



The Impact of Transportation Delays on the Supply Chain — Using the Suez Canal as an Example

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Abstract. One of the world's busiest shipping routes, the Suez Canal provides a vital link for ships traveling between Asia, the Middle East and Europe. Congestion in the Suez Canal can have a significant impact on global trade. The blockage of the canal would most notably hit the industrial and supply chains between Central Europe. In light of the massive losses and impacts caused by the current Suez Canal blockage, this paper investigates the reasons for the grounding of 'Ever Given' and divides them into geographical and human factors. Second, it analyzes this incident's direct and indirect impact on the supply chain and proposes some strategies for dealing with the same incident, such as developing emergency plans, constructing information logistics systems, and promoting multimodal transportation.

Keywords: Transportation Delays, Supply Chain, Suez Canal.

1 INTRODUCTION

The COVID-19 epidemic severely impacted the global supply chain, and trade between countries had to be postponed or suspended due to the epidemic. The blockage of the Suez Canal in March 2021 drew the attention of all nations [1]. Shipping is one of the most important modes of transportation in international trade and has always been a source of contention. The stranding event not only resulted in direct financial losses for all parties in the supply chain but also had some unintended consequences, such as commodity shortages and trade delays in some areas. Based on existing data, this paper will examine the impact of transportation delays caused by the Suez Canal blockage on the supply chain and propose solutions. Simultaneously, the investigation of this incident will assist people in preventing the subsequent channel blockage and what the relevant parties should do to minimize the loss when an accident occurs.

2 SUEZ CANAL BLOCKAGE EVENT AND ITS CAUSES

2.1 'Ever given' Suez Canal Blockage Event and Its Causes

The Suez Canal is one of the busiest in the world. According to statistics, the Suez Canal transports approximately 30% of the world's seaborne oil and 15% of seaborne cargo ships. The cargo ship 'Ever Given' of Taiwan Province Evergreen Group ran aground in the Suez Canal on March 23rd, 2021, due to high winds and sandstorms. Only a few hours later, the Egyptian Suez Canal Authority announced a suspension of Suez Canal traffic. According to the local meteorological report in Egypt, there was a strong wind and sandstorm in the area that day with a gust wind speed of 50 km/h and low visibility. The 'Ever Given' successfully floated until March 29th, and the Suez Canal resumed full service on April 3rd[2].

2.2 Causes of blocking events

Geographical factors.

According to the available data, there will almost certainly be an apparent blocking effect between the river channel and the hull, resulting in poor energy efficiency. During this time, a slight error in the steering is likely to cause the ship's bow to tie up quickly to the side of the river, resulting in a grounding accident. The narrow river channel, the small surplus water depth, and the ship's large main dimensions contributed to the grounding accident[3].

Human factors.

(1) Ignore weather warnings and be unconcerned. According to Egypt, the 'Ever Given' received an early notice but did not draw attention when it sailed in the river. When sailing, 'Ever Given' deviated from the river's middle line several times, but the helmsman was unaware of the combined effect of shallow water and bank wall effects. The blocking influence weakened the ship's course stability[4].

(2) The absence of emergency measures or the failure to implement emergency plans. When visibility decreased before the accident, the helmsman failed to slow down, and the anchor was not in an emergency state when it ran aground[5].

(3) A mismatch between ship size and waterway carrying capacity. Under the assumption of increasing market competition, stable service efficiency, and a fixed loading rate, the economic vitality brought by larger carrying capacity ships means higher profits[6]. Simultaneously, the large-scale ship can significantly reduce the ship's construction cost and energy consumption per unit capacity. The ship construction and operation cost will also be reduced as vessels are enlarged.

To summarize, shipping demand is the most critical factor in promoting large-scale ships.

The Suez Canal has an average water depth of 20 meters and a maximum depth of 23 meters in this incident, but its cross-section is an inverted trapezoid. However, when

ships pass by in the reach where "Ever Given" is located, the water depth on both sides of the channel becomes shallow quickly.

Large-scale ships increasingly demand Suez Canal management, coastal infrastructure, and waterway foundation conditions.

(4) The Canal Administration's management level is insufficient. The relevant regulations do not indicate the width, draft, and speed of ships permitted to navigate the canal. Simultaneously, it failed to implement adequate supervision and provide efficient ship rescue[7].

3 IMPACT OF SHIPPING DELAY ON SUPPLY CHAIN

3.1 Direct impact

The canal trade was interrupted.

The Suez Canal is one of the most prosperous shipping routes in the world, with an average of 50 ships passing through each day, 30 of which are heavy cargo ships. The accident forced some cargo ships to avoid the Cape of Good Hope in Africa, resulting in a 6,000-mile increase and at least a week's delay[8].

As the owner of the Suez Canal, the Egyptian government will bear the cost of the trade disruption. It is believed that the Egyptian government's daily income has decreased by 14 million to 15 million dollars.

Direct monetary losses.

Rescue expenses, ship voyage delays, and global trade losses are direct financial losses. The Egyptian government spent Montage Golden dollars to refloat the "Ever Given."

Furthermore, it is estimated that the voyage of nearly 400 ships transiting the Suez Canal will be delayed for 19 days, resulting in additional losses such as ship rent, fuel oil, other consumables, and crew wages. If a ship's average loss is 40,000 USD per day and the average loss is five days, such losses will be 80 million USD[9].

According to a report by Allianz Insurance in Germany, the accident resulted in global trade losses ranging from \$6 billion to \$10 billion.

Goods delivery delays.

Many commodities risk being delayed due to the canal's blockage. These cargo ships transport everything from coffee and auto parts to live animals and furniture. According to Nintendo, the backup of the Suez Canal has resulted in a shortage of Nintendo Switch inventory and delayed shipment of goods in various locations. Because of the recent decline and delay in global trade freight volume caused by the COVID-19 epidemic, Nintendo's commodity inventory outside of Japan has been in short supply, and the commodities to Europe have been affected by the canal blockage, which exacerbates the commodity shortage. Trabocca, an instant coffee importer, stated that it could not guarantee the timely arrival of coffee, which would hurt physical coffee store sales. At the same time, Nestle's raw materials for making instant coffee are primarily sourced

from East African countries and parts of Asia, with most of the raw materials passing through the Suez Canal. Nestle has also become the coffee company most impacted by traffic jams. Faced with delayed deliveries of auto parts to Asia, all auto parts suppliers have pursued "just-in-time inventory management" to maximize capital efficiency, and will not hoard many raw materials. Based on this, the supply chains of automakers such as Audi and Toyota will be impacted, resulting in a drop in auto production this quarter. According to Mark Fulthorpe, Executive Director of Global Light Vehicle Production Forecast, late deliveries of auto parts will result in the loss of at least 1.2 million vehicles worldwide in the first quarter.

3.2 Indirect influence

The shipping cost rises in the short term.

The inability of a large number of cargo ships to turn around during the grounding of "Ever Given" resulted in an increase in shipping rates, an increase in international trade costs, and a chain reaction. Previously, the global shipping market was impacted by container shortages, trade recovery, and other factors, resulting in tight shipping capacity and apparent price increases. At the same time, issues such as closed booking, a lack of containers, and rising freight rates have resurfaced due to the canal's blockage. On April 2nd, the Baltic Freight Index (FBX) Asian-American freight rate increased, and the west coast was \$5,156 per 40 feet, up 5% from the freight rate in March; the east coast was \$5,814 per 40 feet, up 1% from the previous month. The global Baltic Freight Index stands at \$4,164 per 40 feet, up 1.8% from the last week[10]. According to the relevant shipping company, the Suez Canal blockage will disrupt the route for about a week in the short term. At the same time, the cost of chartering a plane is rising. The daily rental price of a Suez tanker transporting one million barrels of crude oil has been increased to around \$17,000, the highest since 2020. The cost of a cruise from the Middle East to Asia had risen by about 47% as of March 30.

The oil price rises in the short term.

The international oil price increased significantly as a result of this incident. Light crude oil futures for May delivery on the New York Mercantile Exchange and Brent crude oil futures for May delivery on the London Stock Exchange have surpassed \$60 per barrel. However, the price of oil quickly fell back. Because the Organization for Economic Cooperation and Development currently has a stockpile of approximately 3 billion barrels of oil, several tankers stranded in the Suez Canal are unlikely to have a long-term impact on oil prices. The international oil price rose for the first time the day after the incident, on March 24th. WTI futures for May delivery on the New York Mercantile Exchange and Brent crude oil futures for May delivery rose by 5.92% and 5.95%, respectively; the oil price fell by 3.74% on the 25th. Oil prices rose again on the 26th, with WTI rising 4.12% and Brent rising 4.23%. The "Ever Given" was successfully delisted on the 29th, and the WTI futures price rose by 0.97%; the Brent futures price rose by 2.92%.

Two distinct trends emerge from this. First, Oman's crude oil prices remained stable during the canal blockage. Because the waterway associated with Oman crude oil does not pass through the Suez Canal, the Suez Canal does not affect its worldwide supply. Second, from the Suez Canal's closure to the complete resumption of navigation, the prices of Brent crude oil and WIT futures have risen and fallen three times, demonstrating that their transportation is dependent on the Suez Canal.

Both trade parties consider other modes of transportation.

Maritime transport accounts for more than two-thirds of total global trade volume, owing to the three factors listed below: First, there is the cost advantage. Shipping has always been the most cost-effective among all modes of international trade and transportation. The second factor is the accessibility of transportation commodities. Third, it has a well-developed transportation system. There are currently over 2,100 liner routes worldwide, with east-west, north-south, and intra-regional routes crisscrossing and covering a large area, forming an intensive and efficient market network.

In terms of oil trade, in addition to the Suez Canal, other alternative routes for oil transportation exist in various countries. As a result, the Suez Canal blockage will have little effect on the crude oil supply. Furthermore, pipeline transportation is quickly becoming the primary mode of oil transportation. For example, in October 2020, Israel and the United Arab Emirates signed an agreement to extend the oil pipeline connecting Eilat, Israel's Red Sea city, to Ashkelon, Israel's Mediterranean port, to the United Arab Emirates, through which crude oil from the UAE will be transported to the European market.

At the same time, this incident serves as a reminder to global trade that we should not rely solely on shipping and instead promote the development of land logistics systems. This will also increase the demand for safer and more efficient modes of transportation on both sides of the trade.

4 THE DISCOVERY OF A BLOCKAGE ACCIDENT

4.1 Emergency procedures for postponed events

The Suez Canal The blockage has resulted in massive losses to global trade, while every party in the supply chain must address the issue of transportation delays. Simultaneously, we must consider the corresponding emergency plan.

Despite the Egyptian authorities' initial rush to the scene during the jam, rescue progress was still slow. At the same time, Egyptian rescuers had no emergency plan, and their crisis management capacity was insufficient. When a transportation accident occurs, the emergency plan should be activated as soon as possible, and the emergency organizations that have been notified should conduct unified command, collect accurate on-site information and data, formulate targeted and reasonable plans, and solve the congestion source as soon as possible using emergency materials and infrastructure. As a result, before beginning transportation, detailed emergency plans for various emergencies must be developed and strictly followed when accidents occur

4.2 Transportation system optimization

Increase the informatization of transportation route construction.

To avoid a large number of vehicles passing through the same route in a short time, each transportation route should be updated regularly. Data from the entire transportation route is analyzed, and data of the whole line is shared. Lousy weather and emergencies are promptly reported, and the appropriate parties are notified. Put an end to illegal behavior by standardizing traffic rules on transportation routes.

Make the transportation environment more efficient.

Check the transportation routes regularly, identify hidden road hazards, and report them. Data on the road environment is collected, analyzed, and recorded. Maintaining and replacing infrastructure on time, as well as promoting internationalization and standardization of logistics facilities, are all priorities. Maintain flexibility in planning, designing, constructing, and operating important transportation hubs and passages, meet the requirements of moderately advancing the passing capacity, and reserve specific redundant space to improve the anti-risk ability of critical nodes and essential parts. International logistics traffic safety research and measures should be strengthened, daily supervision, evaluation, and early warning should be strengthened, supply chain pressure and risk should be balanced, and an accident should not paralyze the entire supply chain.

Encourage multimodal transportation.

Because of its low cost, marine transportation has become one of the most popular modes of international trade. However, there are some drawbacks, such as a long sailing cycle, a high reliance on weather and natural conditions, piracy, and a limited transportation scope. Reasonable use of multimodal transportation can significantly reduce travel time and risk.

NHK, a Japanese cruise line, was initially focused on shipping. Still, declining shipping profits forced it to shift its business strategy from a separate shipping service to a "multimodal transport" service. First, it realizes strategic alliances by coordinating the operations of its subsidiaries in road transportation, warehousing, freight forwarding, and air transportation. Then it continuously develops logistics centers and establishes logistics networks in significant regions worldwide, providing related logistics services.

These measures have propelled it to the top of the global shipping industry.

5 CONCLUSIONS

Although the Suez Canal blockage harmed global trade, it only affected crude oil, coffee, and other commodities in a small area for a short period. The issues that arise as a result of it deserve people's attention. Solutions can be found whether the cause is artificial, such as poor canal administration management, or realistic, such as a mismatch between ship enlargement and waterway carrying capacity. For example, an infor-

mation logistics system can be set up to improve logistics efficiency, promote multi-modal transportation to lower transportation costs, and optimize the transportation environment to reduce transportation risks.

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