Topic 4

does not relate to topic. Identifying topics from large corpus of words by LDA effective and all topics identified relate to Baltimore disaster impact on global supply chains. Coal supply for domestic US market is also highlighted in topics identified.

Topic #0	Topic #1	Topic #2	Topic #3	Topic #4	Topic #5	Topic #6	Topic #7	Topic #8	Topic #9
port	global	port	baltimore	reference	baltimore	logistics	supply	port	port
baltimore	supply	baltimore	ports	cookies	supply	disruptions	ships	said	supply
value	traffic	said	remain	browser	port	challenges	chains	enable	baltimore
marketplace	chains	bridge	shipping	know	bridge	global	canal	bridge	chain
goods	port	ports	pete	let	global	collapse	trade	impact	cargo
customer	suspension	supply	traffic	robot	chains	baltimore	chains	baltimore	global
supply	navigating	coal	ports	inquiries	customer	port	vessels	coal	operations
visibility	capacity	impact	new	review	cloud	resilience	just	told	cloud
global	does	terminal	transit	click	said	navigate	baltimore	ships	goods
disruptions	trade	chain	supply	terms	value	technology	told	collapse	value

Perplexity is a measure commonly used to evaluate the performance of topic models, including Latent Dirichlet Allocation (LDA). It quantifies how well the model predicts a held-out or unseen set of documents. Lower perplexity values indicate better performance, as they suggest that the model can predict the observed data more accurately. However, perplexity alone may not provide a complete picture of the quality of topics generated by the model. When evaluating the quality of topics generated by a topic model, researchers often consider both perplexity and the interpretability of the topics. Interpretability refers to how well the topics align with human understanding and domain knowledge. Based on perplexity 10 topics is best number of topics.



## VII. CONCLUSION

The study concludes Google News a critical platform for information sharing by aggregating, personalizing, and curating news content from diverse sources and delivering it to users in a convenient and accessible manner during disasters. Real-time updates during critical events such as disasters as they unfold enables timely flow of information and businesses use it make critical decisions. Relevant content particularly related to Baltimore disaster and impact on supply chains is provided for stakeholders to use in making critical decisions.

Information sharing plays a crucial role in building supply chain resilience by facilitating coordination, collaboration, and develop mitigation strategies among supply chain partners. Implement risk mitigation strategies, such as diversifying suppliers, building redundancy into the supply chain, or developing contingency plans is another aspect of supply chain disruptions. In the event of a disruption, real-time information sharing enables rapid communication and response efforts. Supply chain partners can quickly share updates, assess the impact of the disruption, and coordinate recovery efforts to minimize the disruption's effects on the supply chain's operations. Information sharing is essential for enhancing supply chain resilience by providing visibility, enabling risk identification and mitigation, supporting collaborative planning and response efforts, and fostering a culture of resilience among supply chain partners.

## REFERENCES

- [1] Cardoso, Brenda & Fontainha, Tharcisio & Leiras, Adriana. (2022). Disasters impact on supply chains and countermeasure strategies: an overview of the academic literature nature. *Brazilian Journal of Operations & Production Management*. 19. e20221429. 10.14488/BJOPM.2021.05.
- [2] NEZIH ALTAY and ANDRES RAMIREZ. (2010) Impact of Disasters on Firms in Different Sectors: Implications for Supply Chains. *Journal of Supply Chain Management*. <https://doi.org/10.1111/j.1745-493X.2010.03206.x>
- [3] Araz, O., Choi, T., Olson, D., & Salman, F. (2020). Data analytics for operational risk management. *Decision Sciences*. <https://doi.org/10.1111/dec.12443>.
- [4] Tao, Y., Lai, X. & Zhou, S. Information sharing in a transparent supply chain with transportation disruptions and supplier competition. *Ann Oper Res* 329, 307–329 (2023). <https://doi.org/10.1007/s10479-020-03724-3>

- [5] Natarajathinam, M., Capar, I. and Narayanan, A. (2009), "Managing supply chains in times of crisis: a review of literature and insights", *International Journal of Physical Distribution & Logistics Management*, Vol. 39 No. 7, pp. 535-573. <https://doi.org/10.1108/09600030910996251>
- [6] Riley, J.M., Klein, R., Miller, J. and Sridharan, V. (2016), "How internal integration, information sharing, and training affect supply chain risk management capabilities", *International Journal of Physical Distribution & Logistics Management*, Vol. 46 No. 10, pp. 953-980. <https://doi.org/10.1108/IJPDLM-10-2015-0246>
- [7] Day, Jamison M.; Junglas, Iris; and Silva, Leiser (2009) "Information Flow Impediments in Disaster Relief Supply Chains," *Journal of the Association for Information Systems*, 10(8). DOI: 10.17705/1jais.00205 Available at: <https://aisel.aisnet.org/jais/vol10/iss8/1>
- [8] Umar M, Wilson M. Supply Chain Resilience: Unleashing the Power of Collaboration in Disaster Management. *Sustainability*. 2021; 13(19):10573. <https://doi.org/10.3390/su131910573>
- [9] Xavier Polanco, Eric San Juan, Text Data Network Analysis Using Graph Approach. *International Conference on Multidisciplinary Information Sciences and Technology (InSciT2006)*, Oct 2006, Merida, Spain. pp. 586-592, (hal-00165964)
- [10] Juarez, Esteban & Cervantes Villagómez, Ofelia & Ayala, Darnes. (2018). Text Analysis Using Different Graph-Based Representations. *Computación y Sistemas*. 21. 10.13053/cys-21-4-2551.
- [11] Rubayyi Alghamdi and Khalid Alfalqi. 2015. A survey of topic modeling in text mining. *Int. J. Adv. Comput. Sci. Appl.* 6, 1 (2015).
- [12] Loulwah AlSumait, Daniel Barbará, and Carlotta Domeniconi. 2008. On-line LDA: Adaptive topic models for mining text streams with applications to topic detection and tracking. In *Proceedings of the 8th IEEE International Conference on Data Mining*. IEEE, 3–12
- [13] Stefan Bunk and Ralf Krestel. 2018. WELDA: Enhancing topic models by incorporating local word context. In *Proceedings of the 18th ACM/IEEE on Joint Conference on Digital Libraries*. 293–302.
- [14] Ying-Lang Chang and Jen-Tzung Chien. 2009. Latent Dirichlet learning for document summarization. In *Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing*. IEEE, 1689–1692. DOI: <https://doi.org/10.1109/ICASSP.2009.4959927>
- [15] W. Hong, X. Zheng, J. Qi, W. Wang and Y. Weng, "Project Rank: An Internet Topic Evaluation Model Based on Latent Dirichlet Allocation," *2018 13th International Conference on Computer Science & Education (ICCSE)*, Colombo, Sri Lanka, 2018, pp. 1-4, doi: 10.1109/ICCSE.2018.8468739.