Siber Journal of Transportation and Logistic (SJTL)
+62 822-1012-3600 https://research.e-siber.org siberpublisher.info@gmail.com
DOI: https://doi.org/10.38035/sjtl.v2i2

The Impact of Floods on Logistics Efficiency: A Case Study of Goods Delivery via Railway in Semarang City

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Abstract: Flooding is a frequent natural disaster in Semarang City, significantly impacting the logistics sector. This study aims to analyze the impact of flooding on logistics efficiency in goods transportation using railways in Semarang City. The research employs a quantitative approach with secondary data analysis from railway operational reports and primary data through interviews with logistics actors and station managers. The findings reveal that flooding disrupts operations, causing delays, increased logistics costs, and reduced transport capacity. Additionally, access to railway stations is often hindered by water inundation, slowing down the distribution process. The study concludes that flooding significantly reduces logistics efficiency in Semarang City, particularly in railway transportation. To mitigate these impacts, robust infrastructure planning and improved coordination between logistics service providers and local governments are necessary.

Keywords: Cargo, Rail, Delay, and Efficiency

INTRODUCTION

Logistics is one of the important elements in the supply chain, which includes the process of planning, implementing, and controlling the flow of goods, services, and information from the point of origin to the point of destination efficiently and effectively (Christopher, 2011). Logistics efficiency is the main key to ensuring smooth distribution, reducing costs, and increasing customer satisfaction. However, challenges in implementing logistics often arise due to external factors, one of which is natural disasters. (Kereta et al., 2018)

Semarang City, as one of the big cities in Indonesia, has a strategic position in the distribution of goods, especially through rail transportation. This mode is known as one of the efficient transportation methods for large volumes at relatively low costs (Rushton et al., 2014). However, geographical and climatic challenges, including the risk of flooding, are major obstacles to the efficiency of goods delivery. (PAHRUDIN & WIBOWO, 2015).

In Indonesia, one of the problems that must be resolved immediately is disasters. Data from the National Disaster Management Agency (BNPB) in 2022 shows that around 3,494 natural disasters occurred in Indonesia, ranging from floods to droughts. People in Semarang City also experienced the same thing. According to data from the Regional Disaster Management Agency (BPBD), throughout 2022, Semarang City experienced 324 natural

disasters, including floods (63 cases), tidal floods (7 cases), landslides (110 cases), tornadoes (28 cases), collapsed houses (50 cases), fires (39 cases), and fallen trees (46 cases). The victims of these various natural disasters reached 27,325, who needed fast and appropriate humanitarian logistical assistance.

According to Sugiharto (2017), flooding is a form of natural disaster that occurs when high rainfall cannot be absorbed by the ground surface, causing an overflow of water that inundates certain areas. In Semarang, flooding often occurs due to a combination of high rainfall, high tides, and poor drainage systems. This condition disrupts transportation activities, including logistics delivery using trains. (Firdausi, 2020)

The effects of flooding on shipping goods include schedule delays, damage to goods, and increased operational costs due to route rerouting and infrastructure repairs. According to Chopra and Meindl (2016), punctuality in delivery is one of the key indicators in measuring logistics efficiency. When shipping is disrupted, the entire supply chain will be affected, reducing efficiency and increasing operational uncertainty.

This study aims to analyze the impact of floods on logistics efficiency, especially in shipping goods via train in Semarang City. This study not only provides an empirical description of the obstacles faced, but also offers insight into mitigation strategies that can be implemented to reduce risks and improve logistics efficiency. Thus, the results of this study are expected to be a reference for logistics industry players and local governments in managing flood disaster risks.

METHOD

A. Data Collection Method:

1. Using secondary data and interviewing expedition officers and the director of the General Freight Transportation Division of PT. KAI.
2. Conduct observations at the expedition regarding the service system, goods delivery process, and general goods delivery time.

B. Observation Location:

The survey was conducted in the Operation Area 4 Semarang area.

C. Observation Time:

The survey was conducted during business hours and holidays.

RESULTS AND DISCUSSION

Floods in Semarang City have a significant impact on logistics efficiency, especially in shipping goods by train. Operational disruptions due to flooding cause delays, trip cancellations, and losses in shipping volumes.(Influence & Reduction, 2023)

A. Impact of Floods on Freight Delivery by Train in Semarang

In March 2024, floods that hit the Semarang area caused the cancellation of four train trips by Semarang Operations Area IV. This was due to the rail lines being submerged in floodwater, making it unsafe to pass through.(KOMPAS MEDIA NUSANTARA, 2024)

The floods that occurred in Semarang City have a significant impact on train operations, especially in terms of shipping goods. PT Kereta Api Indonesia (KAI) Operational Area 4 Semarang found 22 disaster-prone points during the rainy season along the rail lines in the northern region of Central Java. These vulnerable points are located in Grobogan, Blora, Pekalongan, and Semarang City Regencies, with 11 vulnerable points in Grobogan Regency.(ANTARA NEWS, 2023)

On January 21, 2025, floods inundated the railway line on the road section between Gubug Station and Karangjati Station, Grobogan Regency, with a water level reaching 20 cm. This condition disrupted the journey of five trains, consisting of four freight trains and one

Blora Jaya passenger train on the Cepu-Semarang Poncol route. To ensure safety, the line was temporarily closed until conditions allowed for passage.(DISWAY JATENG, 2025)

In addition, in March 2024, floods and landslides in Semarang caused many long-distance train trips passing through the North Coast (Pantura) route to be canceled. Until the flood conditions subside, Semarang Tawang Bank Jateng station will not accept passengers getting on and off. The Ambarawa Ekspres train connecting Semarang Poncol to Surabaya Pasarturi, the Blora Jaya train connecting Cepu to Semarang Poncol, the Kedungsepur train connecting Semarang Poncol to Ngrombo, and the Banyubiru train connecting Semarang Tawang Bank Jateng to Solo Balapan have been canceled.(COVERAGE 6, 2024)

In addition, in January 2025, floods again disrupted train operations in Semarang. As many as 15 train trips were diverted via alternative routes because the main route was submerged in floodwater.(KOMPAS.COM, 2025)

B. Impact on Logistics Efficiency

The disruption of train operations due to flooding has a direct impact on logistics efficiency in Semarang City. Delays and cancellations of train trips have hampered the distribution of goods, both for the delivery of production results and the supply of raw materials to factories. Aris Pandan Setiawan, Deputy Chairperson for Finance, Taxation, Investment and Capital Markets of the Semarang City Chamber of Commerce and Industry, stated that the flood affected the supply chain from upstream to downstream. Upstream, the supply of production materials was hampered due to limited access, resulting in reduced production results. Downstream, the marketing process was hampered due to disrupted distribution due to transportation being blocked by flooding.(KOMPAS TV, 2023)

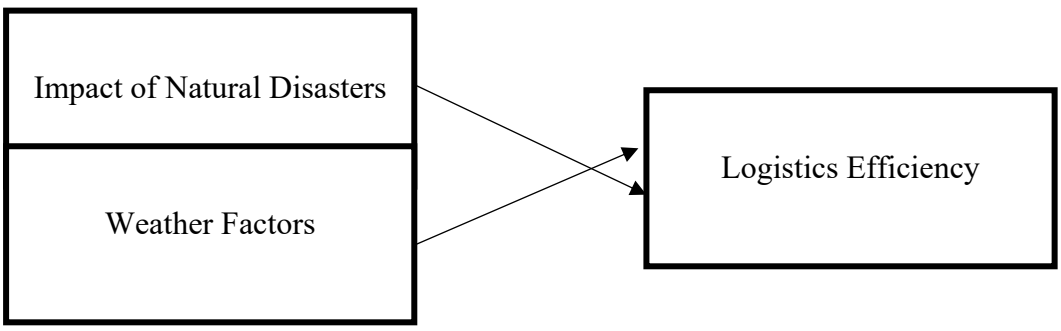
The impacts of these operational disruptions include delays in the delivery of goods, increased operational costs due to the use of alternative routes, and decreased customer confidence in the punctuality of delivery. For example, in February 2021, PT Kereta Api Logistik failed to dispatch more than 7,200 tons of logistics due to flooding that inundated the railway tracks, which caused the cancellation of container train trips.

To overcome this problem, mitigation efforts are needed such as improving flood-resistant rail infrastructure, improving drainage systems around train lines, and developing contingency plans to ensure smooth logistics distribution during the rainy season. In addition, diversifying transportation modes and improving coordination between logistics stakeholders can help minimize the impact of flooding on the efficiency of goods delivery.(Economics, 2021)

By implementing these strategies, it is hoped that the efficiency of logistics for sending goods by train in Semarang City can be improved, despite facing the challenge of recurring floods.

Conceptual Framework

Based on the findings of the problem formulation, highly relevant previous research and research discussion, the conceptual framework for this article is structured as shown in Figure



Based on the conceptual framework above, then: Weather factors and reduction strategies influence flight delays.

Data on Shipping Goods via Train in Semarang

Based on data from the Central Statistics Agency of Central Java Province, the following is data on freight transportation through PT. Kereta Api Daerah Operasi IV Semarang in 2021:

Month	Transport Volume (Tons)
January	150
February	140
March	160
April	155
May	145
June	150
July	160
August	165
September	150
October	155
November	160
December	170

Source: Central Statistics Agency of Central Java Province

The data above shows the fluctuations in freight volumes each month. Although not all fluctuations are caused by flooding, flooding events that occur in certain months, such as March 2024 and January 2025, have the potential to cause a decrease in freight volume due to cancellations or diversions of train trips. These operational disruptions not only affect the efficiency of freight delivery but also have the potential to increase logistics costs due to delays and the need to find alternative shipments.

C. Handling and Mitigation Efforts

PT KAI Daop 4 Semarang has taken steps to anticipate and handle the impact of flooding on train operations. One of them is mapping disaster-prone points and increasing the alertness of officers in the field. Routine inspections of rail conditions are carried out, especially ahead of the rainy season, to ensure the reliability of rails, signaling, and readiness of human resources at each station.(ANTARA NEWS, 2023)

In addition, in flood situations, PT KAI deploys officers, heavy equipment, and materials such as kricak stones to handle the overflowing water and clean up the garbage carried by the flood, which has the potential to hinder the operation of the railway line. The handling process is carried out intensively so that the line can be reused immediately.(DISWAY JATENG, 2025)

D. Impact of Floods on Railway Infrastructure

Floods that hit Semarang City often inundate the railway tracks, especially in low-lying areas and near rivers. High water levels can damage the rail structure, cause corrosion, and result in decreased stability of the soil around the tracks. For example, in February 2021, due to flooding that inundated the railway tracks on the road section between Kedunggedeh Station and Lemahabang Station, PT Kereta Api Logistik (KAI Logistik) failed to send more than 7,200 tons of logistics.economy.business.com

In addition, flooding can also damage other supporting facilities such as signals, electrical systems, and stations. This damage requires time and money to repair, which ultimately disrupts train operations and reduces the efficiency of shipping goods.

E. Operational Disruptions and Delivery Delays

Floods cause significant operational disruptions to train services. Flooded tracks force operators to cancel or delay train trips. As an illustration, in March 2024, Semarang Operation Area 4 canceled four train trips due to flooding that submerged the rail track.

These delays and cancellations have a direct impact on logistics efficiency. Goods that should have arrived on time are delayed, resulting in backlogs in warehouses and potential losses for companies that depend on timely delivery. In addition, the reputation of the delivery service can also be negatively affected by the uncertainty of delivery schedules.

F. Increased Operating Costs

Disruptions due to flooding not only cause delays, but also increase operational costs. Train operators may need to divert trips to longer alternative routes, which means greater fuel consumption and travel time. For example, in January 2025, due to flooding in Semarang, 15 train trips were diverted via the Brumbung-Gundih-Gambringan route, which of course increased travel distance and operational costs.

In addition, the cost of repairing infrastructure damaged by flooding also adds to the financial burden for operators. Repairing rails, signals, and other facilities requires a lot of investment, which in turn can affect shipping rates.

G. Impact on Supply Chain and Distribution of Goods

Logistics efficiency is crucial in maintaining a smooth supply chain. Disruptions to rail transport due to flooding can cause delays in the distribution of goods, both raw materials and finished products. This can disrupt production in factories that depend on timely supplies and lead to product shortages in the market.

As an illustration, the flood that inundated the Pantura route in 2018 significantly disrupted logistics distribution, causing delays in the delivery of goods to various regions.

H. Mitigation and Adaptation Strategies

To reduce the impact of flooding on railway logistics efficiency, a comprehensive mitigation and adaptation strategy is needed. Some steps that can be taken include:

a) **Infrastructure Improvement:**Raise the elevation of tracks in flood-prone areas and improve the drainage system around the railway line to prevent waterlogging.
b) **Weather Monitoring:**Using real-time weather monitoring technology to anticipate and respond quickly to potential flooding.
c) **Contingency Plan:**Develop contingency plans that include rerouting, rescheduling, and communicating with customers regarding delays.
d) **Cooperation with Related Parties:**Coordinate with local governments and related agencies for flood management and infrastructure repair quickly and efficiently.

CONCLUSION

Floods in Semarang City have a significant impact on logistics efficiency, especially in the delivery of goods via rail transportation. The results of the study showed that floods caused operational disruptions in the form of delays, trip cancellations, and train diversions which resulted in increased logistics costs. These disruptions occurred due to waterlogging that hampered access to stations and submerged rail lines, thereby reducing transport capacity and slowing down the distribution of goods.

One of the main impacts identified is the increase in operational costs due to the need for rerouting or using alternative modes of transportation. In addition, disruptions to infrastructure such as rails, signal systems, and stations due to waterlogging cause delays in the delivery of goods. This decrease in efficiency also affects the supply chain from upstream to downstream,

where the supply of raw materials to the industry is hampered, resulting in delays in production and distribution of products to the market.

This study emphasizes the importance of mitigation strategies to reduce the impact of flooding on logistics efficiency. Some steps that can be taken include improving infrastructure with better drainage systems around railway lines, improving weather monitoring and prediction, and developing contingency plans that include rerouting and rescheduling trips. In addition, coordination between logistics service providers and local governments is essential to improve the resilience of the transportation system to natural disasters.

With the implementation of appropriate mitigation strategies, it is expected that the efficiency of freight logistics via train in Semarang City can be improved despite the challenges of recurring floods. This study also provides insights for stakeholders in the logistics sector to develop long-term solutions to maintain supply chain stability amidst the threat of natural disasters.

REFERENCE

Firdausi, N. I. (2020). No 主観的健康感を中心とした在宅高齢者における 健康関連指標に関する共分散構造分析Title. *Kaos GL Dergisi*, *8*(75), 147–154. https://doi.org/10.1016/j.jnc.2020.125798%0Ahttps://doi.org/10.1016/j.smr.2020.02.002%0Ahttp://www.ncbi.nlm.nih.gov/pubmed/810049%0Ahttp://doi.wiley.com/10.1002/anie.197505391%0Ahttp://www.sciencedirect.com/science/article/pii/B9780857090409500205%0Ahttp:

Kereta, K., Stasiun, D. I., Tanjung, P., & Pt, P. (2018). *Analisis Faktor Muat Sebagai Penyebab Keterlambatan*. *XI*(2), 14–17.

Mempengaruhi, F., & Pengurangan, S. (2023). *Analisis Data Keterlambatan Penerbangan Lion Air : Faktor-*. *1*(3), 116–123.

PAHRUDIN, C., & WIBOWO, F. P. (2015). Strategi persaingan usaha angkutan barang PT. Kereta Logistik. *Jurnal Manajemen Bisnis …*, 439–458. http://library.itltrisakti.ac.id/jurnal/index.php/JMBTL/article/view/27/29

Mempengaruhi, F., & Pengurangan, S. (2023). Analisis Data Keterlambatan Penerbangan Lion Air : Faktor-. 1(3), 116–123