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Research Article

IMPLEMENTATION OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP) ON A FERRY

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ABSTRACT
Energy efficiency is an important focus due to rising fuel costs and greenhouse gas emissions. Although maritime transport is considered as the most environmentally friendly mode of transportation, it contributes significantly to environmental pollution. This study focuses on the Energy Efficiency Operational Index (EEOI) to assess the energy efficiency of the Osmangazi-1 high-speed passenger/vehicle ferry. The analysis reveals that there is a direct relationship between the EEOI values and operational parameters such as cargo weight, speed and sailing distance. The data collected between July and August 2013 shows that the average, minimum and maximum EEOI values are 0.001344, 0.000823 and 0.004322 respectively. Operational measures outlined in the Ship Energy Efficiency Management Plan (SEEMP) aim to reduce emissions and improve fuel efficiency. The findings emphasize that SEEMP should be implemented to reduce CO_2 emissions and promote sustainable maritime practices.

Keywords: *SEEMP, Ferry, Energy Efficiency, EEOI, IMO*

1. INTRODUCTION

The environmental effect of exhaust gas emissions and rising fuel prices have made energy efficiency a top priority in recent years (Leach et al., 2020; Prill & Igielski, 2018). Scientific research on environmental degradation, global warming, and energy-related topics has also increased as a result of this circumstance (Afifa et al., 2024). Although it is considered the most environmentally friendly of the three main modes of transportation: land, sea and air maritime transport has serious negative impacts on environmental pollution (Aminzadegan et al., 2022; Jägerbrand et al., 2019; Jing et al., 2022; Viana et al., 2014; Wu et al., 2011). Most transportation systems, including the maritime, employ internal combustion engines, the most prevalent sources of carbon dioxide and other greenhouse gases (Barreiro et al., 2022; Hüffmeier & Johanson, 2021; Wang et al., 2018). Waste ship-oil sludge (WSOS) (Sasidhar et al., 2023), bilge water (Arslan et al., 2022) and emissions resulting from the use of fuels on ships (Millet et al., 2023) cause environmental pollution. Today, it is known that 90% of international transportation is carried out by maritime transportation (Schnurr & Walker, 2019) and ensuring energy efficiency in ships is possible by reducing fuel costs and waste on ships (Oloruntobi et al., 2023).

The energy required for the propulsion and management of ships is provided by the ship's main engines and auxiliary engines, and the amount of CO_2 gas generated as a result of the combustion of fossil fuels used by these engines depends on the fuel and the amount of carbon in its content (Inal et al., 2022). The increase in the number of ships and thus the increase in the use of fossil fuels also increases the role and share of maritime transportation in emissions (Ayesu, 2023). According to the content of the Second IMO Greenhouse Gas Study in 2009 (Buhaug et al., 2009); it is stated that 1046 million tons of CO_2 emissions were generated as a result of maritime transportation activities in 2007 and this constituted 3.3% of the total CO_2 emissions in the world. It is estimated that if the necessary measures are not taken, this contribution may increase by 150-250% in 2050.

Greenhouse gas emissions from maritime transportation in Turkey constitute 3% of the total emissions, with NO_x, SO_2 and CO_2 from ships in the Marmara Sea constituting 1% of the greenhouse gas emissions from maritime transportation worldwide (Deniz & Durmuşoğlu, 2008). It is predicted that the greenhouse gas emissions from passenger engines operating in the Marmara Sea, the number of which is increasing daily, and ships making international transit are expected to increase continuously (Bayırhan et al., 2019).

To reduce emissions from ships and fuel consumption, the International Maritime Organization (IMO) published the "Ship Energy Efficiency Management Plan" (SEEMP) in March 2012 under circular MEPC.213(63) (IMO, 2013). As of January 1, 2013, all ships exceeding 400 gross tons of international voyages are required to have a SEEMP. The primary objective of SEEMP is to improve the energy efficiency of ship operations for both the company and the vessel. (Beşikçi et al., 2021). Since ships and companies differ, each vessel requires a SEEMP tailored to its specific needs. SEEMP serves as a guiding framework, offering operational and technical recommendations to minimize a ship's energy consumption. It facilitates increased energy efficiency by providing coordination between the company and the ship (Dewan & Godina, 2023; Hansen et al., 2020).

SEEMP should be continuously developed in collaboration with the ship owner, operator, or charter company. Like other management systems, SEEMP aims to enhance energy efficiency through four key phases: planning, implementation, monitoring, and self-assessment and improvement. These stages play a crucial role in each phase of SEEMP.

Energy efficiency measures are classified into two main categories: technical and operational. Technical measures include structural optimization and ship design, improvements to propulsion systems, arrangements for energy systems, use of renewable energy sources and waste heat recovery and exhaust gas cleaning systems. Operational measures include the optimization of time and activities at port, voyage planning and routing according to weather conditions, speed optimization, ship maintenance (such as hull and propeller cleaning) and the use of shore power (Elena, 2012). Operational measures can reduce CO_2 and greenhouse gases by up to 40%. For example, reduction in speed by 10% alone can reduce emissions by 25% (Marin et al., 2010).

In order to increase energy efficiency, Öztürk (2015) concentrated on operational methods. This research examines fuel-efficient activities such weather routing, hull and propeller cleaning, speed optimization, and trip planning and virtual arrival. The study demonstrated how time and speed management are intimately linked to voyage planning and virtual arrival, and it gave instances of how these strategies might cut fuel expenses by as much as 40%.

Musulin et al. (2024) aimed to evaluate how trim optimization of container ships at different speeds can reduce exhaust gas emissions and fuel consumption. They calculated that with the right trim, fuel consumption can be up to 5% lower at constant route and speed. Ship emissions, fuel consumption, and energy efficiency may all be improved by optimizing trim at different speeds and drafts (Riyadi et al., 2022). Trim optimization in ship operations, using operational data and ensemble learning techniques, enhances energy efficiency and reduces emissions, especially for inland sea vessels (J. Gao et al., 2022).

This study differs from the existing literature by focusing on Osmangazi-1, a high-speed passenger/vehicle ferry operating in the Marmara Sea, a region with rapidly increasing maritime traffic. By analyzing Energy Efficiency Operational Index (EEOI) data over a long period of time, this research aims to assess how operational parameters such as trim, average speed, fuel consumption, cargo load and sailing distance affect the energy efficiency of the ferry. Unlike previous studies, which often rely on theoretical or simulation-based models, this study uses actual operational data from the ferry, providing valuable insights into how energy efficiency measures can be implemented in real-world settings.

2. METHODOLOGY

The most important method developed by IMO for controlling the functioning of SEEMPs prepared for ships in service is the EEOI. The information under this section was taken from IMO's circular dated 17.08.2009, numbered MEPC.1/Circ.684. In the formula OF EEOI, it is accepted that the CO_2 emission of a ship is directly related to fuel consumption. In other words, EEOI can be determined as the ratio of the mass of CO_2 produced to the amount of work performed.

For a ship carrying single voyage cargo;

$$EEOI = \frac{\sum_j FC_j \times C_{Fj}}{m_{cargo} \times D} \quad (1)$$

For a ship sailing for a certain period of time;

$$\boldsymbol{EEOI_{avarage}} = \frac{\sum_i \sum_j (\boldsymbol{FC_{ij}} \times \boldsymbol{C_{Fj}})}{\sum_i (\boldsymbol{m_{cargo,i}} \times \boldsymbol{D_i})} \quad (2)$$

Where j is the fuel type, i is the number of voyages, FC_{ij} is the mass of fuel j consumed in the i-th voyage, C_{Fj} is the conversion factor of fuel mass to CO_2 mass for fuel j, m_{cargo} is the mass of the cargo carried (or gross tonnage in passenger ships), D_i is the distance the cargo is carried in nautical miles (Acomi & Acomi, 2014). To apply the formulas above, it is necessary to use Table 1, which lists the carbon content and CO_2 emission data per unit of fuel type.

Table 1. CO_2 conversion per unit of fuel (Kim & Jeon, 2022)

Fuel Type	Reference	Carbon Content	Cf (t-CO_2/t- Oil)
Diesel/Gas Oil	ISO 8217 Grades DMX to DMC	0.875	3.206000
Light Fuel Oil (LFO)	ISO 8217 RMA to RMD class	0.86	3.151040
Heavy-fuel oil (HFO)	ISO 8217 Grades RME to RMK	0.85	3.114400
Liquefied Petroleum Gas	Propane, Butane	0.819 0.827	3.000000 3.030000
Liquefied Natural Gas	-	0.75	2.750000

The voyage EEOI is obtained by multiplying the amount of fuel by the mass amount of CO_2 converted from the fuel and dividing the result by the product of the cargo carried and the nautical miles traveled by the ship. The average EEOI was obtained by dividing the value obtained by multiplying the sum of the individual totals of the fuel types used by the mass amount of CO_2 conversion of the fuels and then summing them by the value obtained by summing the products of the amount of cargo carried at the end of each voyage and the cruising distance. This study aimed to reduce EEOI and average EEOI values using the measures determined in SEEMP.

The data used in this study was collected from the ferry Osmangazi-1 operating in the Turkish Sea of Marmara (Figure 1). Data on the ferry's fuel consumption, speed, and operational conditions were obtained from onboard sensors and operational logs maintained by the ferry's crew and operational team**.** Osmangazi-1, built in 2007 at Austal Shipyard in Australia with construction number 294, is Turkey's largest vehicle/passenger ferry with a carrying capacity of 1200 passengers and 225 vehicles. The vessel is 88 m long and can reach a maximum speed of 38 knots.

Fig. 1. Osmangazi-1 vessel

Table 2. Properties of the Osmangazi-1 vessel

Property	Value
IMO Number	9372127
Port of Registry	Istanbul
Registry Number	1322
Call Sign	TCCH5
Overall Length	88 m
Registered Length	79.68 m
Beam	24 m
Depth	8.25 m
Gross Tonnage	6133 GT
Net Tonnage	1840 NT
Deadweight Tonnage	520.20 DWT
Keel Laid Date	38742
Delivery Date	39167
Cargo Capacity	225 vehicles and 1200 passengers
Fuel Tank Capacity	(2x50650)+(2x25850)+(3x3500) = 225360 L.
Water Tank Capacity	2x5335 = 10670 L
Engine Power	4x7200 kW–1150 Rpm
Generator Power	4x280 kW, 1500 Rpm

In this study, no specific restrictions were imposed on the engine speeds of the studied ships, and this issue was left entirely to the discretion of the master and chief engineer. It was observed that the vessel prioritized customer satisfaction over energy efficiency and focused more on factors such as speed and voyage time. Table 3

presents the fuel data for Osmangazi-1 for 2013 and shows that there were significant differences in the monthly fuel consumption. The vessel uses diesel fuel, and its characteristics are stated in the supplier's analysis report. The company also performs oil analysis every three months and changes the oil approximately every 1,200 hours of operation depending on usage.

Table 3. Properties of fuel used in the Osmangazi-1 vessel

Property	Unit	Reference Limit	Measurement Uncertainty	Measurement Value	Test Method
Density	kg/m³	Min 820 Max 845	±0.11	829.3	TS EN ISO 12185
Total Contamination	mg/kg	Max 24		<6.0	TS EN 12662
Flash Point	°C	Min 55	±2.42	61	TS EN ISO 2719
Cold Filter Plugging Point	°C	+5 (Summer) -15 (Winter)	±0.91	-7	TS EN 116/AC, Cylindrical Strengthening
250°C Distillation	% (V/V)	Max 65	±0.63	26.1	TS EN ISO 3405
350°C Distillation	% (V/V)	Max 85	±0.54	93.0	TS EN ISO 3405
95% Distillation Temperature	°C	Max 360	±2.75	356.6	TS EN ISO 3405
Water Content	mg/kg	Max 200	±10.60	67	TS EN 6147/EN ISO 12937
Sulfur Content	mg/kg	Max 10	±0.22	5.2	TS EN ISO 20846
Cetane Index	--	Min 46.0	±0.92	57.9	TS EN ISO 4264

While calculating the EEOI, operations carried out for the safety of the ship, lifesaving etc. are excluded and voyages to the shipyard and ballast voyages (voyages without cargo) can be included in the calculations.

The fuel consumption equation represents the amount of fuel consumed by the main engine, auxiliary engines and other equipment at port and underway. The voyage distance refers to the actual distance traveled by the ship in nautical miles. The term "cargo" includes all types of cargo, including general goods, solid, liquid, and gaseous materials, as well as containers, passengers, and vehicles.

While establishing the EEOI monitoring system connected to SEEMP; the calculation period is defined, the sources of information are identified, data is collected, and the information is converted into valid formats. The expected benefits of EEOI are summarized as follows:

- Measurement of energy efficiency at each time step
- Assessment of the structural or operational changes in a ship
- Identification and correction of critical phases of the operational management of a ship
- Performance evaluation of owners and operators
- Continuous monitoring of the ship.

3. RESULTS AND DISCUSSION

Since there are many factors affecting the fuel consumption of a ship, it is only possible to obtain accurate results using methods such as EEOI. Although the values obtained using the EEOI indicate the amount of fuel consumed and CO_2 emissions emitted for the work performed, it should be aimed to keep these values to a minimum. Within the scope of this study, the voyage number, date, port of departure, amount of cargo carried, number of passengers, number of vehicles, trim value, cruising distance, average speed, type of fuel used, voyage EEOI, and average EEOI values were obtained.

The values obtained from the EEOI are used to compare the recorded voyage values. Therefore, it is not expected that the obtained values will be within certain ranges. The EEOI calculated at the end of each voyage indicates the changes in the factors that affect fuel consumption during the voyage. In general, a decrease in the EEOI indicates that energy efficiency measures have been effectively implemented. This also reduces the average EEOI.

Between 01.07.2013 and 15.08.2013, data were collected on the vessel with the current operational status, and the EEOI indicator was calculated and evaluated. According to the results obtained, the average EEOI value was 0.001344, which gives significant results when correlated with other parameters. It was found that the EEOI reached its highest level (0.004322) when the trim and average speeds were high. On the other hand, the EEOI value decreased to its lowest level (0.000823) when trim and average speeds were low.

The average fuel consumption was 6.49 metric tons (MT). The minimum fuel consumption was 5.35 MT,

while the maximum fuel consumption was 7.96 MT. The EEOI obtained at the minimum fuel consumption level was 0.001043, which is below the average EEOI. The EEOI obtained at the maximum fuel consumption level is 0.001375, which is very close to the average EEOI. This analysis shows the effect of trim and average rpm on the EEOI. High trim and rpm values decrease energy efficiency and increase fuel consumption, whereas low trim and rpm values indicate more efficient energy use.

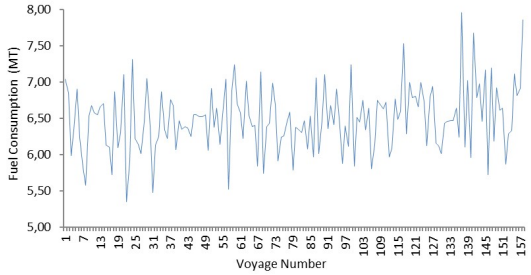

Fig. 2. Fuel Consumption depending on the voyage number

Fig. 3 shows the change in the number of vehicles with the number of voyages. The average number of vehicles was 663. The maximum and minimum number of vehicles carried in this process is 220 and 46, respectively. In terms of the total cargo, the maximum cargo carried by the vessel was 425 tons and the minimum cargo was 88 tons.

When the EEOI values are analyzed, the EEOI values when the number of vehicles is maximum and minimum are 0.000966 and 0.004322, respectively. This shows that the cruise distance plays an important role. It is observed that 57.3472 nautical miles are cruised in the case of maximum cargo transportation, where the EEOI is 0.000966, and 56.71 nautical miles are traveled in the case of minimum cargo transportation. In other words, although less load reduces fuel consumption, the EEOI value is below the average even if the fuel consumption and the amount of load are high for a high cruising distance.

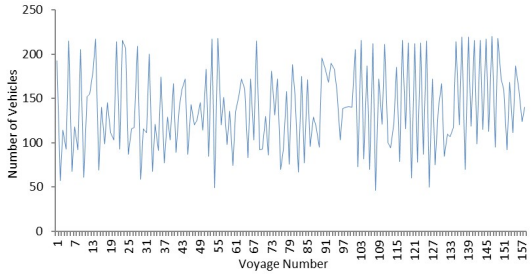

Fig. 3. Number of vehicles depending on the voyage number

According to the graph of vessel speed in relation to the number of voyages shown in Figure 4, the average speed was 34.35 knots. During this period, the maximum recorded speed was 37.5 knots, while the minimum recorded speed was 27.1 knots. At maximum speed, the vessel traveled 61.85 miles, consumed 6.45 tons of fuel, and carried 185 tons of cargo. In contrast, at minimum speed, the vessel cruised 58.73 miles, consumed 6.43 tons of fuel, and transported 247 tons of cargo. The EEOI calculated under the maximum speed conditions (0.001804) was higher than the average EEOI. Notably, although the amount of fuel consumed at the minimum speed was very close to that consumed at the maximum speed, the EEOI value (0.001420) differed and was also above the average EEOI value. This indicates that the load carried is an influential parameter in addition to fuel consumption.

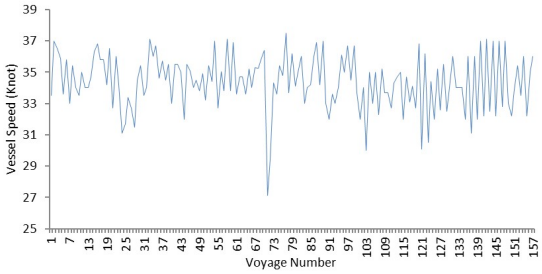

Fig. 4. Vessel speed depending on the voyage number

According to the results obtained, the average cruising distance was 58.7833 nautical miles. During this period, the maximum cruising distance recorded was 69.7334 nautical miles, while the minimum cruising distance was 51.9002 nautical miles (see Figure 5). The EEOI values at the maximum and minimum cruising distances were 0.001603 and 0.001248, respectively.

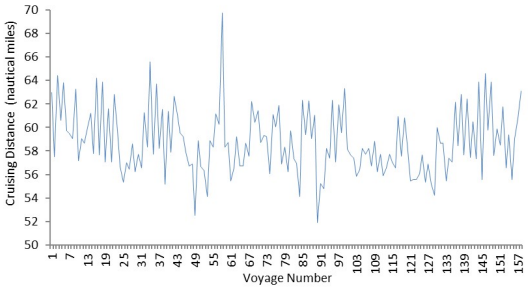

Fig. 5. Cruising distance depending on the voyage number

The number of passengers and vehicles carried on the 21st voyage were 1169 persons and 214 vehicles, respectively, and the ship speed reached 32.7 knots during the voyage, while the number of passengers and vehicles carried on the 53rd voyage were 1182 persons and 217 vehicles, respectively, and the ship speed reached 34.4 knots. If the 21st and 53rd voyages are compared, the EEOI value of 0,000949 for the 21st voyage is higher than the EEOI value of 0,000923 for the 53rd voyage due to the difference between the speeds, although the amount of cargo carried is close to each other. Therefore, it can be concluded that this increase in speed increases fuel consumption and consequently increases CO_2 emissions (Figure 6).

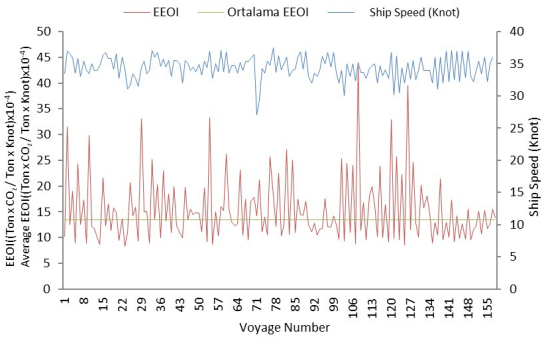

Fig. 6. Relationship between average speed and average EEOI

When the cruising distance between the same ports was maximum, the EEOI value was higher than the average EEOI value by 0.000259, and when the distance was minimum, the EEOI value was lower than the average EEOI value by 0.000096 (Figure 7). However, the cruising distance was extended when necessary due to the importance of ensuring the safety of life and property at sea, depending on the weather conditions. The same ships may take different routes between the same ports depending on weather conditions or other factors. This can lengthen or shorten distances.

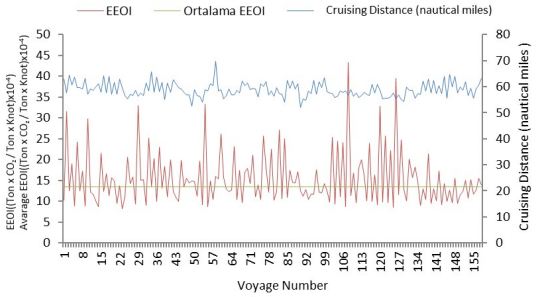

Fig. 7. Relationship between cruising distance EEOI and average EEOI.

For the voyages between the same ports, when the fuel consumption was the maximum, the EEOI value was 0.000301 below the average EEOI, and when the fuel consumption was the minimum, the EEOI value was 0.000328 below the average EEOI (Figure 8). Average EEOI and EEOI are operational indices based on different calculation methods, where fuel consumption is only one factor. These indices are influenced not only by fuel consumption, but also by load, distance and other variables. Therefore, even if the operational index increases, the average index may remain at a lower level.

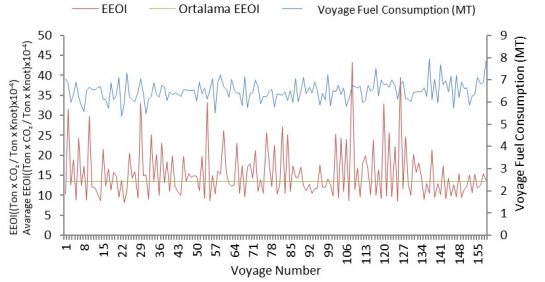

Fig. 8. The relationship between voyage fuel consumption, EEOI and average EEOI

As seen in Figure 9, despite the higher number of passengers and vehicles transported, the increase in ship speed was more important than the increase in the amount of cargo transported on low-speed voyages, and the changes in speed were parallel to the changes in EEOI values. Figure 9 shows that the change in vessel speed has a greater effect on EEOI compared to the cargo carried.

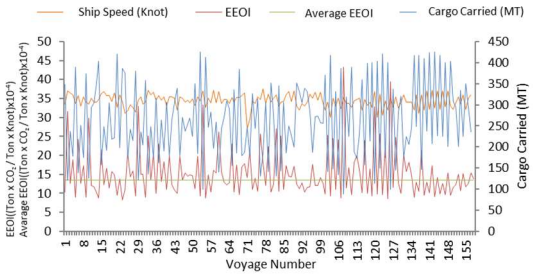

Fig. 9. Relationship between the cargo carried, average speed, and EEOI

As shown in Figure 10, when the average speed was low, a significant reduction in fuel consumption was observed. This reduction also led to a decrease in the EEOI.

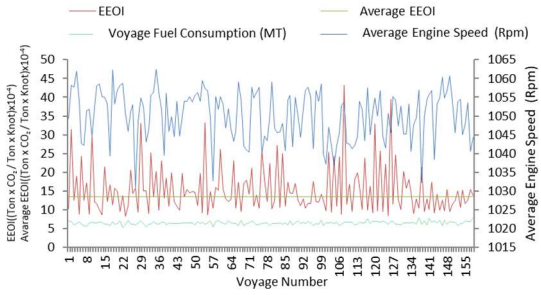

Fig. 10. Relationship between EEOI and average engine speed and fuel consumed

An increase in trim causes an increase in the friction surface of the ship under water and has a negative effect on fuel consumption for voyages with the same amount of cargo. This increased fuel consumption has also negatively affected the EEOI, causing the index to increase (Figure 11). Trim affects the hydrodynamic performance of the vessel, influencing its resistance to motion and, consequently, fuel efficiency. Our analysis found that slight adjustments to the trim could lead to measurable changes in fuel consumption.

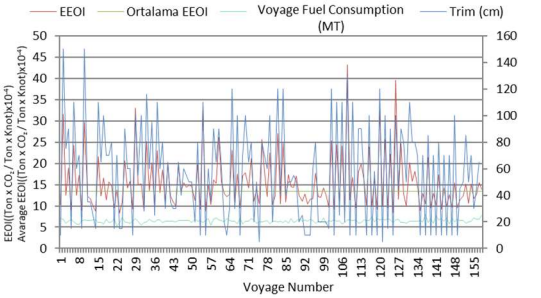

Fig. 11. Relationship between EEOI and trim and fuel consumed

4. CONCLUSION

The increase in marine vessels carrying passengers and vehicles in the Marmara Sea has led to an increase in CO_2 emissions and fuel consumption. The implementation of SEEMP, which is mandatory by IMO for all ships operating internationally over 400 GT, initially in the Marmara Sea and subsequently for all ships operating on the cabotage lines in Turkey will contribute greatly to the realization of energy savings. In conclusion, this study highlights the critical relationship between various operational parameters and fuel consumption in maritime transportation, as assessed using the EEOI. The analysis reveals that multiple factors, including the voyage characteristics, such as cruising distance, trim value, average speed, cargo volume, and the number of passengers, significantly influence fuel consumption and CO_2 emissions. The following conclusions can be drawn from this study:

- It is observed that higher trim and average speed values increase fuel consumption and EEOI.
- Lower trim and speed values improve energy efficiency and reduce fuel consumption.
- When the fuel consumption data of the ship were analyzed, it was determined that the average fuel consumption was 6.49 MT, the minimum consumption was 5.35 MT and the maximum consumption was 7.96 MT.
- At maximum speed (37.5 knots), the vessel consumed 6.45 tons of fuel, while at minimum speed (27.1 knots), 6.43 tons of fuel were consumed. The increase in speed raised the EEOI values: 0.001804 at maximum speed and 0.001420 at minimum speed.
- Increasing the trim value resulted in higher fuel consumption and an increase in the EEOI. High trim values led to an increase in fuel consumption by 0.1-0.2 tons.
- On voyages with maximum cargo (663 vehicles), the EEOI was 0.000966, while for minimum cargo (46 vehicles), the EEOI was 0.004322. The amount of cargo and cruising distance affected the EEOI values.
- Cruising distance plays an important role in determining the EEOI compared to the amount of cargo transported. Lower EEOI values were found at higher cruising distances.
- Vessel speed changes significantly affected fuel consumption and CO_2 emissions, with higher speeds resulting in higher EEOI values.
- The lower speed and fuel consumption reduced the EEOI and improved the energy efficiency.

Overall, this study highlights that ship operators should prioritize energy efficiency in their operations and use tools such as EEOI to monitor performance and identify areas for improvement. Future research should focus on developing more refined strategies to optimize these variables in real-time operational environments to further improve energy efficiency in the maritime sector.

REFERENCES

Acomi, N., & Acomi, O. C. (2014). Improving the Voyage Energy Efficiency by Using EEOI. Procedia - Social and Behavioral Sciences, 138, 531–536. https://doi.org/10.1016/j.sbspro.2014.07.234

Afifa, Arshad, K., Hussain, N., Ashraf, M. H., & Saleem, M. Z. (2024). Air pollution and climate change as grand challenges to sustainability. Science of The Total Environment, 928, 172370. https://doi.org/10.1016/j.scitotenv.2024.172370

Aminzadegan, S., Shahriari, M., Mehranfar, F., & Abramović, B. (2022). Factors affecting the emission of pollutants in different types of transportation: A literature review. Energy Reports, 8, 2508–2529. https://doi.org/10.1016/j.egyr.2022.01.161

Arslan, O., Solmaz, M. S., & Usluer, H. B. (2022). Determination of the perception of ship management towards environmental pollion caused by routine operations of ships. Aquatic Research, 5(1), 39–52. https://doi.org/10.3153/AR22005

Ayesu, E. K. (2023). Does shipping cause environmental emissions? Evidence from African countries. Transportation Research Interdisciplinary Perspectives, 21, 100873. https://doi.org/10.1016/j.trip.2023.100873

Barreiro, J., Zaragoza, S., & Diaz-Casas, V. (2022). Review of ship energy efficiency. Ocean Engineering, 257(May), 111594. https://doi.org/10.1016/j.oceaneng.2022.111594

Bayırhan, İ., Mersin, K., Tokuşlu, A., & Gazioğlu, C. (2019). Modelling of Ship Originated Exhaust Gas Emissions in the Strait of Istanbul (Bosphorus). International Journal of Environment and Geoinformatics, 6(3), 238–243. https://doi.org/10.30897/ijegeo.641397

Beşikçi, E. B., Solmaz, M. S., & Jurdana, I. (2021). Determining the awareness and knowledge of officers towards ship energy efficiency measures. Pomorstvo, 35(2), 327–340. https://doi.org/10.31217/p.35.2.15

Buhaug, Ø., Corbett, J., Endresen, Ø., Eyring, V., Faber, J., Hanayama, S., Lee, D., Lindstad, E., Markowska, A. Z., Mjelde, A., Nelissen, D., Nilsen, J., Pålsson, C., Winebrake, J., Wu, W. –., & Yoshida, K. (2009). Second IMO GHG study 2009.

Deniz, C., & Durmuşoğlu, Y. (2008). Estimating shipping emissions in the region of the Sea of Marmara, Turkey. Science of The Total Environment, 390(1), 255–261. https://doi.org/10.1016/j.scitotenv.2007.09.033

Dewan, M. H., & Godina, R. (2023). Roles and challenges of seafarers for implementation of energy efficiency operational measures onboard ships. Marine Policy, 155, 105746. https://doi.org/10.1016/j.marpol.2023.105746

Elena, K. (2012). Measures for Improvement of Energy Efficiency of Ships. Journal of Marine Technology \& Environment, 1, 59–67.

Hansen, E. K., Rasmussen, H. B., & Lützen, M. (2020). Making shipping more carbon-friendly? Exploring ship energy efficiency management plans in legislation and practice. Energy Research & Social Science, 65(April 2019), 101459. https://doi.org/10.1016/j.erss.2020.101459

Hüffmeier, J., & Johanson, M. (2021). State-of-the-art methods to improve energy efficiency of ships. Journal of Marine Science and Engineering, 9(4). https://doi.org/10.3390/jmse9040447

IMO. (2013). Annex 9. Resolution MEPC.213(63). Adopted on 2 march 2012. 2012 Guidelines for the development of a ship energy efficiency management plan.

Inal, O. B., Charpentier, J.-F., & Deniz, C. (2022). Hybrid power and propulsion systems for ships: Current status and future challenges. Renewable and Sustainable Energy Reviews, 156, 111965. https://doi.org/10.1016/j.rser.2021.111965

Gao, J., Chi, M., & Hu, Z. (2022). Energy consumption optimization of inland sea ships based on operation data and ensemble learning. Mathematical Problems in Engineering, 2022(1), 9231782.

Jägerbrand, A. K., Brutemark, A., Barthel Svedén, J., & Gren, I.-M. (2019). A review on the environmental impacts of shipping on aquatic and nearshore ecosystems. Science of The Total Environment, 695, 133637. https://doi.org/10.1016/j.scitotenv.2019.133637

Jing, Q.-L., Liu, H.-Z., Yu, W.-Q., & He, X. (2022). The Impact of Public Transportation on Carbon Emissions—From the Perspective of Energy Consumption. Sustainability, 14(10), 6248. https://doi.org/10.3390/su14106248

Kim, S., & Jeon, H. (2022). Comparative Analysis on AC and DC Distribution Systems for Electric Propulsion Ship. Journal of Marine Science and Engineering, 10(5), 559. https://doi.org/10.3390/jmse10050559

Leach, F., Kalghatgi, G., Stone, R., & Miles, P. (2020). The scope for improving the efficiency and environmental impact of internal combustion engines. Transportation Engineering, 1, 100005. https://doi.org/10.1016/j.treng.2020.100005

Marin, N., Nikolaj, A., & Petko, P. (2010). Engine Room Simulator ERS4000 Use for Analysis of Energy Efficiency of Integrated Ship Energy System. Journal of Marine Technology \& Environment, 1(3), 205–212.

Millet, Y., Fidan, Y., & Öz, S. (2023). Effect of fuel type on maritime transportation's pollution: An EEOI application. Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 16(1), 66–78. https://doi.org/10.25287/ohuiibf.1087108

Musulin, M., Mihanović, L., Balić, K., & Musulin, H. N. (2024). The Impact of Container Ship Trim on Fuel Consumption and Navigation Safety. *Journal of Marine Science and Engineering*, *12*(9), 1658. https://doi.org/10.3390/jmse12091658

Oloruntobi, O., Mokhtar, K., Gohari, A., Asif, S., & Chuah, L. F. (2023). Sustainable transition towards greener and cleaner seaborne shipping industry: Challenges and opportunities. Cleaner Engineering and Technology, 13, 100628. https://doi.org/10.1016/j.clet.2023.100628

Öztürk, E. (2015). Operational Measures For Energy Efficiency In Shipping. Journal of ETA Maritime Science, 1(2), 65–72.

Prill, K., & Igielski, K. (2018). Calculation of Operational Indicator EEOI for Ships Designed to Other Purpose Than Transport Based on A Research – Training Vessel. New Trends in Production Engineering, 1(1), 335–340. https://doi.org/10.2478/ntpe-2018-0041

Riyadi, S., Aryawan, W. D., & Utama, I. K. A. P. (2022). Experimental and computational fluid dynamics investigations into the effect of loading condition on resistance of hard-chine semi planning crew boat. International Journal of Technology, 13(3), 518-532.

Sasidhar, K. B., Arkin, G., Gowtham, G., Somasundaram, M., & Vuppaladadiyam, A. K. (2023). Conversion of waste ship-oil sludge into renewable fuel: Assessment of fuel properties and techno-economic viability of supplementing and substituting commercial fuels. Journal of Cleaner Production, 427, 139362. https://doi.org/10.1016/j.jclepro.2023.139362

Schnurr, R. E. J., & Walker, T. R. (2019). Marine Transportation and Energy Use. In Reference Module in Earth Systems and Environmental Sciences. Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.09270-8

Viana, M., Hammingh, P., Colette, A., Querol, X., Degraeuwe, B., Vlieger, I. de, & van Aardenne, J. (2014). Impact of maritime transport emissions on coastal air quality in Europe. Atmospheric Environment, 90, 96–105. https://doi.org/10.1016/j.atmosenv.2014.03.046

Wang, K., Yan, X., Yuan, Y., Jiang, X., Lin, X., & Negenborn, R. R. (2018). Dynamic optimization of ship energy efficiency considering time-varying environmental factors. Transportation Research Part D: Transport and Environment, 62(May), 685–698. https://doi.org/10.1016/j.trd.2018.04.005

Wu, S., Cheng, Y., & Ma, Q. (2011). Discussion on ship energy-saving in low carbon economy. Procedia Engineering, 15, 5259–5262. https://doi.org/10.1016/j.proeng.2011.08.974

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Review Article

THE IMPORTANCE OF LOGISTICS COSTS IN E-COMMERCE BUSINESSES

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ABSTRACT
The increase in global trade volume, driven by digitalization and changing consumer demands, has transformed the logistics sector from merely a supporting activity into a crucial element that shapes the competitive advantage of businesses and stands as a strategic cornerstone of national and international economies. Logistics encompasses processes such as transportation, warehousing, order processing, packaging, and demand forecasting, ensuring the timely, reliable, and cost-effective delivery of products. Today, with the intensification of global competition, the share of logistics activities in total costs has increased, highlighting the growing importance of strategic decisions related to the management and financing of logistics operations. In recent years, developments in communication, transportation, and information technologies, along with the widespread use of the internet, have accelerated the shift from traditional commerce to e-commerce. E-commerce offers businesses the opportunity to reach wider customer bases and respond to fluctuating demands quickly, efficiently, and at lower costs. This digital transformation has impacted not only trade processes but also logistics systems, giving rise to the concept of e-logistics. E-logistics, with its digitalized logistics processes, has evolved into a more flexible, data-driven, and customer-centric structure, becoming one of the key support components of e-commerce. This study examines the structure, business models, and practices of e-commerce enterprises in detail and explains their relationship with e-logistics. The main objective of the research is to reveal the importance of logistics costs in the e-commerce sector. As part of the study, a systematic literature review was conducted, and the findings were analyzed. The results indicate that e-commerce enterprises are transforming the logistics sector, this transformation has acquired a digital dimension, and logistics costs are a significant determining factor for profitability, competitive power, and customer satisfaction.

Keywords: *Logistics, E-logistics, Commerce, E-commerce, Logistics Costs*

1. INTRODUCTION

E-commerce activities, which first emerged in the 1960s, have led to significant transformations in all areas of commerce up to the present day (Gedik, 2021: 184). Since the second half of the 1990s, the internet has been used not only as a communication tool but also as a commercial medium, which has contributed to the widespread adoption of e-commerce (Elibol & Kesici, 2004: 303).

With the proliferation of the internet and advancements in communication and information technologies, the traditional concept of commerce has rapidly shifted toward e-commerce. E-commerce refers to the buying and selling of products and services over the internet. However, it is not limited to revenue-generating commercial transactions; it also includes activities that support income generation. These include creating demand for goods and services, offering sales support services, providing customer service, and facilitating communication between business partners—key components of e-commerce (Fayyad et al., 2020: 20).

In today's technological era, businesses engaged in e-commerce are becoming increasingly significant in the global market. As of 2024, the global e-commerce market has reached an estimated volume of approximately $18.77 trillion (Statista, 2025). This market is projected to grow at a compound annual growth rate (CAGR) of 14.9% between 2024 and 2034, reaching $75.12 trillion (GlobeNewswire, 2024). Regionally, the Asia-Pacific region leads the market, accounting for more than 57% of total global e-commerce revenue (Statista, 2025). This growth is supported by advanced digital infrastructure, the proliferation of mobile commerce, and increasing consumer demand.

Parallel to the global growth in e-commerce, Turkey's e-commerce volume rose by 115.15% in 2023 compared to the previous year, reaching 1.85 trillion Turkish Lira (Hürriyet Daily News, 2023). Although official figures for 2024 have not yet been released, the volume is estimated to have reached 3.4 trillion TL (RSS, 2024). The share of e-commerce within the retail sector has risen to 16.5%, and its share in total consumer spending has increased to 20.3% (CMSWIRE, 2023). Sector-wise, the highest shares were recorded in white goods and small home appliances with 234 billion TL, electronics with 135 billion TL, and clothing, shoes, and accessories with 127 billion TL (Hürriyet Daily News, 2023). Furthermore, 656.4 million e-commerce transactions took place in the last quarter of 2023, reflecting the vibrancy of the sector (Icelog, 2024). These figures clearly demonstrate the scale and significance of e-commerce both globally and within the Turkish economy.

The e-commerce sector in Turkey continues to grow rapidly, driven by digitalization and changing consumer habits. This growth underscores the increasing importance of logistics and digital infrastructure investments. E-commerce is no longer just a sales channel but has become one of the most critical components of global economic development and commercial competitiveness.

The virtual environments in which e-commerce occurs are referred to as e-marketplaces. E-marketplaces can be described as websites with established e-commerce infrastructure, online auction platforms, and smartphone applications (Gedik, 2021: 185). E-commerce allows businesses to overcome physical limitations and reaches a broader customer base, while also offering opportunities to optimize costs and manage operational processes more efficiently (Mwencha, 2019: 70; Faraoni et al., 2019: 1). To achieve sustainability and a competitive advantage, e-commerce businesses must manage logistics processes effectively (Bayraktutan & Özbilgin, 2015: 95).

Logistics is a comprehensive field of activity that includes procurement, storage, order processing, packaging, transportation, and delivery of products to customers (Lambert et al., 1998: 2). In e-commerce enterprises, logistics processes are more complex compared to traditional commerce, and the management of these processes directly affects costs. Storage expenses, transportation fees, order processing and packaging costs, inventory management, demand forecasting, handling, customer service, reverse logistics (return processes), and investments in technological infrastructure are among the logistics cost elements of e-commerce businesses (Bayraktutan & Özbilgin, 2015: 97).

For e-commerce businesses, the effective management of logistics costs is crucial both for ensuring customer satisfaction and increasing profitability. Fast and reliable delivery processes directly affect customer experience and play a significant role in building brand loyalty, while also enhancing businesses' competitiveness by optimizing logistics costs (Yıldız, 2020: 38).

This study provides information on e-commerce businesses, defines the scope of logistics costs, and explains the importance of logistics costs for e-commerce enterprises. The literature review focused on this topic and related studies were added to this research. Since there were very few studies directly related to this topic in 2024 and 2025, studies conducted in previous years were included in this study. In today's expanding e-commerce sector, a better understanding of the impact of logistics costs on businesses will provide a strategic advantage for companies operating in the industry. This study aims to raise awareness among businesses about the significant impact of logistics costs on overall business performance, emphasizing how effective management of these costs can enhance operational efficiency and profitability. It examines the ways in which logistics expenses influence e-commerce companies and highlights their critical role in optimizing supply chain processes, improving customer satisfaction, and gaining competitive advantage.

In this study, general information regarding e-commerce enterprises will first be presented, followed by a discussion of e-commerce practices. A brief overview of e-commerce models will be provided, along with an examination of the concept of e-logistics and its associated activities. Subsequently, the topic of logistics costs will be addressed comprehensively. Within this framework, existing studies in literature will be reviewed to determine the significance of logistics costs for e-commerce businesses, and findings relevant to the study's objectives will be interpreted accordingly.

2. E- COMMERCE BUSINESSES

Today, e-commerce has become one of the most dynamic and rapidly evolving areas of the business world. With the advancement of digital technologies, customer and supplier relationships have been reshaped, business

processes have become more efficient, and fundamental transformations have occurred across many sectors (Daniel et al., 2002: 253). E-commerce eliminates physical boundaries, offering consumers the opportunity to shop at any time of the day and from anywhere in the world. Digital shopping is defined as a method of commerce involving the process by which consumers purchase products or services via the internet (Jusoh & Ling, 2012: 223–224).

Wigand (1997: 2) describes e-commerce as the continuous application of information and communication technologies across the entire value chain in electronically conducted business processes designed to achieve a specific goal (MacGregor & Vrazalic, 2005: 5).

Steinfield (2004: 354) defines e-commerce as a business model based on the use of telecommunications networks to connect institutions and individuals who establish commercial relationships via computers. He characterizes e-commerce as a system that facilitates buying and selling transactions through platforms such as the internet, electronic data interchange (EDI), and electronic funds transfer (EFT), in addition to inter-organizational communication networks like point-of-sale systems. Technology lies at the heart of e-commerce, with computer systems, internet connections, and digital communication networks forming the foundational elements of this ecosystem (MacGregor & Vrazalic, 2005: 5). For businesses, e-commerce is not just a sales channel but a strategic tool that enhances business processes, increases customer satisfaction, and provides a competitive advantage in the global marketplace (Mou et al., 2019: 219).

Compared to traditional commerce models, e-commerce enables businesses to access a broader customer base, reduce operational costs, and utilize automation through digital tools in their business processes—thus contributing to their competitive advantage. This transformation is not limited to conducting existing business practices in a digital environment; rather, it is seen as a strategic paradigm shift that brings about profound changes in the way business is conducted (Kunesovs & Eger, 2017: 152).

E-commerce is conducted not only through internet-connected computers but increasingly via smartphones and tablets, especially due to the declining cost of mobile internet in recent years. Consequently, businesses continue to enhance their websites' mobile versions and develop mobile applications to provide access for customers using mobile devices. Considering that approximately 60% of e-commerce purchases today are made via mobile devices, it is critically important for businesses to invest in and prioritize mobile applications to ensure profitability and sustainability (Ceran et al., 2022: 107).

One of the fundamental components of e-commerce is the facilitation of economic value exchange through digital platforms. Commercial transactions between suppliers and customers are carried out via electronic networks, while data sharing and financial transactions are conducted securely and swiftly through digital systems. In this process, the use of e-commerce applications, electronic data interchange (EDI), and other digital infrastructures enables businesses to optimize inventory management and manage order processes more effectively (Allison, 2017: 227).

2.1. E-Commerce Applications

E-commerce applications facilitate digital interaction between the parties involved in commercial transactions while also simplifying the management of data throughout the process. The variety of these applications makes e-commerce more advantageous for both consumers and businesses. From the consumer's perspective, online stores offer the ability to compare different products and place orders easily. From the business perspective, these digital solutions create potential for developing new services and expanding business opportunities (Eyal & Milo, 2001: 16).

Furthermore, there are various types of applications designed for different areas of e-commerce usage (Almarabeh & Majdalawi, 2019: 28). These applications are illustrated in Figure 1.

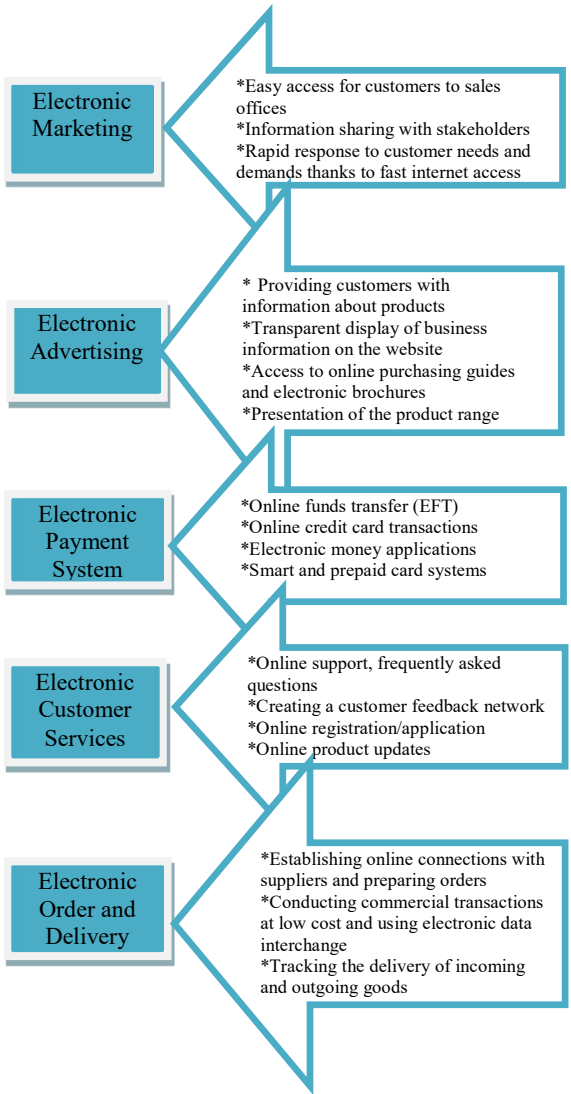

Fig. 1. E-commerce Applications
Source: (Almarabeh & Majdalawi, 2019: 28)

The e-commerce applications illustrated in the figure have further advanced since the early 21st century due to rapid developments in information and communication technologies and the widespread adoption of electronic production systems. These advancements have

accelerated the integration of e-logistics systems into business processes. Chopra and Meindl (2000), outline the advantages of e-commerce for businesses across a broad spectrum—from enabling direct sales and speeding up information sharing to improving pricing flexibility, enhancing logistics processes, and facilitating monetary transactions. These developments help businesses become more competitive in the global market, increase their operational efficiency, and offer significant advantages in customer relationship management.

E-commerce applications provide businesses with the ability to create digital stores, showcase their products, interact with customers, and manage payment processes. As a result, companies can make their products accessible 24/7, gain the opportunity to enter international markets, and eliminate the need to open physical stores, thereby achieving cost advantages. In addition, critical functions such as establishing a logistics infrastructure, effectively managing inventory, and responding quickly to customer feedback can also be carried out efficiently.

2.2. E-commerce Models

E-commerce models are categorized based on how businesses operate in the digital environment (Diker and Varol, 2013: 30). The main e-commerce models classified according to the ways of operating in the digital environment are listed below:

Direct E-commerce: This model involves selling through online platforms instead of physical stores, offering a delivery process similar with traditional methods. Sellers gain the opportunity to directly reach customers through their websites or online stores (Parlakkaya, 2005:169; Merdan, 2021: 26-27).

Indirect E-commerce: This model involves the buying and selling of goods or services through intermediary platforms. These platforms typically include online marketplaces and social media channels (Akpınar, 2017: 210).

B2B (Business to Business): This is the model in which businesses sell products or services to other businesses (Arslan and Öz, 2020: 14). Examples of businesses in this model include Alibaba, ThomasNet, Amazon Business, etc.

B2C (Business to Consumer): The most common model where businesses sell directly to individual consumers (Ekici, 2020: 218). Examples include Amazon, Trendyol, and Hepsiburada.

C2C (Consumer to Consumer): This model allows individuals to sell second-hand or handmade products to each other (Pir and Derinözlü, 2021: 130). Examples include eBay, Letgo, and Sahibinden.

C2B (Consumer to Business): This is the model in which individuals offer services or products to businesses (Dikkaya and Aytekin, 2018: 76). Examples include Freelancer, Upwork, and Shutterstock.

D2C (Direct to Consumer): This model allows manufacturers or brands to sell directly to consumers without intermediaries (Schacker and Stonevska, 2023: 170). An example is Tesla selling through its own website.

B2G (Business to Government): This is the model in which businesses supply goods or services to public institutions (Alrylat, et al., 2023: 71). Public tenders and government procurement platforms are examples of this model.

G2C (Government to Consumer): This model refers to public institutions providing online information and services to citizens (Hussein, et al., 2011: 225). The e-government portal can be given as an example.

In recent years, the impact of technological advancements on e-commerce has been increasing. In this context, the effective management of logistics processes and the optimization of costs have become highly significant. Fast and cost-effective logistics solutions are enhancing businesses' competitive strength and supporting the widespread growth of e-commerce.

3. E-LOGISTICS

3.1. E-Logistics Concept

Logistics ensures the effective and efficient management of the flow of products, services, and information throughout the supply chain. The main goal of logistics is to deliver the right product to the right place, at the right time, and at the lowest cost (Tekin, 2014: 14).

E-logistics, emerging from e-commerce, refers to systems that enable logistics operators to digitalize traditional logistics chains. In this system, processes and data management are carried out digitally (Erceg & Sekuloska, 2019: 156). E-logistics is an advanced version of traditional logistics integrated with internet technologies. In other words, e-logistics involves the execution of logistics processes in the electronic environment using information technologies. E-logistics supports businesses' e-commerce activities by offering digital solutions in processes such as purchasing, storage, and customer services (Beşli, 2004: 50).

E-logistics not only provides businesses with a competitive advantage but also forces companies in the logistics sector to invest in technology and digitalize their operational processes (Sarıcan, 2016: 36). Through this digital transformation, core logistics activities such as transportation, storage, inventory management, and customer services can be carried out more efficiently and in a coordinated manner.

3.2. E-Logistics Activities

The logistics activities that have developed in parallel with the growth of e-commerce and are actively used in e-commerce operations are referred to as e-logistics activities (He et al., 2019: 1). In this context, e-commerce logistics is a complex process that requires the integrated execution of logistics services. This process not only includes the storage and distribution of products but also involves many crucial stages such as the accurate processing of information and ensuring security (Yang et al., 2006: 198).

The flow of information is continuously maintained digitally throughout the process, from the order to the delivery. For effective use of e-logistics, common platforms where trade between businesses and consumers can be tracked must be in place (Yildiz, 2020: 40). The e-logistics activity processes, as outlined by Xu et al. (2019), can be summarized as follows (Xu et al., 2019: 29-35):

Order Placement: The customer places an order via the e-commerce platform. This marks the beginning of the process.

Payment: The customer makes a payment to complete

the order, and the e-retailer checks to confirm that the payment has been received. This step can also involve options such as cash on delivery.

Order Processing: Upon receiving the order, the e-retailer processes it and checks the details in the system. The order processing phase begins at this point.

Printing the Order: Depending on the content of the order, products are directed to different warehouses. Warehouse operators print the order or use other methods to send it to the appropriate warehouses.

Packaging: Products are packaged in a manner suitable for delivery.

Sorting: Packaged products are sorted at distribution centers according to their destination.

Shipment: The packaged product is shipped to be delivered to the final customer.

Order Receipt: The final customer receives the product, after which other e-logistics processes begin.

Other E-logistics Processes: In this context, customer service is considered an integral part of e-logistics activities. Providing information before orders, tracking orders, post-delivery support, and managing complaints play a crucial role in improving customer satisfaction. Additionally, return processes and reverse logistics applications are also essential components of e-logistics systems.

Each of these processes is critical for the effective management of logistics services. Logistics service providers use advanced information systems and technologies to optimize each process. Furthermore, ensuring that the data at each stage of the logistics process is processed correctly and transmitted securely is of utmost importance for e-commerce platforms.

Compared to traditional logistics, e-logistics activities, which involve more information and services, enhance the efficiency of logistics activities while providing businesses with cost advantages, flexibility, and high-quality benefits. Thanks to the digital platforms created worldwide, businesses can work in harmony (Karagöz, 2012: 52).

3.3. Logistics Cost

In today's business environment, the ability to remain competitive, maintain existing customer portfolios, and increase market share is dependent on successful logistics services. The success of these services is possible through the efficient execution of logistics activities at low cost. Uncertainties in the global business environment and increasing customer demands have made it mandatory for businesses to be effective in logistics management. Logistics cost management allows businesses to make strategic and efficient decisions in the logistics area by effectively planning, controlling, and monitoring business processes (Bokor, 2008: 1).

Logistics costs can be defined as the costs incurred during the execution of logistics activities (Zakariah and Pyeman, 2013: 119). According to another definition, logistics costs are the costs associated with all activities from the procurement of a product to its delivery to the customer (Özdemir, 2015: 17-18). Logistics costs are not limited to the costs arising solely from logistics activities. They are also related to activities such as marketing, sales, distribution, management, and production. Furthermore, logistics costs include factors such as order management, transportation fees, damage, loss, and deterioration fees during transportation, capital costs, and inventory management (Engblom et al., 2012: 29).

Logistics cost components can also be categorized as explicit (direct) logistics costs, implicit (hidden) logistics costs, variable logistics costs, fixed logistics costs, direct (indirect) and indirect (overhead) logistics costs. Businesses tend to focus more on explicit logistics costs because these cost components are traceable and auditable. Implicit logistics costs are often neglected by businesses because they are difficult to separate and measure from other cost items (Silva et al., 2014: 333). In many businesses, logistics costs cannot be fully calculated, and in cases where outsourcing is used, these expenses are transferred to the collaborating business (Gu and Dong, 2016: 230). This situation prevents business managers from sufficiently analysing the factors affecting logistics costs and their relationships with other expense items, which can lead to inaccurate assessments or wrong decisions (Tokay et al., 2010: 272). The logistics cost components related to the basic logistics services used in the commercial activities of businesses are shown in Figure 2 (Weiyi and Luming, 2009: 538).

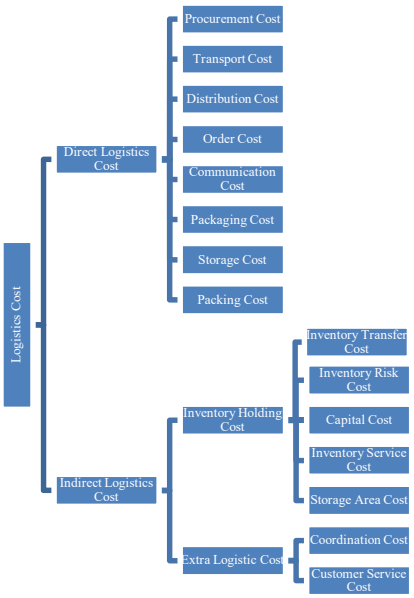

Fig. 2. Logistics Cost Components
Source: (Weiyi F., Luming, Y, 2009: 538)
(Deran vd., 2014: 90) Akt. Erduru, 2015: 54

In the figure, logistics costs are classified as direct and indirect costs, with cost items listed under each category. As seen, logistics costs encompass many different sub-cost elements. This makes it quite difficult for businesses to analyse all logistics cost items separately. Therefore, businesses may benefit from third-party logistics (3PL) service providers to manage their logistics activities effectively. Logistics costs also include variable and fixed costs. Variable logistics costs are costs that fluctuate according to the logistics service provided. For example, energy costs per product produced by attaching a counter to a machine or handling costs per item handled by a worker are considered variable costs. Fixed logistics cost expenses are those that arise independently of the logistics service and are not affected

by cost-driving factors. Examples of fixed logistics costs include preparation or capacity costs, warehouse rental expenses, and amortization. In addition to the above-mentioned logistics costs, it is necessary to mention both direct and indirect costs. Direct logistics costs are costs that can be counted and directly added to expense items, such as product type, unit of the product, and orders. On the other hand, costs that cannot be directly accounted for in a procurement process are called indirect costs (Ceren & Alagoz, 2007: 158).

E-commerce transactions are generally completed with a physical transportation and delivery process. In e-commerce businesses, logistics costs include costs related to order processing, storage, transportation, packaging, handling, and customer services. Additionally, other costs such as invoice preparation, accounting of transactions, and collection are also considered logistics costs (Deran et al., 2014: 97). Logistics costs can be categorized into three headings in terms of process (Deran, 2006: 175-185):

*Costs related to inbound logistics (acceptance)
*Costs related to storage and handling
*Costs related to outbound logistics (shipping)

Below is a summary of the costs for common logistics activities in e-commerce.

Transportation costs: These costs cover the monetary value of sacrifices made in operations starting from the supply of necessary materials to the business, continuing with distribution processes, and ending with the delivery of products to customers (Kaya, 2015: 123). These costs can constitute up to 50% of a business's total logistics costs and are often the highest-cost logistics activity in most businesses (Murphy & Knemeyer, 2016: 18).

Storage costs: These are the costs incurred during the storage of inventory in the logistics process from raw material to finished goods. They play an important role in minimizing total costs while maintaining the desired customer service level (Deran et al., 2014).

Inventory management costs: These costs include stock holding costs, order-related costs, and stock-out costs. Inventory management costs consist of costs related to maintaining the optimal stock level, meeting customer demands in a timely and accurate manner, minimizing stock losses (such as waste, obsolescence, theft), and reducing costs such as depreciation, rent, and maintenance (Kaya, 2015: 124).

Unit (finished goods batch) costs: These are costs that vary depending on the number, volume, and weight of the products to be distributed, such as production, capacity, and handling of finished goods. These costs increase as the unit quantities of purchased, sold, and distributed goods and services rise (Wang et al., 2021: 1280).

Customer service costs: These costs cover the expenses incurred until customer orders are safely, quickly, and economically ready for delivery. Additionally, customer service costs can be expressed as costs arising from services such as returns, repairs, and spare parts support from customers (Ceren and Alagoz, 2007: 160). Customer service costs include tangible expenses such as salaries of staff in the department, as well as intangible factors like customer perception. The cost of negative customer perceptions cannot be measured directly, but such perceptions can lead to customer loss, market share decline, and damage to the business image. This situation can increase the costs of other logistics activities as well (Kayali et al., 2020: 311).

Packaging costs encompass the total expenditure on materials and associated processes necessary for the transportation, storage, protection, and presentation of products to consumers. It is stated that packaging costs typically account for less than 5% of total logistics costs in businesses. While this proportion seems low, especially in high-volume operations, determining the right packaging strategy can provide a significant cost advantage. Indeed, an increase in the ordered product quantity can reduce packaging costs per unit and offer businesses economies of scale (Ceran et al., 2022: 108).

Order processing and communication system costs: These costs involve the stages of receiving, processing the order, transferring information to relevant units, and the transportation process, which include both internal and external cost items. Effective order management, a strong communication network, and quality information flow are required to ensure that orders are delivered as quickly as possible. These factors directly affect the system's effectiveness and costs (Ceren & Alagoz, 2007: 160).

The share of logistics costs within total costs varies depending on factors such as the structure, industry, and policies followed by the business. However, logistics costs generally constitute a large portion of the costs in the supply chain and typically represent 5% to 15% of the product sales price (Deran et al., 2014: 79). As a business's sales increase, the ratio of logistics costs to sales revenue decreases. These cost advantages in the ratios provide businesses with a competitive edge (Muha, 2019: 102).

A study conducted in the United States revealed that a 5% reduction in logistics costs results in profitability equal to or greater than the profitability obtained by increasing business sales by 20% (Deran et al., 2014: 97). Research conducted in Turkey shows that logistics costs vary significantly between industries. For example, logistics costs for businesses producing fast-moving consumer goods account for 5% of their turnover, while in manufacturing businesses, this rate can reach 20%. It has also been found that logistics costs are higher in other sectors and SMEs (Karacan and Kaya, 2011: 114-115). These studies highlight the importance of logistics cost management and control for businesses and demonstrate how these activities impact overall costs. Therefore, analysing logistics activities and the costs incurred is of great importance (Aktaş, 2013: 4).

E-commerce businesses benefit from digitalization and automation through cost savings in various logistics areas. Especially in warehouse management, order picking, packaging, and shipping processes, technological solutions reduce labour needs, increase operational speed, and decrease error rates. This allows e-commerce businesses to significantly reduce their logistics costs compared to traditional retail businesses. Additionally, models such as centralized storage and direct delivery to consumers can create additional savings in inventory and distribution costs. Therefore, correctly setting up e-logistics processes and continuously monitoring costs provide e-commerce businesses with both a competitive advantage and the possibility of sustainable profitability.

4. THE MANAGEMENT OF LOGISTICS COSTS IN E-COMMERCE: A REVIEW OF STUDIES

The management of logistics costs in the e-commerce sector plays an important role in the operational efficiency and financial sustainability of businesses. In this context, studies in the literature have shown that the share of logistics activities in total costs is steadily increasing, and this situation has become a strategic priority for e-commerce businesses. To comprehensively highlight the importance of logistics costs in e-commerce businesses, academic studies published both domestically and internationally on this topic have been reviewed.

In a study conducted by Yılmaz and Demirtaş (2022), the effects of logistics costs of e-commerce businesses in Turkey on their competitiveness, such as product pricing and delivery times, were examined. The study emphasized that the rapid growth of e-commerce in Turkey and the effective management of logistics costs provide a competitive advantage to businesses.

Chen et al. (2022) aimed to investigate how logistics supply chain costs in e-commerce businesses can be effectively controlled. Using the case of Jingdong (JD.com), the study analysed how cost control strategies could be developed in response to the rising logistics costs brought about by the rapid growth of e-commerce. The research aims to enhance businesses' competitiveness by increasing supply chain efficiency. The case study method was used to analyse the logistics operations of Jingdong comprehensively. Supply chain processes, cost structures, and business strategies were evaluated within the value chain framework. Additionally, a data analysis-based comparative approach was adopted, and the impact of strategies such as digitalization, automation, and storage optimization implemented by Jingdong was examined. The results of the study showed that technological investments and smart storage systems implemented by Jingdong led to significant reductions in supply chain costs. Furthermore, through supply chain integration and data-based decision-making mechanisms, operational efficiency was increased, and inventory management costs were reduced. These findings indicate that logistics cost control is important not only for short-term savings but also for long-term competitive advantage.

In a study by Ceran et al. (2022), the aim was to define logistics costs within the framework of international strategic marketing decisions and Logistics 4.0 applications and to analytically assess the impact of these costs on business profitability. After conducting a literature review, a model was created and tested using panel data analysis. The empirical findings revealed a statistically significant negative relationship between logistics costs and profitability indicators such as net profit margin and earnings per share.

In a study conducted by Vogue Business (2021), the logistics processes of brands such as Frank & Oak and Wknd Nation were examined, using case study and comparative analysis methods. The study emphasized that technology and data-driven approaches reduce costs and decrease environmental impact by increasing the sustainability of logistics processes.

Guihang et al. (2021) explored how e-commerce businesses' logistics costs can be controlled from a value chain perspective, using the case of Pinduoduo. The study employed case analysis and literature review methods. The analysis revealed that Pinduoduo faced issues such as inadequate control of delivery costs, unreasonable transportation fees, and high reverse logistics costs in its internal value chain. In terms of external value chain, issues such as low customer loyalty, intense competition from rivals, and underdeveloped value chains in low-level markets were identified. The article proposed several recommendations for addressing these problems. For the internal value chain, it was suggested that Pinduoduo adopt Just-In-Time (JIT) and Activity-Based Costing (ABC) methods, strengthen the control of delivery costs, and improve post-sale service efficiency. In terms of the external value chain, it was recommended that Pinduoduo establish strong relationships with suppliers and customers. Most importantly, the establishment of a flawless information system was considered critical.

In a study by Irak and Şen (2021), the effects of businesses' effective management of logistics costs (such as warehousing, transportation, order processing, stock, handling, customer services, etc.) on their performance in both domestic and foreign markets were examined. Based on survey data from 240 businesses in sectors like steel, electrical-electronics, and ready-made clothing and textiles, which were obtained from the 2019 report of the Turkish Exporters Assembly (TİM), path analysis showed that logistics performance explained 30% of the changes in non-financial performance, 5.5% of changes in financial performance, and 7.3% of changes in export performance. Furthermore, logistics costs were found to affect 10% of changes in logistics performance.

Ding and Zhao (2021) aimed to examine the impact of the COVID-19 pandemic on e-commerce logistics and develop cost control strategies that could be applied during and after the pandemic. The study also aimed to reduce logistics costs in the context of cross-border logistics strategies to prevent and control COVID-19. It emphasized that logistics costs are a critical element in business efficiency and consumer experience. In line with this, the authors developed a logistics cost algorithm tailored to the unique conditions of the pandemic. The experimental findings showed that the proposed method remained within the budgeted cost range and provided significant advantages in application. The research demonstrated that the pandemic not only affected social and economic stability but also severely impacted the effectiveness of e-commerce logistics operations. The developed method contributes to the economic benefit of e-commerce businesses and offers an effective logistics cost management approach during the pandemic.

In his study, Karaca (2021) discussed the effects of digitalization on e-commerce logistics and the opportunities it provides for managing logistics costs. The study examined the potential of digitalization to increase efficiency and reduce costs in logistics processes.

Zhao (2021) aimed to analyse cost management in e-commerce businesses within the framework of value chain theory. Particularly, through the example of Suning Tesco, the mechanisms of cost formation in different business activities were examined to develop effective cost control strategies for e-commerce businesses to gain a competitive advantage. The study used Michael Porter's value chain model to analyse Suning Tesco's primary and support activities in detail. Supported by qualitative analysis, the study used case study techniques to assess real data. The analysis identified the cost elements in Suning's logistics, supply chain, marketing, and service

areas. The findings showed that Suning Tesco faced high-cost pressure in certain value chain links but could reduce this pressure through strategic cost management practices. Specifically, improvements in areas such as digitalization, supply chain integration, and logistics optimization were found to reduce costs and increase competitive strength. The study concluded that the value chain approach provides a holistic perspective for cost management in e-commerce businesses.

In a study conducted by Zhang et al. (2020), the existing literature on last-mile logistics in the context of e-commerce was systematically reviewed, highlighting key approaches, challenges faced, and future research needs in this field. The authors reviewed academic studies on last-mile logistics using a systematic literature review method, classifying various models and evaluating how they were applied in the context of e-commerce logistics. The study emphasized that last-mile delivery costs account for a significant portion of total logistics expenses and directly affect customer satisfaction.

In his study, Christopher (2016) discussed how supply chain and logistics management can be optimized, particularly in fast-changing markets such as e-commerce. The findings from the study demonstrated that effective management of logistics costs contributes to customer satisfaction and competitive advantage.

In their study, Hubner et al. (2016) addressed last-mile logistics and distribution strategies in multi-channel retailing. The study also emphasized the role of logistics cost management in strategic decision-making processes and discussed the importance of logistics costs in enhancing the competitive strength of e-commerce businesses.

Huang and Benyoucef (2013) examined the impact of the integration of e-commerce and social commerce on logistics and cost management. The study provided significant findings on how logistics costs can be optimized in the process of integrating social commerce.

Upon reviewing the literature on the topic, it is evident that e-commerce and e-logistics have become research areas that deserve more attention in recent years. However, the number of studies conducted in this area is limited, and the topic has not been thoroughly addressed. This suggests that more detailed research should be conducted by evaluating e-commerce and e-logistics together. In this context, it is clear that logistics costs have strategic importance for businesses. These costs directly impact businesses' overall performance, their capacity to achieve strategic goals, gain competitive advantage, and maintain customer satisfaction. Therefore, properly analysing and managing logistics costs plays a significant role in the long-term success of businesses.

5. IMPORTANCE of LOGISTICS COST in E-COMMERCE BUSINESS

The rapid advancement of technology has transformed traditional commerce, leading to the development of modern e-commerce practices. Today, consumers are able to instantly access the products they desire through online applications provided by businesses. They can compare prices and products and rank their preferences.

The COVID-19 pandemic had significant impacts, including in the e-commerce sector, and led to further growth in some countries. Especially with the rise of contactless communication, changes in consumer behaviour increased the use of e-commerce. However, due to the nature of e-commerce, where there is no direct contact with the product or seller, some negative perceptions may arise among customers. To eliminate these negative effects and ensure customer satisfaction, one of the fundamental pillars of e-commerce, e-stores must offer the highest quality e-logistics services. In this context, the primary goal of logistics companies should be to develop smart logistics strategies that will contribute to the sustainable growth of e-commerce and support the industry's progress (Şahin, 2021: 94–95). Smart logistics strategies are aimed at optimizing logistics processes using technologies like digitalization, automation, data analytics, artificial intelligence, and the Internet of Things (IoT). These strategies aim to make logistics processes faster, more efficient, and cost-effective. Smart logistics aims to improve not only physical transportation processes but also supply chain management, inventory control, warehouse management, and response times to customer demands. These strategies are crucial for the sustainability of the logistics sector, as they can reduce energy consumption, minimize carbon footprints, and improve customer experiences. Smart logistics also allows logistics processes to become more flexible and capable of adapting quickly (Pereira & Romero, 2019, Waller & Fawcett, 2013: 293). Smart logistics strategies are accelerating the global growth of e-commerce.

The rapid global expansion of e-commerce forces businesses to manage their logistics processes more efficiently. Logistics costs account for a significant portion of e-commerce businesses' total expenses, and effective management of these costs can provide a competitive advantage. This study examines the role of logistics costs in e-commerce businesses and discusses strategic approaches for managing these costs.

Logistics costs cover expenses incurred throughout the process of obtaining products and delivering them to the end customer. These costs represent a significant portion of a business's total expenses. Therefore, effectively managing these costs is a crucial factor that directly impacts the profitability of e-commerce businesses.

The importance of logistics costs for e-commerce businesses is explained below (Christopher, 2016: 45-49; Rushton et al., 2017: 87-94; Şahin, 2021: 94-95):

* They make up a large part of total costs: E-commerce businesses require significant logistics expenses for processes such as product storage, packaging, transportation, and delivery to customers. These items generally account for a large portion of total business costs. In e-commerce businesses, logistics costs go beyond being operational expenses; they are a strategic factor that directly affects competitiveness. Studies on the impact of logistics costs on e-commerce emphasize that effectively managing these costs increases the efficiency of e-commerce businesses and directly impacts customer satisfaction. Digitalization and technological innovations allow logistics processes to become more efficient, while last-mile logistics stands out as one of the most expensive and critical components of e-commerce. Therefore, managing logistics costs correctly not only improves businesses' profit margins but also strengthens their competitive advantages (Hubner et al., 2016: 263).
* They directly affect profitability: Inefficiencies in logistics processes (e.g., high transportation costs, storage

waste, return rates) reduce profitability. Therefore, optimizing logistics costs increases the company's profit margin. The optimization of logistics costs is achieved in the following ways (Rahman, 2024: 62):

Effective supply chain and logistics management is crucial for reducing costs in e-commerce. Building partnerships with reliable suppliers and negotiating favourable supply terms help lower supply costs. To optimize storage processes and reduce handling costs, a centralized warehouse system should be implemented.

Advanced transportation solutions should be used to speed up order fulfilment processes and minimize shipping costs. Identifying these strategies has a direct impact on a business's profitability. One of the factors most influencing a business's profitability is service quality, which is closely related to logistics processes. For e-commerce businesses, delivering products to customers on time and in the right location depends on the efficiency of processes such as transport time, inventory management, and order tracking. Each of these processes constitutes important logistics cost components. Therefore, effective management of logistics processes not only ensures service quality but also helps control costs. Effective logistics management increases a business's competitiveness while ensuring customer satisfaction and supporting operational efficiency. Consequently, addressing logistics processes from a strategic perspective plays an important role both in short-term performance and long-term sustainability (Şahin, 2017: 30). Traditional logistics methods are inadequate for managing complex processes, and the integration of digital systems provides businesses with both operational efficiency and cost advantages. In this context, logistics practices in e-commerce enable quick responses to customer demands and services like real-time order and delivery tracking, contributing to the reduction of logistics costs (SendFromChina, 2025).

* It ensures customer satisfaction and loyalty: Timely delivery, damage-free product shipment, and easy return processes are essential components of customer experience. Efficient management of logistics processes in a business ensures customer satisfaction and loyalty (Gude, 2018: 103-104).

One important strategy that directly impacts logistics processes in e-commerce, though still used by a limited number of businesses, is the omnichannel retail approach, where large brands continue both online and offline sales without closing their physical stores. Through this model, consumers can collect online orders from physical stores, as well as handle returns and exchanges through these stores. This approach significantly reduces logistics costs in the distribution process, while also offering consumers lower product prices and faster delivery. Additionally, this model improves consumer experience, which positively contributes to customer satisfaction and loyalty. Similarly, the "pickup point" model, which is widely used in Europe and the United States but still limited in Turkey, is an effective way to reduce logistics costs. In this system, instead of having a product delivered to their home address, the consumer may choose to pick it up from the nearest delivery point. This reduces shipping costs and shortens the delivery time for the business. E-commerce companies such as Trendyol and Hepsiburada, which use this model, show that it can be expanded by creating neighbourhood-based delivery points in collaboration with local businesses. Offering these points as alternatives during the ordering process and providing a lower price if the consumer chooses a delivery point could influence consumer preferences (Fernie & Sparks, 2019: 150; Hubner et al., 2016: 235; Ozen, 2019: 107).

* It provides a competitive advantage: In the highly competitive e-commerce environment, businesses that offer fast and cost-effective logistics solutions can easily differentiate themselves from competitors. This increases customer acquisition and brand value (Aqabneh, 2025: 581-590).

Another factor affecting business profitability is the integration of data logistics with physical logistics flow. The collection, storage, analysis, and integration of data into decision support systems enhances the effectiveness of logistics processes and plays a strategic role in reducing logistics costs. Particularly, the use of real-time data helps eliminate cost-causing elements like excess inventory, transportation delays, and reshipping, thereby increasing operational efficiency (Loebbecke & Powell, 1998: 8–11). Businesses' improved operational performance provides them with a competitive advantage over competitors.

Logistics processes constitute a significant share of businesses' total costs. Businesses aim to find new ways to lower logistics costs for a competitive edge. In businesses that operate using traditional logistics methods, the slow pace of processes and high human error rates highlight the importance of technology-driven solutions. This transformation need has increased demand for third-party logistics (3PL) companies that support the digitalization of logistics processes, paving the way for the development of customized software solutions for businesses. However, the lack of qualified personnel required to effectively use these e-logistics systems presents a new challenge. While human errors are prominent in traditional processes, the shortage of skilled personnel capable of using digital systems has become a fundamental barrier in e-logistics.

To address this gap, programs and courses are being offered by İŞKUR and local governments in Turkey, and some businesses are seeking solutions through internal training programs. However, many businesses are reluctant to invest in training, viewing it as an additional cost, and instead seek personnel already capable of using the relevant software. This situation not only complicates businesses' human resources management but also negatively impacts the resolution of unemployment issues (Ozen, 2019: 105).

* Sustainability and efficiency: Properly planned logistics activities allow for more efficient use of resources and improve operational efficiency. Furthermore, logistics activities contribute to reducing the carbon footprint, thereby supporting environmental sustainability. This has become an increasingly important factor for today's consumers (Kavas, 2020: 147-157). In this regard, logistics practices that contribute to environmental sustainability also have a decisive impact on businesses' cost structures.

Logistics processes are a significant cost element for businesses, and efficiently managing these processes is crucial for both gaining a competitive advantage and ensuring the business's sustainability. The transformations businesses make to reduce logistics costs should not only focus on economic gains but should also consider environmental impacts. Establishing sustainable

logistics structures should align with businesses' social responsibility understandings, especially in the context of increasing global population and the risk of resource depletion. Thus, restructuring logistics processes should prioritize not only business efficiency but also environmental sustainability (McKinnon et al., 2015: 78).

Based on these findings in the literature, logistics costs are understood to be not just an expense item but also a strategic competitive element. Therefore, optimizing logistics processes and investing in innovative solutions in this field is of great importance for e-commerce businesses.

5.1. Strategic Approaches to Logistics Cost Management

Globalization has heightened competition, requiring logistics businesses to integrate their activities for sustainable competitive advantage. The integrated implementation of fundamental logistics activities not only increases the profitability of the business but also strengthens communication and collaboration between departments within the organization (Christopher, 2016: 45).

Today, with the rapid development of information and communication technologies, logistics understanding, especially within the framework of e-logistics, is being reshaped. The development of digital infrastructures and automation systems is enhancing the efficiency of logistics process management. Through data integration and real-time tracking technologies, the efficiency of logistics processes is significantly optimized. In this context, e-logistics applications for e-commerce businesses contribute to reducing costs and increasing customer satisfaction by making supply chain management more flexible, faster, and efficient (Hübner et al., 2016: 290).

Connected with digitization and automation systems, integrated logistics management is critical for controlling costs. The integration of logistics activities, particularly sub-processes such as transportation, storage, inventory control, and order management, increases coordination between processes and allows for more efficient use of resources. This approach reduces repetitive tasks, prevents time loss, and increases the overall efficiency of the logistics system (Bowersox et al., 2013: 320).

Karagöz (2012) defines several key success factors to increase the effectiveness of logistics processes and gain a cost-competitive advantage. Among these factors, the need to analyse, restructure, and optimize supply chain processes in a holistic manner stands out. Information sharing and stock planning based on customer needs, as well as organizing warehouse and storage management according to capacity, are considered essential in this context. Additionally, the integration of applications such as Transportation Management Systems (TMS), vehicle tracking systems, and reverse logistics into logistics processes plays a crucial role in increasing process efficiency.

Furthermore, integrating modern production approaches like total quality management, agile manufacturing, and just-in-time production into logistics systems increases process flexibility and customer orientation. The use of advanced software and management systems is also essential for shortening delivery times and meeting customer expectations on time. In this context, the integration of information technologies such as ERP and barcode systems plays a significant role in the success of e-logistics applications.

Moreover, supporting logistics activities through outsourcing, particularly through collaboration with third-party logistics (3PL) and fourth-party logistics (4PL) providers, enhances operational efficiency. Implementing strategies that reduce procurement costs also contribute to the long-term sustainability of logistics performance (Bowersox et al., 2013: 314).

Especially in e-commerce platforms where digitalization is heavily felt, return processes represent a significant cost element for businesses operating under marketplace models. Consumer returns, for various reasons, increase both logistics and operational costs, posing a threat to the financial sustainability of sellers. While customer satisfaction-based service policies are prioritized, it is also necessary to consider the presence of customers attempting to exploit the system for unfair gain (Özen, 2019: 106-107). Return processes, which constitute a significant portion of logistics costs, can be optimized through the improvement of reverse logistics processes. The increasing return rates, driven by changing consumer habits, have forced businesses to make this process more efficient. The use of AI-based analytics and customer behaviour models in return management helps prevent fraud and reduce unnecessary return traffic (Rogers & Tibben-Lembke, 2001: 129-148). Therefore, developing algorithms and control mechanisms to prevent the abuse of return processes is necessary.

One proposed application is the automatic detection of customers who frequently and irregularly perform returns in the system. For these customers, applying certain deductions during the refund process could be a solution that minimizes the losses for platforms and sellers (Ülkü et al., 2013: 300). This would ensure that commercial balance is maintained without damaging the customer experience.

Finally, logistics activity management and cost approaches form the foundation for developing a sustainable logistics cost strategy. Modern costing methods such as Activity-Based Costing (ABC) reveal the actual costs of logistics processes, making it easier to identify inefficiencies and evaluate improvement opportunities. Additionally, these types of cost analyses enable rational investment decisions and provide strategic contributions to managers in terms of cost control (Gunasekaran & Ngai, 2003: 831).

Conducting logistics activities in an integrated, digital-based, and customer-oriented manner enables businesses to minimize their costs while strengthening their competitive edge by increasing customer satisfaction. The adoption of e-logistics applications accelerates processes, reduces error rates, and enhances operational efficiency. In this regard, the integration of digital technologies in logistics management, strategic partnerships, and process optimizations offer numerous advantages, including sustainable growth, efficient resource utilization, and increased customer loyalty. E-commerce businesses must focus on key success factors and enhance logistics processes to stay competitive.

6. RESEARCH METHODOLOGY

This section provides information regarding the purpose and importance of the research, its scope and limitations, as well as the research methodology.

6.1. Purpose and Importance of the Research

The primary motivation of this study is to find the answer to the question of how important logistics costs are for e-commerce businesses. In this context, the main aim of the research is to identify the components of logistics costs and highlight their significance in the e-commerce sector. This study aims to develop a theoretical awareness regarding the strategic importance of logistics costs in e-commerce businesses. Logistics costs are not only considered as operational expenditures; they also play a decisive role in a company's capacity to gain a competitive advantage, maintain customer satisfaction, and ensure the effectiveness of sustainability policies. While the majority of studies in the literature focus solely on logistics costs, very few studies link e-commerce with logistics and e-logistics concepts. In this regard, this study is expected to make a significant contribution to the literature. Furthermore, despite existing studies on logistics costs, the lack of research emphasizing the importance of logistics costs adds to the uniqueness of this study and holds the potential to contribute to improving business performance.

6.2. Scope and Limitations of the Research

This study addresses the strategic importance of logistics costs in e-commerce businesses and highlights the potential of outsourcing in e-logistics enterprises. General information about e-commerce businesses is provided; however, a sector-specific evaluation has not been conducted. The scope of the study is limited to a literature review, without including a practical application in the form of a case study or business analysis, which also constitutes a limitation of the research.

6.3. Research Methodology

In this study, the Systematic Literature Review (SLR) method has been used. SLR systematically reviews academic studies using clear, reproducible methods to answer a specific research question. SLR ensures the complete scanning of the relevant literature, the careful selection of appropriate studies, and the critical analysis and synthesis of these studies. This method is frequently used in fields such as health, education, social sciences, and engineering to base decision-making processes on scientific evidence (Petticrew & Roberts, 2006: 9-26, Siddaway et al., 2019: 748-751). This study involved a comprehensive literature review using Google Scholar, TR Dizin, and Web of Science databases. During the scanning process, only peer-reviewed and scientific studies that examine the relationship between logistics costs and e-commerce businesses were considered. The selection of studies was based on criteria such as direct relevance to the topic, reliance on up-to-date data, and scientific methodological adequacy. Furthermore, this selection process helped identify gaps in the literature and highlight the unique contribution of the research. The literature review revealed that there is a limited number of studies focusing on the relationship between logistics costs and e-commerce businesses.

7. FINDINGS

In today's rapidly digitalizing and globally competitive economic structure, the management of logistics processes has become not only an operational necessity but also a strategic requirement for e-commerce businesses. Especially with the acceleration of digital consumption habits during the Covid-19 pandemic, customer expectations have shifted towards faster, more reliable, and cost-effective delivery services, which has made the role of logistics costs in the e-commerce ecosystem even more significant.

Logistics costs cover a wide operational chain for e-commerce businesses, ranging from transportation, storage, packaging, inventory, and return processes to last-mile delivery. The effective management of these costs not only provides businesses with increased profitability but also strengthens customer loyalty by enhancing customer satisfaction and creates a sustainable competitive advantage. Particularly in countries like Turkey, where logistics expenses are significantly affected by fuel prices, vehicle taxes, and infrastructure deficiencies, accurately analysing and strategically managing logistics costs becomes even more critical. This study was conducted to raise awareness among businesses about the contribution of logistics costs to business performance and to emphasize the importance of logistics costs. The study investigates how logistics costs affect e-commerce businesses and discusses their importance.

In this research, a literature review has been conducted to clearly express the importance of logistics costs. The research has identified significant differences in the logistics cost structure between e-commerce businesses and traditional businesses. Studies indicate that e-commerce businesses gain advantages in certain cost categories. According to the findings from Irak and Şen (2021) and Zhang et al. (2020), storage and inventory management, transportation and distribution, especially last-mile logistics, order processing and packaging, reverse logistics and return management, customer services, information systems, and automation investments form the backbone of e-commerce operations and have a direct impact on total logistics costs.

E-commerce businesses, due to the impact of digitalization and technology-based processes, gain an advantage in some logistics costs compared to traditional retail:

1. E-commerce businesses can operate with lower stock levels through central storage systems and demand forecasts supported by data analytics, without the need for physical stores (Karaca, 2021: 30; Christopher, 2016: 45-49). This reduces inventory holding costs.

2. With automatic order management systems and digital solutions, the need for human labour has decreased, leading to reduced labour costs (Vogue Business, 2021; Ceran et al., 2022: 108-109).

3. While physical store expenses (rent, electricity, store staff) are a significant cost item in traditional businesses, e-commerce businesses mostly eliminate these costs, gaining a cost advantage (Yılmaz and Demirtaş, 2022:

469).
4.Multichannel distribution strategies, route optimization, and outsourcing practices help reduce distribution costs, making last-mile logistics more efficient (Hubner et al., 2016: 280; Zhang et al., 2020).

However, it is also evident that in some areas of e-commerce, costs are higher compared to traditional trade:
1. The direct-to-customer delivery model increases distribution costs, particularly with time-sensitive delivery expectations, which significantly raise costs (Zhang et al., 2020).
2. Higher return rates in e-commerce businesses make return processes (product retrieval, inspection, repackaging, or disposal) more costly (Irak & Şen, 2021: 1120; Karaca, 2021: 23-35).
3. The need for specialized software, call centers, and trained personnel to manage customer interactions in the digital environment can incur additional costs (Yılmaz & Demirtaş, 2022: 470).

E-commerce businesses benefit from significant advantages in some key cost categories due to digitalization and data-driven logistics management, while facing cost pressures in areas like last-mile logistics and return processes. Therefore, the effective management of logistics costs is an important factor for e-commerce businesses in gaining a competitive advantage and ensuring sustainable profitability (Christopher, 2016: 45-49; Ceran et al., 2022: 109). The literature review confirms that logistics costs have a profound impact on business competitiveness, customer satisfaction, and profitability.

Studies on this topic demonstrate the strategic importance of logistics cost management for e-commerce businesses in terms of their competitive strength and customer satisfaction. Yılmaz and Demirtaş (2022), in their analysis specific to Turkey, highlight that in the rapidly growing e-commerce sector, logistics costs directly affect businesses' competitiveness through product pricing and delivery times. Christopher (2016), from a broader perspective, emphasizes the role of logistics and supply chain management in ensuring customer focus and cost advantages, particularly in dynamic and variable e-commerce markets. Huang and Benyoucef (2013) discuss the positive effects of the integration of e-commerce and social commerce on logistics cost structures, showing how digital and social network-based processes contribute to cost optimization. Zhao (2021) states that the value chain approach offers a holistic cost management perspective for e-commerce businesses, emphasizing the importance of cost management and its impact on profitability.

8. DISCUSSION

In addition to the evaluations presented in the Findings section, studies specific to Turkey reveal that the largest share of logistics costs is attributed to transportation activities. This situation increases the cost pressure on e-commerce businesses and becomes a limiting factor for their competitive strength. Therefore, structural improvements at the public policy level (such as regulations on fuel taxes, incentives for transportation vehicles, or infrastructure investments) can ease the burden on the logistics sector and provide significant advantages to e-commerce businesses in both domestic and international markets.

However, not only external regulations but also the internal restructuring of businesses through digital transformation are crucial for the effective management of logistics costs. In this context, strategic approaches such as digitalization, automation systems, integrated logistics management, data-driven decision support systems, and reverse logistics practices contribute to both increasing process efficiency and reducing costs. Particularly, innovative solutions like multichannel retailing and delivery point applications improve consumer experience while optimizing logistics operations, giving businesses flexibility and cost advantages. The successful implementation of this technological transformation is not limited to infrastructure investments but is also directly related to the quality of human resources. Therefore, to operate these systems efficiently, it is vital to expand education and employment programs conducted in cooperation between the public and private sectors to close the skills gap in the sector. In this direction, the sustainable operation of e-logistics systems requires the simultaneous development of technology and human resources.

For e-commerce businesses, an efficient supply chain and logistics management is of strategic importance in reducing overall costs. In this context, developing sustainable partnerships with reliable suppliers and negotiating favourable commercial conditions to reduce procurement costs plays an essential role. Additionally, optimizing inventory management through centralized storage activities and minimizing handling costs is achieved. To increase the effectiveness of order fulfilment processes and reduce transportation expenses, utilizing advanced transportation solutions and digital logistics technologies offers significant contributions to cost control (Rahman, 2024: 62).

There are various strategies to reduce costs in e-commerce logistics (Wolff, 2023):
*Outsourcing logistics processes to a third-party logistics provider gives businesses significant cost advantages while making logistics processes more efficient.
*The use of technologies such as robots and automatic conveyor systems speeds up warehouse processes and reduces error rates.
*Packaging products in shapes that are suitable for recycling and reusable reduces transportation costs and environmental impacts.
*Poorly managed return processes can lead to additional costs such as extra storage and product disposal, while effectively managing return processes helps reduce such costs and ensures more efficient inventory usage.
*Transparent and effective customer communication helps prevent incorrect orders and improves customer satisfaction.
*Consolidating multiple shipments into a single container or vehicle reduces transportation costs and lowers the carbon footprint.
*Digital platforms, by comparing offers from different transportation companies, provide the most suitable option and ensure more efficient management of logistics processes. These strategies not only reduce costs in e-commerce logistics but also make processes more efficient and sustainable.

On the other hand, modern cost analysis methods provide managers with valuable data for more effective management of logistics processes. Activity-based costing helps analyze processes and identify

inefficiencies in logistics operations. In this way, not only are current costs controlled, but also strategic planning and investment decisions for the future can be based on healthier foundations.

9. CONCLUSION AND RECOMMENDATIONS

With digitalization and changing consumer habits, logistics costs have become a strategic management area for e-commerce businesses. The effective management of these costs not only ensures operational efficiency but also enhances customer satisfaction and boosts competitive strength. Especially in markets like Turkey, where logistics expenses are high, it is crucial for businesses to analyse these costs correctly and make strategic decisions to achieve sustainable success.

This study, which aims to raise awareness among businesses by examining the importance of logistics costs in the e-commerce process, presents a holistic perspective by demonstrating that these costs are not only an operational expense but also a strategic competitive factor for e-commerce businesses. A comprehensive and in-depth theoretical framework has been established based on a national and international literature review on the relationship between e-commerce, logistics management, and cost optimization. Additionally, the empirical findings specific to Turkey provide concrete data regarding the practices in developing countries. The study highlights the importance of macroeconomic factors such as fuel taxes, taxation on transportation vehicles, and infrastructure deficiencies in countries like Turkey, offering significant policy recommendations for policymakers. The cost-reducing effects of digitalization, automation, and integrated logistics systems have been detailed, emphasizing the necessity of digital transformation for e-commerce businesses. In this regard, the study serves as a strategic guide for businesses when planning their transformation processes. The focus on detailed components of logistics costs (such as transportation, storage, order processing, etc.) and the recommendation of methods like activity-based costing further contributes to the practical implications for practitioners.

This study was conducted to raise awareness about the strategic importance of logistics costs in e-commerce businesses. It underscores that logistics costs are not only operational expenses but also factors that directly affect businesses' competitiveness, customer satisfaction, and sustainability strategies, offering a holistic perspective on the subject. Future studies could analyse:

1.Logistics costs in more detail using the activity-based costing method for e-commerce businesses. Such an approach can help identify where costs are concentrated, thereby contributing to the development of strategies to increase efficiency.

2. Comparing logistics costs across different sectors (such as ready-made clothing, electronics, food, or healthcare) could enable sector-specific strategic planning. In this context, it would be worthwhile to investigate how logistics costs differ based on sectoral dynamics, product structures, and customer demands.

3. Another potential area of research could examine the impact of digital solutions on calculating and managing logistics costs. Specifically, the contribution of big data analytics, AI-powered forecasting systems, and automation technologies in reducing costs and improving process efficiency could be evaluated through empirical methods.

4. The environmental and social sustainability aspects of logistics costs could also be addressed in future studies. Green logistics practices, cost analysis focused on carbon emissions, or the cost effects of reverse logistics systems within the scope of the circular economy can provide valuable data for developing sustainable business models.

5. Lastly, the effects of government-supported incentives or regulatory changes on logistics costs, and how these regulations reflect on business strategies, could be suggested as a valuable area of research for policymakers and decision-makers.

In conclusion, managing logistics costs is no longer merely about controlling an expense item for e-commerce businesses; it is a holistic strategy that optimizes customer satisfaction, operational efficiency, sustainability, and competitiveness simultaneously. Therefore, both internal process improvements and public sector-supported structural regulations should be addressed in an integrated manner. Turkey's potential to become a global hub in e-commerce and logistics should be assessed within this comprehensive approach and realized through concrete steps.

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REFERENCES

Akpınar, E. N. (2017). "The relationship between electronic foreign trade and employment." *The Journal of International Lingual Social and Educational Sciences*, Vol: 3, No: 1, pp. 208-217.

Aktaş, R. (2013). *Reverse Logistics Activities and Their Impact on Costs*. S.H. Tokay and E. Kaya (Ed.). *Logistics Costs and Reporting II,* First Edition, Anadolu University Press, pp. 2-24, Eskişehir.

Allison, J. (2017). "E-commerce and the newspaper industry: Determinants of first-movership." *Academy of Strategic Management Journal*, Vol: 16, No: 1, pp. 225-243.

Almarabeth, T. and Majdalawi, Y. (2019). "Cloud computing of e-commerce." *Modern Applied Science*, Vol: 13, No: 1, pp. 27-35.

Alryalat, M. A. A., Alryalat, H., Alhamzi, K. H. M., and Sharma, A. (2023). "Perceived barriers to business-to-government (B2G) e-commerce adoption: The case of Government E-Marketplace (GeM) portal in India." *International Journal of Electronic Government Research*, Vol: 19, No: 1, pp. 71–89. https://doi.org/10.4018/IJEGR.323571

Arslan, İ. K. and Öz, N. (2020). "The applicable law in electronic commerce contracts." *Istanbul Commerce University Journal of Social Sciences*, Special Issue on Law, Vol: 19. No: 38, pp. 13-31.

Aqabneh, M. I. (2025). "The impact of e-logistics service quality on customer satisfaction, trust building, and customer loyalty among e-shoppers in Palestine." *Journal of Management World*, No: 1, pp. 581–590. https://doi.org/10.53935/jomw.v2024i4.743

Bayraktutan, Y. and Ozbilgin, M. (2015). "Logistics costs and logistics performance metrics." *Journal of Finance Research*, Vol: 1, No: 2, pp. 95-112.

Beşli, Süleyman. (2004). *Logistics*. Export Development Study Center, Ankara.

Bokor, Z. (2008). *Supporting Logistics Decisions by Using Cost and Performance Management Tools*. Budapest: Budapest University of Technology and Economics.

Bowersox, D. J., Closs, D. J., and Cooper, M. B. (2013). *Supply Chain Logistics Management*. 4th ed. McGraw-Hill Education.

Ceran, Y. and Alagoz, A. (2007). "Logistics cost management: logistics costs and logistics cost accounting." *Journal of Management Sciences*, Vol: 5, No: 2, pp. 153-175.

Ceran, Y., Ortakarpuz, M., Erkocak, and H. Enes. (2022). "International strategic marketing decisions and the relationship between logistics costs and profitability in the context of Logistics 4.0." *European Journal of Science and Technology*, Vol: 35, pp. 102-110.

Chen, Y., Apibunyopas, J., Batool, H. (2022). "Research on cost control of logistics supply chain in e-commerce enterprises." *Science, Technology, and Social Sciences Procedia,* No: 2, CiM06. https://wjst.wu.ac.th/index.php/stssp

Christopher, M. (2016). *Logistics & Supply Chain Management,* 5th ed., Pearson Education.

CMSWIRE, 2024. https://www.cmswire.com/the-wire/e-commerce-market-report-2024-industry-size-worth-us-1838-trillion-by-2032-cagr-of-2716(Accessed 07/05/2025)

Daniel, E., Wilson, H., and Myers, A. (2002). "Adoption of e-commerce by SMEs in the UK: Towards a stage model." *International Small Business Journal*, Vol: 20, No: 3, pp. 253–270.

Deran, A. (2006). "Strategic cost management." *Turkish General Staff Education and Doctrine Command*, Ankara.

Deran, A., Arslan S., and Köksal, A. G. (2014). *Calculating Logistics Costs in Businesses*. Konya: Eğitim Publishing House.

Diker, A. and Varol, A. (2013). "E-commerce and security." *1st International Forensic Informatics and Security Symposium*, pp. 20-21.

Dikkaya, M. and Aytekin, İ. (2018). "Global e-commerce and Turkey." *Journal of Economy, Business, Politics, and International Relations*, Vol: 4, No: 1-2, pp. 66-68.

Ding, Q., Zhao, H. (2021). "Study on e-commerce logistics cost control methods in the context of COVID-19 prevention and control." *Soft Comput 25*, 11955–11963 https://doi.org/10.1007/s00500-021-05624-5

Ekici, Ş. (2020). "The legal status of virtual marketplaces in B2C e-commerce." *Istanbul Medeniyet University Faculty of Law Journal,* Vol: 5, No: 8, pp. 207-227.

Elibol, H. and Kesici, B. (2004). "Electronic commerce from a modern business perspective." *Selçuk University Social Sciences Institute Journal,* Vol: 11, pp. 303-329.

Engblom, J., Solokivi, T., Töyli, J., and Ojala, L. (2012). "Multiple-method analysis of logistics costs." *International Journal of Production Economics,* Vol: 13, No:1, pp. 29-35.

Erceg A., and Damoska, S.J. (2019). "E-logistics and e-SCM: How to increase competitiveness." *LogForum*, Vol: 15, No: 1, pp. 155-169.

Erduru, I. (2015). Reverse logistics channel and process costs calculated according to activity-based costing method and an application. PhD Thesis, University of Nigde, Turkey.

Eyal, A. and Milo, T. (2001). "Integrating and customizing heterogeneous e-commerce applications." *The VLDB Journal*, Vol: 10, No: 1, pp. 16-38.

Faraoni, M., Rialti, R., and Zollo, L. (2019). "Exploring loyalty antecedents in B2C e-commerce: Empirical results from Italian grocery retailers." *British Food Journal*, Vol: 121, No: 2, pp. 574-589.

Fernie, J., and Sparks, L. (2019). *Logistics and retail management: emerging issues and new challenges in the retail supply chain* (5th ed.). Kogan Page.

Gedik, Y. (2021). "E-commerce: A theoretical framework." *Ankara University Social Sciences Journal*, Vol: 12, No: 1, pp. 184 – 198.

Globenewswire, 2024. https://www.globenewswire.com/news-release/2024/03/20/2849612/0/en/Turkey-Social-Commerce-Market-Intelligence-Report-2024-Featuring-Trendyol-TurkSey-Facebook-and-Instagram.html (Accessed 07/05/2025)

Gu, Y. and Dong, S. (2016). "Logistics cost management from the chain perspective." *Journal of Service Science and Management*, No: 9, pp. 229-232.

Gude, K. (2018). "The Role of Logistics in Customer Satisfaction." *International Journal of Logistics Management,* Vol: 29, No: 2, pp. 103-117.

Guihang, G., Yanqin, W., and Chuyao, G. (2021). "Research on logistics cost control of e-commerce enterprise from the perspective of value chain: A case study of Pinduoduo." *International Journal of Economics and Finance,* Vol: 13, No: 7, pp. 42-54.

Gunasekaran, A., and Ngai, E. W. T. (2003). "The successful management of a small logistics company." *International Journal of Physical Distribution & Logistics Management*, Vol: 33, No: 9, pp. 825–842.

He, P., Zhang, S., and He, C. (2019). "Impacts of logistics resource sharing on B2C e-commerce companies and customers." *Electronic Commerce Research and Applications*, Vol: 34, pp. 1-15.

Huang, Y., and Benyoucef, M. (2013). "From e-commerce to social commerce: A close look at design features." *Electronic Commerce Research and Applications,* Vol: 12, No: 1, pp. 13–27.

Hussein, R., Mohamed, N., Rahman Ahlan, A., and Mahmud, M. (2011). "E-government application: An integrated model on G2C adoption of online tax." *Transforming Government: People, Process, and Policy*, Vol: 5, No: 3, pp. 225–248. https://doi.org/10.1108/17506161111155388

Hübner, A. H., Holzapfel, A., and Kuhn, H. (2016). "Distribution systems in omni-channel retailing." *Business Research*, Vol: 9, No: 2, pp. 255–296. https://doi.org/10.1007/s40685-016-0034-7

Hübner, A., Kuhn, H. and Wollenburg, J. (2016). "Last mile fulfilment and distribution in omni-channel grocery retailing: A strategic planning framework." *International Journal of Retail & Distribution Management,* Vol: 44, No: 3, pp. 228–247. https://doi.org/10.1108/IJRDM-11-2014-0154

Hurriyetdailynews, 2023. https://www.hurriyetdailynews.com/e-commerce-market-size-tops-800-billion-turkish-liras-184851?utm_source=chatgpt.com (Accessed 07/05/2025).

Iceclog, 2024. https://iceclog.com/strong-growth-in-the-turkish-e-commerce-market/ (Accessed 07/05/2025)

Irak, G., and Şen, H. (2021). "Analysis of the effects of logistics costs and logistics performance on firm and export performance." *Journal of Accounting and Taxation Studies*, Vol: 14, No: 3, pp. 1109-1131. https://doi.org/10.29067/muvu.901392

Jusoh, Z. and Ling, G. (2012). "Factors influencing consumers' attitude towards e-commerce purchases through online shopping." *International Journal of Humanities and Social Science,* Vol: 2, No: 4, pp. 223–230.

Karaca, A. (2021). "E-commerce logistics and cost management in the process of digitalization." *Journal of Logistics Research,* Vol: 4, No: 1, pp. 23–35.

Karacan, S. and Kaya, M. (2011). *Costing in Logistics Activities*. Kocaeli: Umuttepe Publications.

Kaya, E. (2015). "Logistics and cost management." In M. Nalçakan and F. Er (Eds.), *Principles of Logistics* (pp. 110–139). Eskişehir: Anadolu University Publications.

Kayali, N., Necef Yerli, A. and Onur, G. (2020). "A study to evaluate business managers' perspectives on logistics costs." *Journal of Van Yüzüncü Yıl University Institute of Social Sciences*, Vol: 47, pp. 303–324.

Karagöz, B. (2012). *E-Logistics Applications*. Ekin Publishing, Bursa.

Kavas, E. (2020). "Effect and Importance of Green Logistics Towards Purchase Behaviours of Consumer in E-Commerce." In Grima, S., Sirkeci, O., and Elbeyoğlu, K. (Eds.), *Global Street Economy and Micro Entrepreneurship*, Vol: 103pp. 147–157.

Kotler, P. and Keller, K. L. (2016). *Marketing Management* (15th ed.). Pearson Education.

Kunesova, H. and Eger, L. (2017). "Evaluation and comparison of B2C e-commerce intensity in EU member states." *E+M Economics and Management*; Liberec, Vol: 20, No: 4, pp. 151–167.

Lambert, D.M., Stock, J.R. and Ellram, L. M. (1998). *Fundamentals of Logistics Management*. Irwin McGraw-Hill, USA.

MacGregor, R. and Vrazalic, L. (2005). "Role of small business strategic alliances in the perception of benefits and disadvantages of e-commerce adoption in SMEs." *Advanced Topics in Electronic Commerce*, Vol: 1, pp. 1–27.

McKinnon, A., Cullinane, S., Browne, M. and Whiteing, A. (2015). *Green Logistics: Improving the Environmental Sustainability of Logistics*. Kogan Page.

Mentzer, J. T., Moon, M. A. and Smith, C. D. (2004). *Supply Chain Management* (2nd ed.). Sage Publications.

Merdan, K. (2021). "E-commerce in Turkey." In G. Sümer (Ed.), *Selected Topics in Economics*-2, pp. 25–44. Efe Academy Publications.

Mou, J., Cui, Y. and Kurcz, K. (2019). "Bibliometric and visualized analysis of research on major e-commerce journals using Citespace." *Journal of Electronic Commerce Research*, Vol: 20, No: 4, pp. 219–237.

Muha, R. (2019). "An overview of the problematic issues in logistics cost management." *Scientific Journal of Maritime Research,* Vol: 33, No:1, pp. 102–109.

Murphy, P. R. and Knemeyer, A. M. (2016). *Contemporary Logistics*. Trans. F. Yercan and Ş. Demiroğlu. Ankara: Nobel Academic Publishing.

Mwencha, P. (2019). "Taxation of electronic commerce – a commentary." *Financing for Development*, Vol: 1, No: 1, pp. 70–79.

Özdemir, A. (2015). "Basic concepts of logistics." In M. Nalçakan and F. Er (Eds.), *Principles of Logistics*, pp. 2–24. Eskişehir: Anadolu University Publications.

Ozen, A. (2019). E-logistics Applications in the E-commerce Sector: A Business Case. Master's Thesis, University of Istanbul, Turkey.

Parlakkaya, R. (2005). "E-commerce and its impact on accounting practices." *Journal of Social and Economic Research*, Karamanoğlu Mehmetbey University, Vol: 2, pp. 168–175.

Pereira, C. R. and Romero, D. (2019). "Smart logistics: Integrating advanced technologies for logistics systems." *Journal of Manufacturing Science and Engineering*, Vol: 141, No: 4, 041006.

Petticrew, M. and Roberts, H. (2006). *Systematic Reviews in the Social Sciences: A Practical Guide*. Oxford: Blackwell Publishing.

Pir, E. Ö. and Derinözlü, E. (2021). "The mediating role of trust in the C2C platform between minimalism and second-hand purchasing intention." *Journal of Economics, Business and Management,* Vol: 5, No: 2, pp. 125–161.

Rahman, T. (2024). "Role of e-commerce in reducing operational cost." *International Journal of Advances in Engineering and Management*, Vol: 6, No: 1, pp. 58–63.

Rogers, D. S. and Tibben-Lembke, R. (2001). "An examination of reverse logistics practices." *Journal of Business Logistics*, Vol: 22, No: 2, pp. 129–148. https://doi.org/10.1002/j.2158-1592.2001.tb00007.x

Rushton, A., Croucher, P. and Baker, P. (2017). *The Handbook of Logistics and Distribution Management: Understanding the Supply Chain* (5th ed.). Kogan Page Publishers.

Sarıcan, M.A. (2016). Identification of Critical Activities in E-logistics and E-logistics Applications in Turkey. Master Thesis, Pamukkale University, Institute of Social Sciences.

Schacker, M. and Stanoevska-Slabeva, K. (2023). "A morphology of digital direct-to-consumer (D2C) models." *Procedia Computer Science*, 219, pp. 170–177. https://doi.org/10.1016/j.procs.2023.01.278

SendFromChina. (2025). Digital logistics vs. traditional logistics. https://www.sendfromchina.com/blog/digital-logistics-vs-traditional-logistics/ (Accessed 16.06.2025).

Siddaway, A. P., Wood, A. M., and Hedges, L. V. (2019). "How to do a systematic review: A best practice guide for conducting and reporting narrative reviews, meta-analyses, and meta-syntheses." *Annual Review of Psychology,* Vol: 70, pp. 747–770. https://doi.org/10.1146/annurev-psych-010418-102803

Silva, T. F. G., Gonçalves, A. T. P. and Leite, M. S. A. (2014). "Logistics Cost Management: Insights on Tools and Operations." *International Journal of Logistics Systems and Management*, Vol: 19, No: 3, pp. 329–346.

Statista, 2025. https://www.statista.com/statistics/1290279/e-commerce-market-size-in-turkey (Accessed 07/05/2025)

Statista, 2022. https://www.statista.com/statistics/1290263/turkey-e-commerce-sales-value-by-sectors (Accessed 07/05/2025)

Steinfield, C.W. (2004). "Situated electronic commerce: Toward a view as complement rather than substitute for offline commerce." *Urban Geography*, Vol: 25, No: 4, pp. 353–371.

Şahin, M. (2021). *The Relationship Between Logistics Management and Customer Satisfaction in E-commerce*. Istanbul: Beta Publishing.

Şahin, S. (2021). "International logistics and cross-border e-commerce in a globalizing world: Is e-commerce the most important trade method of the future?" *Journal of the Faculty of Economics and Administrative Sciences*, Tarsus University, Vol: 2, No: 2, pp. 82–97.

Şahin, C. and Karakas, A. (2017). "E-commerce sector in the world and in Turkey." *International Congress on Management Economics and Business - ICMEB'17*, pp. 27–33.

Tekin, M., Etlioğlu, M. and Tekin, E. (2017). "Electronic Logistics and Learning*." The International New Issues in Social Sciences*, Vol: 5, No: 5, pp. 361–383.

Tokay, S.M., Deran, A. and Arslan (2010). "Strategies to be followed in logistics cost management and expectations from accounting education." *29th Turkish Accounting Symposium.*

Ülkü, M. A., Dailey, L. C. and Yayla Küllü, H. M. (2013). "Serving fraudulent consumers? The impact of return policies on retailer's profitability." *Service Science*, Vol: 5, No: 4, pp.296–309. https://doi.org/10.1287/serv.2013.0051

Vogue Business, 2021. https://www.voguebusiness.com/sustainability/how-e-commerce-brands-can-scale-logistics-sustainably?utm_source (Accessed 22/04/2025)

Waller, M. A. and Fawcett, S. E. (2013). "Click here to order: The role of e-commerce in supply chain management." *International Journal of Logistics Management*, Vol: 24, No: 2, pp. 290–315.

Wang, X., Du, T., Ma, Y. and Yu, M. (2021). "Logistics cost control in food processing enterprises based on TD-ABC." *Journal of Cleaner Manufacturing*, Vol: 315, pp. 1280–1293. https://doi.org/10.3233/JCM-215464

Weiyi, F. and Luming, Y. (2009). "The discussion of target cost method in logistics cost management." *ISECS International Colloquium on Computing, Communication, Control and Management.*

Wigand, R.T. (1997). "Electronic Commerce: Definition, Theory, and Context." *The Information Society*, Vol: 13, pp. 1–16.

Wolff, J. (2023). "Reducing logistics costs in e-commerce: 7 helpful strategies." https://www.saloodo.com/blog/reducing-logistics-costs-in-e-commerce-7-helpful-strategies/

Xu, G., Qiu, X., Fang, M., Kou, X. and Yu, Y. (2019). "Data-driven operational risk analysis in E-Commerce Logistics." *Advanced Engineering Informatics*, Vol: 40, pp. 29–35.

Yang, Y., Humphreys, P. and McIvor, R. (2006). "Business service quality in an e-commerce environment." *Supply Chain Management: An International Journal*, Vol: 11, No: 3, pp. 195–201.

Yıldız, B. (2020). "The impact of e-commerce logistics service quality on trust, satisfaction, and loyalty." *Journal of Giresun University Faculty of Economics and Administrative Sciences*, Vol: 6, No: 1, pp. 37–59.

Yılmaz, S. and Demirtaş, Ö. (2022). "The effect of logistics costs on competitive power in e-commerce: The case of Turkey." *International Journal of Management, Economics and Business*, Vol: 18, No: 3, pp. 456–472.

Zakariah, S. and Pyeman, J. (2013). "Logistics cost accounting and management in Malaysia: Current state and challenge." *International Journal of Trade, Economics and Finance*, Vol: 4, No: 3, pp. 119–123.

Zhang, X., Zhao, K. and Kumar, A. (2020). "Last-mile logistics in e-commerce: A literature review and research agenda." *Transportation Research Part E: Logistics and Transportation Review*, Vol: 142.

Zhao, C. (2021). "Research on cost management of e-commerce enterprises based on value chain—Taking Suning Tesco as an example." *5th International Conference on Informatization in Education, Management and Business (IEMB 2021),* pp. 165–173.

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Review Article

THE EFFECT OF THE ISRAEL-GAZA WAR ON MARITIME TRADE AND TRASPORTATION

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ABSTRACT

This study investigates the impact of the Israel-Gaza War on global maritime trade and transportation. The conflict has led to significant disruptions in key maritime routes, particularly in the Red Sea and Suez Canal, forcing vessels to divert to alternative passages such as the Cape of Good Hope. These route changes have resulted in increased sailing times, fuel consumption, operational costs, insurance premiums, and carbon emissions. Port congestion and delays in international deliveries have also intensified. In this review-based study, recent data and reports from industry sources are synthesized to examine the war's implications for maritime trade flows, shipping insurance, and the economic sustainability of global logistics. The findings highlight the urgent need for strategic resilience planning in maritime operations under conditions of geopolitical conflict.

Keywords: *İsrael-Gazza War, Maritime Trade, Maritime Transportation, Suez Canal Traffic, Cape of Good Hope Traffic*

1. INTRODUCTION

The Israel-Gaza conflict, which began with the attack by Hamas on Israel on October 7, 2023, has had significant geopolitical, humanitarian, and economic consequences. As a result of the conflict and subsequent military operations, thousands of lives have been lost—particularly in Gaza—where over 30,000 people were killed, and more than 70,000 were injured. Widespread destruction of infrastructure, loss of livelihoods, and a dramatic decline in employment and economic output have been reported (ILO, 2023; UNCTAD, 2024a).

One of the lesser-discussed but critical consequences of the war has been its disruptive effect on global maritime trade and transportation. Attacks on commercial ships, including those by the Houthis in the Red Sea region, have significantly affected the security of shipping routes, especially the Suez Canal. As a result, many shipping companies have rerouted vessels around the Cape of Good Hope, resulting in longer transit times, higher fuel consumption, increased emissions, higher insurance costs, and supply chain instability.

Given that approximately 90% of global trade is conducted by sea, disruptions to maritime logistics can have wide-ranging impacts on international trade, energy security, food supply chains, and global markets. Geopolitical tensions in maritime chokepoints—such as the Suez Canal—pose severe risks to the continuity and cost-effectiveness of global shipping operations.

This study aims to review and analyze the impacts of the Israel-Gaza War on global maritime trade and transportation, with a particular focus on route disruptions, economic consequences, maritime security, and insurance dynamics. The objective is to synthesize available evidence and highlight the broader implications for maritime resilience and global trade sustainability under conditions of conflict.

In the second part of the paper, the effects of the Israel-Gaza War on maritime trade and transportation are explored. The third part focuses on the economic impacts, the fourth part examines maritime security challenges, and the fifth part investigates implications for maritime insurance. The study is limited by the scarcity of academic literature and statistical data concerning post-war changes in the use of the Suez Canal and the Cape of Good Hope.

2. IMPACT ON MARITIME TRADE AND TRANSPORTATION

It is stated that if the conflict expands throughout the region, it will have a negative impact on global trade (Hill Dickinson, 2023). The maritime industry in the Red Sea has been seriously affected by the Israel-Hamas conflict that started on October 7. 2023 (Statista, 2024a). As a result of the Israel-Gaza war, global trade and maritime commerce have been severely affected. 22 to 23% of goods traded by sea between non-neighboring countries pass through the Red Sea, primarily through Bab-el-Mandeb and the Suez Canal. Before the October 7. 2023 attack, approximately 12% of global trade passed through the Suez Canal (ITA, 2024). While 15.4 million barrels were transported from the Middle East, which constitutes approximately one-third of the world's oil production, in 2022, only 589.262 barrels were shipped from the region on February 8, 2024 (Statista, 2024b). 50 ships, 7 million barrels of oil and 1.2 billion cubic meters of classified natural gas (LNG) pass through the Bab-el-Mandeb Strait every day (Gürdeniz, 2023).

Global shipping companies are rerouting with increasing costs due to the war. being forced to reflect more broadly. Due to the Israel-Gaza conflict, there was a decrease in oil tanker transportation volume between ports in the world. Due to the Israel-Gaza conflict, there was a decrease in oil tanker transportation volume between ports in the world. This situation has greatly affected ships passing through the Red Sea region. The number of vessels exporting crude oil in the world, have significantly reduced (Zhang et al, 2025).

The number of oil tankers passing through the conflict and Red Sea region has greatly decreased. Increased tension in the region generally leads to increases in oil supply and oil prices. Increased tension in the region causes increases in oil supply and oil prices. Muhammadiyad, 2024). There are already delays in operations at Israeli ports. Israel has established a security strip of up to 80 km in the sea. Ships coming to the country cannot dock further than this distance. Increasing the security level of ships calling at Israeli ports to the highest level has seriously disrupted maritime transportation in the Eastern Mediterranean. Additional war risk premiums to be paid by ships calling at regional ports have increased 10-fold (Dünya Gazetesi, 2023). This situation is an important factor that increases the freight rate.

30-50% of global container shipping, 12% of oil transported by sea, 8% of LNG and grain trade passes through the Suez Canal (Atlantic Council, 2024). After the beginning of the Israel-Gaza War, commercial ship traffic in the Suez Canal decreased by approximately 55% on a weekly basis. Attacks on merchant ships have led to an estimated 15% of global maritime trade volume and more than 22.000 ships a year avoiding the Red Sea (Ferraa et al, 2024). Before the Israel-Hamas conflict, 75 ships passed through the Suez Canal per day, but after the conflict, this number dropped to 32 ships per day. This situation reduced the revenue of the Suez Canal by 60% (SAFETY4SEA, 2025).

There has also been an increase of 98% in the number of dry cargo, tankers and container ships passing through the Cape of Good Hope. In particular, there has been a significant decrease in container ships passing through the Suez Canal. There was a 76.1% decrease in the number of ships passing through the Suez Canal in 2024 compared to the previous year. Dry bulk carriers were least affected by the Red Sea crisis. However, the number of dry bulk cargoes passing through the Suez Canal in January 2024 decreased by 18.4% compared to the previous year. Container Ships headed towards the Cape of Good Hope. Red Sea attacks could permanently divert maritime trade from the Suez Canal to alternative routes, increasing the cost to Egypt (Atlantic Council, 2024). All Israeli maritime trade passes through the Mediterranean ports of Haifa and Ashdod (Middle East Institute, 2024). S&P Global Market Intelligence analysts note that about 15% of goods imported into Europe, the Middle East and North Africa are shipped by sea from Asia and the Gulf.

Table 1. Weekly Ship Traffic by Types

	Suez Canal			Cape of Good Hope		
	Dry	Tanker	Liner	Dry	Tanker	Liner
2023						
30 Oct-5 November	178	177	112	248	68	43
6-12 November	191	165	107	266	55	41
13-19 November	179	172	126	277	55	55
20-26 November	168	184	112	345	73	45
27 Nov-3 December	206	185	106	249	63	43
4-10 December	212	178	103	256	64	57
11-17 December	180	192	99	277	80	68
18-24 December	203	160	60	254	71	60
25-31 December	171	143	47	338	74	145
2024						
1-7 January	138	134	40	306	103	102
8-14 January	148	109	44	328	113	93
15-21 January	138	111	34	307	130	77
22-28 January	111	96	31	327	121	105
29 Jan.-4 February	104	84	35	357	149	158
5-11 February	118	92	26	362	139	127
12-18 February	87	88	35	409	153	149

Tanker traffic has decreased by over 55% for 9 months until February 2024. Container Ships were significantly affected by the Red Sea crisis due to the fact that part of the liner shipping passes through the Suez Canal. Container Ship operators carry cargo on behalf of hundreds of different customers, increasing the responsibilities and risks associated with navigation compared to tankers and bulk cargo. As of January 2024, there was a 42.8% decrease in Capesize ships passing through the Suez Canal compared to the previous year (Axmarin, 2024).

In 2023, approximately 22% of global seaborne container trade passed through the Suez Canal. In addition, goods such as natural gas, oil, automobiles, raw materials and many manufacturing products and industrial components are also transported through this channel (UNCTAD, 2024b). Container ships are diverted to the Cape of Good Hope at the southern of Africa due to the Israel-Gaza conflict. This causes the journey from Asia to Europe to take longer, increases transportation, insurance costs, and inflation (Bonini, 2024).

Many global shipping companies continue to use the South African route. While an average of 75 ships passed through the Suez Canal per day before the Israel-Gaza war, currently 32 ships pass through it per day (Neele-vat, 2025). The number of ships passing through the Suez Canal in the first two months of 2024 decreased by 50% compared to the previous year, and the number of ships passing through the Panama Canal decreased by 32%. This situation has disrupted supply chains and key macroeconomic indicators (IMF Blog, 2024). Number of ships passing through the Suez Canal as of mid-October 2024 (UNCTAD, 2024a). As seen in Figure 2, while the number of ship passages passing through the Suez Canal increased before the Israel-Gaza War, it decreased significantly after the war (UNCTAD, 2024a).

Due to Yemeni Houthis attacking Israeli commercial ships passing through the Red Sea, shipping companies are directing their ships to the Cape of Good Hope, the southernmost point of Africa. The capacity of ships to change route to pass the Cape of Good Hope has increased by 89%, resulting in more costs, delays and increased carbon emissions (UNCTAD, 2024b).This situation causes the cruise time to be extended by 3,500 nautical miles, the fuel cost to increase, the freight rates to increase by 40% and increase in insurance prices. Container capacity has decreased due to extended travel times, and shipping companies' shipments through the Suez Canal have decreased due to increased fuel and operating costs. This has increased maritime transportation costs by approximately 300% (UN DP, 2024).

99% of trade in Israel is carried out by sea. In the first quarter of 2024, the amount of goods unloaded in Israel's Red Sea port of Eilat decreased to 25.000 metric tons. Between the third quarter of 2023 and the first quarter of 2024, the amount of cargo arriving at the South Port decreased by approximately 64 %. Since the start of the Israel-Hamas conflict on October 7, 2023, multiple attacks by Yemen's Houthis against Cargo ships in the Red Sea have resulted in a significant decrease in cargo ships arriving in the port (Statista, 2024c). A significant increase in the shipping market is predicted due to the Israel-Gaza conflict (Hill Dickinson, 2023; Stock logistic, 2024).

Approximately 15% of global trade and 30% of world container traffic passes through the Red Sea and Bab el Mandeb Strait. Ensuring uninterrupted trade flow in the Bab el Mandeb Strait is very important for the global economy and trade. Due to the increase in attacks on ships crossing the Red Sea, global shipping companies have paused Red Sea transit and changed their routes towards the Cape of Good Hope (UN DP (2024). Major shipping companies such as Hapag Lloyd, MSC and Maersk have suspended their operations in the Red Sea. Using alternative routes such as the Cape of Good Hope extends transportation times, increased delivery times by an average of 10 days, increases costs and insurance costs. Houthis' attacks in the region will significantly affect the security in the region (Kamali et al., 2024; Sarı, 2024). Circulating Europe-Asia traffic around Africa via the Cape of Good Hope will cause in at least 3,000 nautical miles more travel. Extending the cruising time at sea will increase staff salary payments, ship deck and shipyard maintenance costs, which will bring additional costs to shipping companies.

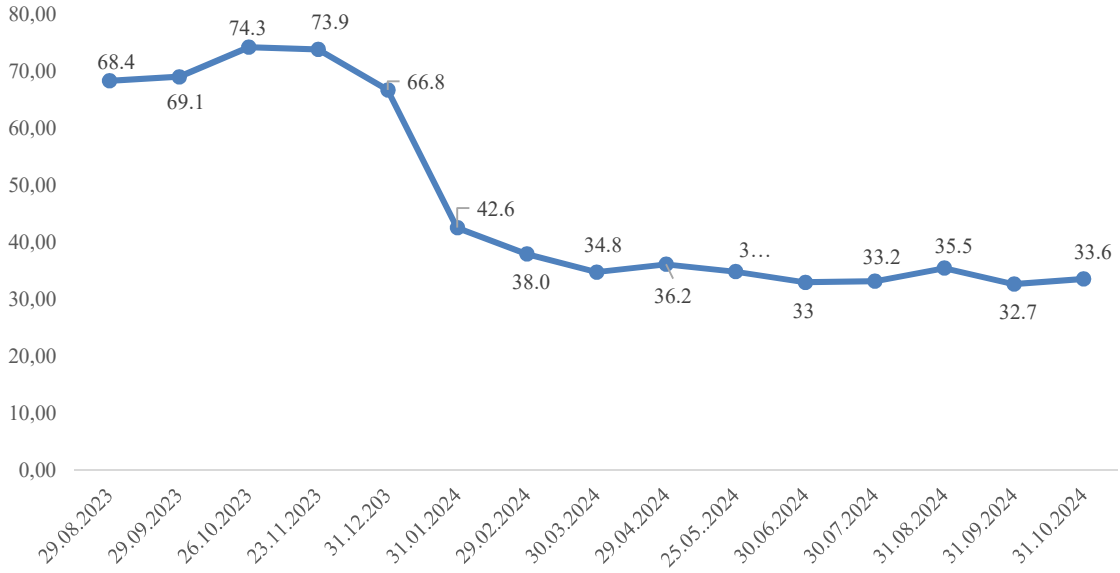

Fig.1. Daily transit trade volume of Suez Canal and Cape of Good Hope (million metric tons)
Source: UN Global Platform, IMF PortWatch, IMF Blog, 2024

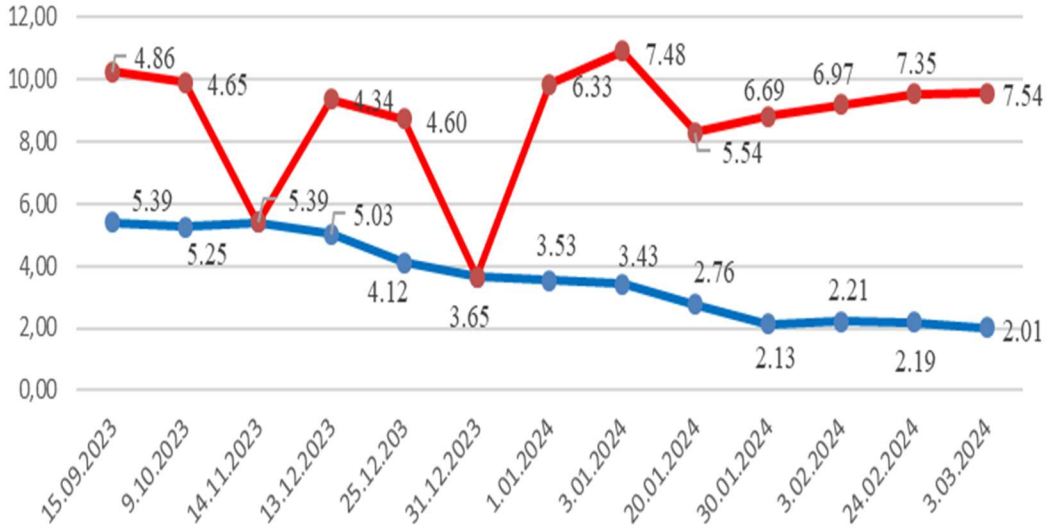

Fig.2. Number of daily ship passages passing through the Suez Canal (29.08.2023-31.10.2024)
Source: UNCTAD, 2024c.

According to transit forecasts, the trade volume passing through the Suez Canal in the first two months of 2024 decreased by 50% compared to the same period last year, while the trade volume passing around the Cape of Good Hope increased by 100% (Kamali et al., 2024). Israel does not allow the construction and operation of Gaza's air or sea ports and prohibits the import of critical production inputs and technology. Approximately 15 percent of global maritime trade, 8 percent of global grain, 12 percent of seaborne oil and 8 percent of liquefied natural gas pass through the Red Sea. According to Drewry World Container Index container shipping price 93% has increased.

Transportation costs are increasing due to Houthis attacking ships. Choosing the Cape of Good Hope instead of the Red Sea causes congestion in ports in Asia and Europe and an increase in transportation costs. It takes about two weeks longer for ships to pass around South Africa's Cape of Good Hope than through the Suez Canal. Extra fuel alone is estimated to cost $1 million (€0.92 million) per trip, according to the Shipping Research. ensions between Israel and the Houthis could have further knock-on effects on consumer prices. Diversion of the global maritime trade route is both economic and has negative climate-related consequences. Diversion of sea route increases container freight rates (Atlantic Council, 2024). Bloomberg states that the maritime sector's carbon emissions will increase by 23 million tons in the first half of 2024, which may be due to the new route.

Unable to use the Red Sea due to the attacks of the Houthis, Israel directed its maritime transportation services to the ports of the United Arab Emirates, Saudi Arabia and Jordan. These cargo reach Israel via the road (Gürdeniz, 2023).

3. ECONOMIC IMPACTS

UNCTAD states that the military operation has greatly reduced. Gaza's economy, with annual GDP per capita of Gaza required to reach its pre-blockade 2006 level by 2035. Daily production loss amount according to the Palestinian Central Bureau of Statistics. It reached 16 million US dollars due to the interruption of economic activities in the Gaza Strip. The daily gross domestic product (GDP) loss is estimated to be between US$14-20 million. The Gaza war has negatively affected oil and gas prices. The closure of the Suez Canal to oil and liquefied natural gas (LNG) traffic from the Gulf to Europe has caused serious supply disruptions. Traffic through the Suez Canal has decreased by 60%. The loss of approximately $350 million per month in Suez Canal tolls has reduced Egypt's foreign exchange earnings (Butter, 2024).

Suez Canal's one of Egypt's most important sources of foreign currency and will account for approximately 10 percent of its revenues in 2022/2023 (UN DP, 2024). Since Egypt earns 30-35 million dollars daily from Suez Canal transits, the canal constitutes an important source of foreign currency for the country. Due to the impact of the war, Egypt's revenues in January 2024 decreased by 36% compared to the same period of the previous year, and this situation negatively affected the Egyptian economy. In the first two months of 2024, Suez Canal trade decreased by 50 percent compared to the same period of the previous year. This situation as disrupted global trade, supply chains and key macroeconomic indicators. During the war, Haifa port and bulk cargo port Hadera are operating. Ashkelon port is not working. The Israeli Navy controls maritime traffic in and around the ports of Ashdod and Ashkelon (SAFETY4SEA, 2023).

It is stated that China, which carries out 80 percent of its foreign trade by sea, has also been affected by these changes and has put alternative land routes on its agenda against demand shocks. If the war continues, regional and global economies will continue to be negatively affected (AA, 2024). UNCTAD estimates that Gazan economy had already contracted by 4.5% in the first three quarters of 2023 (UNCTAD, 2024a).

The war caused significant losses in employment and livelihoods (ILO, 2024). Gaza's economy shrunk by 24% in 2023, nearing its 1994 level. 79% of Gaza's labour force is unemployed (UNCTAD, 2024a). The International Labor Organization (ILO) states that there has been a job loss of at least 61 percent (182,000 jobs) in the Gaza Strip since the beginning of the Israel-Gaza war. There was an estimated total loss of 390,000 jobs in the two regions that make up the Occupied Palestinian Territories, with a daily loss of labor income of US$ 16 million. These figures are expected to increase if military operations in Gaza continue (Bonini, 2024). Operations were disrupted in ports in the war zone. Disruptions at ports pose a threat not only to Turkey's trade with Israel and Palestine, but also to Turkey-related cargoes from Syria, Jordan and even Asia (UTIKAD, 2023).

4. THE IMPACT OF ISRAEL-GAZZA WAR ON MARITIME SECURITY

In late November 2023, the Houthis began targeting international shipping in the Red Sea, particularly ships passing through the Bab-el-Mandab Strait, by launching attacks on Israeli-owned ships or ships heading towards Israel. The Houthis also began to attack commercial ships connected to Israel's Western allies, especially the USA and the UK (Vtw, 2024). The conflict poses a serious maritime security risk in the region and ships are changing their routes. Maritime security risks are increasing due to Houthi attacks in the Bab el Mandeb Strait, which connects the Gulf of Aden and the Sea of Oman to the Mediterranean via the Red Sea and the Suez Canal. UAVs (Drones), mobile munitions, limpet mines, explosive boats pose a threat to commercial ships operating primarily in the Persian Gulf, Strait of Hormuz, Gulf of Oman, Red Sea, Bab el Mandeb Strait and Gulf of Aden (Maritime Mutual, 2023).

It is recommended to increase the speed of ships passing through risky areas, to pass only during daylight hours whenever possible, to improve all watchkeeping procedures, and to maintain contact with international naval forces and maritime security officials in the region (CIMSEC, 2016). There have been 47 Houthi attacks since November 19, 2023. Ships passing through this area are strongly advised to turn off their AIS transponders, as turning off AIS makes it more difficult to track and target a ship accurately. When commercial vessels passing through this area are instructed on VHF to deviate from their route by the Houthis or entities claiming to be Yemeni authorities, they should ignore it and continue their passage if safe to do so.

To protect the sustainability of commercial shipping in the region, a US-led international naval task force has

been deployed to the Red Sea to destroy Houthi missiles and drones, the primary weapons used to target ships (Vtw, 2024).

Another strategic concern is the increased militarization of key chokepoints such as the Bab el-Mandeb Strait and the Strait of Hormuz. The persistent threat posed by Houthi forces has triggered not only unilateral naval responses but also multinational maritime coalitions, such as Operation Prosperity Guardian led by the United States and supported by allies including the United Kingdom, France, and Italy (U.S. Department, 2024). These operations aim to ensure freedom of navigation and deter further attacks on commercial shipping. However, their presence has also escalated regional tensions, leading to the potential for miscalculations or accidental confrontations with non-state actors or even with Iranian naval forces, who are alleged to support Houthi operations (Risk Intelligence, 2023; Reuters, 2024, Vtw, 2024).

The economic implications of security risks are also severe. Due to growing threats, major shipping companies—such as Maersk, MSC, and Hapag-Lloyd—have temporarily suspended operations through the Red Sea, rerouting vessels via the Cape of Good Hope. While this detour avoids conflict zones, it adds approximately 10–14 days of transit time and significantly increases fuel consumption and operational costs (Drewry, 2024a). These factors not only raise freight rates but also disrupt global supply chains, especially for energy and containerized goods moving between Asia and Europe.

Moreover, the increased use of private maritime security contractors (PMSCs) is becoming more prominent, particularly for high-risk transits. Many shipowners are now employing armed guards and investing in onboard defense systems such as long-range acoustic devices (LRADs), anti-drone jammers, and reinforced citadels (OCHA, 2024). These measures, while enhancing vessel resilience, also represent additional financial burdens and legal complexities, especially concerning the use of force in international waters (USDD, 2024).

Lastly, the psychological and operational toll on seafarers is gaining global attention. Crew anxiety over navigating through conflict-prone waters has risen, leading to growing calls from maritime unions and the International Transport Workers' Federation (ITF) for designating the Red Sea as a war risk area for seafarer safety considerations (ITF, 2024). This designation would entitle seafarers to war risk allowances and the right to refuse transits through hazardous zones without facing employment penalties.

5. IMPACT ON PORTS

The Israel-Gaza conflict has had substantial and multifaceted impacts on regional and global port operations. Ports are critical nodes in the global supply chain, and disruptions in their functionality reverberate throughout the maritime logistics system. The escalation of hostilities in the Eastern Mediterranean and Red Sea has affected ports in Israel, Palestine, and neighboring countries, while also influencing global port activity due to rerouted shipping and increased port congestion (MM, 2023; UNCTAD, 2024a). The Port of Ashdod and Port of Haifa, Israel's main maritime gateways, experienced operational slowdowns and temporary closures due to security threats and missile attacks (Lloyd's List, 2024). As a result, many shipping lines have suspended or limited their calls at Israeli ports. Simultaneously, Gaza's limited port infrastructure, already constrained due to longstanding blockades, has faced further restrictions, halting all humanitarian or commercial maritime access (OCHA, 2024; Martin, 2024). Ports in nearby countries, such as Port Said and Alexandria in Egypt, and Aqaba in Jordan, have faced increased pressure due to the rerouting of vessels away from conflict zones. These ports have attempted to absorb the additional volume, leading to congestion, longer waiting times, and overstretched infrastructure (USDTMA, 2024; World Bank, 2024).

The disruption in the Suez Canal due to attacks on commercial vessels in the Red Sea has caused many ships to bypass the route and take the longer passage via the Cape of Good Hope (IMO, 2024). This shift has created unexpected bottlenecks in ports across Sub-Saharan Africa, as well as in European and Asian ports not previously equipped to handle such large and delayed volumes. Container terminals, especially in transshipment hubs such as Singapore, Rotterdam, and Durban, have reported increased dwell times and reduced schedule reliability (Drewry, 2024b). Moreover, the shift in shipping patterns has affected port rotations and service frequencies. Ports that were regularly part of major east-west liner routes have seen reduced activity, while alternative ports have faced unexpected surges, challenging their throughput capacity and logistics coordination (Clarksons Research, 2024b; Oceans Beyond Piracy, 2024).

With the elevated risk of drone and missile attacks, ports in the Eastern Mediterranean have heightened their security protocols. This includes enhanced surveillance, restricted access zones, and increased inspections. While necessary, these measures have also slowed down cargo handling and vessel turnaround times, further straining port efficiency (Mepanews, 2023; ICS, 2024). Additionally, insurance premiums for ports deemed high-risk have increased, leading to rising operational costs for port authorities and shipping companies alike (Allianz Global Corporate & Specialty, 2024). Port labor and logistics workers in affected regions have faced operational uncertainty, with some ports reducing shifts or temporarily halting services for safety reasons.

The restricted use of Gaza's port infrastructure has further exacerbated the humanitarian crisis by limiting the inflow of aid and essential goods. Attempts to establish maritime humanitarian corridors have been discussed at international forums but remain logistically and politically complex (UN DP, 2024). From a strategic standpoint, the war has underscored the vulnerability of ports in conflict-prone regions and the urgent need for resilient infrastructure planning, port diversification strategies, and regional maritime cooperation (BIMCO, 2024).

6. IMPACT ON MARINE INSURANCE

The Israel-Gaza conflict has significantly influenced the global marine insurance industry, altering risk perceptions, raising premium rates, and reshaping underwriting strategies. As maritime trade routes face increased security threats—particularly in the Eastern Mediterranean and Red Sea—the war has forced insurers to reevaluate war risk zones, coverage terms, and liability

frameworks. The Israel-Hamas conflict directly affects war risks insurance, and premiums for ships trading to the region are increasing. The Israel-Gaza War may result in increased insurance costs for various goods transported in the region. Israel's southern ports of Ashkelon and Ashdod are the riskiest ports in terms of conflict and are considered the highest risk (Hill Dickinson, 2023). Marine insurance premiums for ships using the Red Sea route have increased rapidly, with the premium rate increasing between 0.75% and 1.0 % (UN DP, 2024).

Naval war risk premiums for ships transiting the Red Sea or Gulf of Aden due to conflicts have been significantly affected.

One of the most immediate effects has been the elevation of war risk premiums for vessels operating near Israeli ports or transiting the Red Sea and Eastern Mediterranean. Following a series of drone and missile attacks on commercial vessels, major insurers have designated key areas such as the Gulf of Aqaba and the southern entrance to the Red Sea as "listed" or "high-risk" zones under the Joint War Committee's advisory (Lloyd's Market Association, 2024). Consequently, ship-owners have faced war risk surcharges up to tenfold higher than pre-conflict levels (Allianz Global Corporate & Specialty, 2024a). These rising premiums not only impact the cost of maritime trade but also influence route selection. Several shipping lines have opted to reroute vessels via the Cape of Good Hope, despite longer transit times, to avoid elevated insurance costs and security threats (Clarksons Research, 2024a).

The conflict has also affected hull and cargo insurance policies. Insurers have imposed stricter conditions, including exclusion clauses for war-related losses or requirements for prior notice when entering conflict-adjacent zones (Marsh, 2024). Underwriters are increasingly requesting detailed security assessments, routing plans, and real-time monitoring for coverage to remain valid. Protection and Indemnity (P&I) clubs have issued advisories regarding coverage limitations in regions deemed unstable, urging shipowners to consult with brokers before calling affected ports. These clubs have also updated their liability policies in response to increased risks of crew injury, vessel detention, and cargo loss due to conflict (Gard P&I Club, 2024).

Reinsurance markets have come under pressure due to the accumulation of geopolitical risks globally, including the Israel-Gaza war, the Red Sea crisis, and the Russia-Ukraine conflict. As reinsurers become more conservative, capacity for war risk coverage has tightened, leading to higher reinsurance premiums and a ripple effect on primary marine insurers (Swiss Re Institute, 2024). Some underwriters have exited specific regional markets altogether, citing unsustainable exposure levels.
The conflict has introduced complex legal challenges related to insurance claims. Determining causation, responsibility, and the applicability of war clauses is increasingly difficult in high-conflict areas. Additionally, the political nature of the conflict raises questions around the enforceability of claims linked to sanctioned entities or ports (Norton Rose Fulbright, 2024). Delays in claims processing, increased litigation, and arbitration around war-related damage have become more common. Insurers have responded by enhancing policy documentation and incorporating specific conflict clauses, but the lack of standardized interpretations remains an industry-wide concern.

Long-term, the Israel-Gaza conflict is prompting a reassessment of global marine insurance strategies. Insurers are investing in advanced threat intelligence tools, partnering with maritime security firms, and developing dynamic pricing models based on real-time risk exposure (Munich Re, 2024). The conflict also underscores the need for broader cooperation between insurers, port authorities, and shipping companies to enhance resilience against future regional crises.

7. CONCLUSION AND RECOMMENDATIONS

The Israel-Gaza War has had profound and far-reaching consequences for global maritime trade and transportation. Disruptions in the Red Sea, including Houthi attacks and increased geopolitical tensions, have significantly affected the Suez Canal route—leading to longer sailing times, higher fuel consumption, increased transportation costs, and a surge in insurance premiums. These developments have disrupted global supply chains and created uncertainty within the logistics sector. As a result, many shipping companies have had to revise their operational strategies and reroute vessels, which further exacerbates delivery delays and economic pressures.

Moreover, fluctuations in maritime security due to regional conflicts and piracy have introduced new risks to international trade. These factors not only threaten the sustainability of maritime transport but also impact broader economic stability.

To ensure the resilience of maritime trade routes, there is a critical need for enhanced international cooperation, coordinated maritime governance, and proactive strategies to mitigate the impact of regional conflicts on global logistics networks.

7.1. Recommendations

Diversification of Trade Routes: Stakeholders should explore and invest in alternative shipping corridors to reduce dependence on high-risk chokepoints such as the Suez Canal.

Strengthening Maritime Security: Greater investment is needed in surveillance technologies, naval coordination, and private maritime security to ensure safe passage through conflict-prone areas.

Policy and Governance Improvements: International organizations and maritime authorities must collaborate to develop adaptive regulatory frameworks that allow for rapid response to emerging geopolitical risks.

Geopolitical Risk Forecasting: Shipping and logistics firms should integrate real-time risk assessment tools and geopolitical forecasting into their planning processes.

Crisis Preparedness and Simulation: Simulation-based scenario planning and crisis drills should be regularly conducted to improve response mechanisms across the global maritime industry.

By implementing these recommendations, maritime stakeholders can enhance their operational resilience, ensure continuity of trade, and better navigate the uncertainties posed by current and future geopolitical conflicts.

REFERENCES

Allianz Global Corporate & Specialty. (2024). War Risk and Marine Insurance Trends in 2024.

Allianz Global Corporate & Specialty. (2024a). Maritime Risk Bulletin: Conflict Zones and Insurance Premiums.

Anadolu Ajansı (AA) (2024). Israel's attacks on Palestine bring region's economy to stalemate, https://www.aa.com.tr/en/middle-east/israel-s-attacks-on-palestine-bring-region-s-economy-to-stalemate/3142650. (Accessed May 23, 2025).

Atlantic Council (2024). The Economic and Social Costs of the War in Gaza. 1-31, https://www.atlanticcouncil.org/wp-content/uploads/2024/10/The-Economic-and-Social-Costs-of-the-war-in-Gaza.pdf. (Accessed May 23, 2025).

Axmarin (2024). Nearly 300 Less Ships Per Week Through Suez Canal Due To Red Sea Crisis, https://public.axsmarine.com/blog/nearly-300-less-ships-through-suez-canal-through-red-sea-crisis. (Accessed May 23, 2025).

BIMCO. (2024). Maritime Security Update: Eastern Mediterranean Focus.

Bonini, E. (2024). Hamas-Israel conflict hits Suez Canal, trade crisis risk, including Italy. [online] EUNEWS, 9 Jan. Available at: https://www.eunews.it/en/2024/01/09/hamas-israel-conflict-hits-suez-canal-trade-crisis-risk-including-italy/ (Accessed 23 May 2025).

Butter, D. (2024). Economic Impact of the Gaza War. IEMed. Mediterranean Yearbook 2024. Strategic Sectors : Economy&Territory, pp.273-274. (Accessed May 23, 2025).

CIMSEC (2016). Dangerous Waters: The Situation In The Bab El-Mandeb Strait. https://cimsec.org/dangerous-waters-situation-bab-el-mandeb-strait/.(Accessed May 23, 2025).

Clarksons Research. (2024a). Global container market outlook – Q1 2024. Retrieved June 23, 2025, from https://www.clarksons.net/

Clarksons Research. (2024b). Impact of Red Sea conflict on shipping insurance. Clarksons Shipping Intelligence Network. Retrieved June 23, 2025, from https://www.clarksons.net/

Drewry (2024a). Container market outlook: Disruption in the Red Sea and implications for global ports. Drewry Insights Retrieved June 23, 2025, from https://www.drewry.co.uk/container-insight-weekly/weekly-feature-articles/january-freight-loop---red-sea-crisis-impact-assessment-for-global-shippers.

Drewry (2024b). Container market outlook – Q1 2024. Drewry Container Forecaster (Subscriber Access). Retrieved June 23, 2025, from https://www.drewry.co.uk/supply-chain-advisors/supply-chain-expertise/world-container-index-assessed-by-drewry

Dünya Gazetesi (2023). Savaş nedeniyle sigorta risk primleri 10 kata kadar arttı (Insurance risk premiums increased up to 10 times due to the war), https://www.dunya.com/sektorler/sigortacilik/savas-nedeniyle-sigorta-risk-primleri-10-kata-kadar-artti-haberi-709659. (Accessed May 23, 2025).

Excelsior (2024). How Does the Israel War Affect Global Logistics and Freight Forwarding?, https://excelsior.ph/how-does-the-israel-war-affect-global-logistics-and-freight-forwarding/

Ferraa, O., Kanboui, L., & Touzi, B. (2024). Red Sea Disruptions: Exploring Global TradeImplications through a Literature Review. International Conference on Science, Innovations and Global Solutions. (pp. 173-178). Futurity Research Publishing. https://futurity-publishing.com/international-conferenceon-science-innovations-and-global-solutions-archive/

Galani, G. (2022). Consequences of War On Supply Chain And Relative Disruptions. Master Degree, Department of Maritime Studies M.Sc. In Shipping Management, pp.59. 1-77.

Gard P&I Club (2024). Advisory on Israel-Gaza Conflict and Implications for P&I Coverage.

Gürdeniz, C. (2023). İsrail-Filistin savaşını küresel deniz taşımacılığına etkisi (The impact of the Israeli-Palestinian war on global shipping), (https://www.denizbulten.com/israil-filistin-savasinin-kuresel-deniz-tasimaciligina-etkisi-52988h.htm.

Hill Dickinson (2023). Israel-Palestine conflict: The effect on the global shipping industry, https://www.hilldickinson.com/insights/articles/israel-palestine-conflict-effect-global-shipping-industry

ICS (International Chamber of Shipping). (2024). Security Measures and Operational Guidelines for Conflict-Affected Ports.

ILO (2023). Israel Raw Materials Supply Chain on the labour market and livelihoods in the Occupied Palestinian Territory: No. 3 Bulletin

ILO (2024). Impact of the Israel-Hamas conflict on the labor market and livelihoods in the Occupied Palestinian Territory [EN/AR]. Retrieved May 23, 2025, from https://reliefweb.int/report/occupied-palestinian-territory/impact-israel-hamas-conflict-labour-market-and-livelihoods-occupied-palestinian-territory-.enar?gad_source=1&gclid=CjwKCAjwko21BhAPEiwAwfaQCHLEHvzIFdZZOfqnlfxWq79ZPiNwNWCt3OjCL6aYgoLPs9nKAgmsZRoCVeAQAvD_BwE.

IMF Blog (2024). Red Sea Attacks Disrupt Global Trade. https://www.imf.org/en/Blogs/Articles/2024/03/07/Red-Sea-Attacks-Disrupt-Global-Trade.DOI: https://doi.org/10.54394/OZPO4600

IMO (International Maritime Organization). (2024). Situation Brief: Red Sea Maritime Security Update – March 2024.

ITA (2024). Israel Raw Materials Supply Chain Affected by Israel-Hamas Conflict. Retrieved June 23, 2025, from https://www.trade.gov/market-intelligence/israel-raw-materials-supply-chain-affected-israel-hamas-conflict#:~:text=The%20Israel%2DHamas%20Conflict%20has,Sea%20to%20alternative%20sea%20routes.

ITF (2024). ITF urges action to protect seafarers in Red Sea war zone. Retrieved June 10, 2025, from https://www.itfglobal.org/en/news/itf-urges-action-protect-seafarers-red-sea-war-zone.

Kamali P., Koepke, R., Sozzi, A., Verschuur, J. (2024). IMF Blog, Retrieved May 10, 2025, from https://www.imf.org/en/Blogs/Articles/2024/03/07/Red-Sea-Attacks-Disrupt-Global-Trade#:~:text=Attacks%20on%20vessels%20in%20the,the%20Cape%20of%20Good%20Hope.

Lloyd's List. (2024). Israel Conflict Disrupts Shipping Lines and Port Operations. Retrieved June 23, 2025, from https://lloydslist.maritimeintelligence.informa.com/LL1148800.

Lloyd's Market Association. (2024). Joint War Committee listed areas – Updated February 2024. Retrieved June 23, 2025, from https://www.lmalloyds.com/LMA/News/LMA_bulletins/LMA_Joint_War_Committee_Listed_Areas_February_2024.pdf

Maritime Mutual (MM) (2023). Israel/Palestine War and Increased Threats to Merchant Ships in Middle East Waters. Maritime Mutual Risk Bulletin No. 75. Retrieved May 10, 2025, from https://maritime-mutual.com/risk-bulletins/israel-palestine-war-and-increased-threats-to-merchant-ships-in-middle-east-waters/.

Marsh. (2024). Marine insurance alert: Coverage adjustments due to Middle East conflict. Retrieved June 23, 2025, from https://www.marsh.com/

Martin, N. (2024). Red Sea shipping crisis worsens after Israel-Houthi attacks. DW, Business Yemen. Retrieved May 10, 2025, from https://www.dw.com/en/red-sea-shipping-crisis-worsens-after-israel-houthi-attacks/a-69738531.

Mepanews (2023). Kızıldeniz'i kullanamayan İsrail'in imdadına Suudi Arabistan, BAE ve Ürdün yetişti (Saudi Arabia, UAE and Jordan came to the rescue of Israel, which could not use the Red Sea). Retrieved June 23, 2025, from https://www.mepanews.com/kizildenizi-kullanamayan-israilin-imdadina-suudi-arabistan-bae-ve-urdun-yetisti-64022h.htm.

Middle East Institute (2024). Israel in the Red Sea during the War in Gaza: Strategic insights. Retrieved May 23, 2025 from https://www.mei.edu/publications/israel-red-sea-during-war-gaza-strategic-insights.

Muhammadiyad, P.S. (2024). The Geopolitical Ripple: Understanding The Israel-Palestine Conflict's Impact On Global Trade. Retrieved May 23, 2025 from https://psm.umy.ac.id/id/the-geopolitical-ripple-understanding-the-israel-palestine-conflicts-impact-on-global-trade/#:~:text=The%20rerouting%20of%20ships%20due,et%20al.%2C%202023).

Munich Re. (2024). Geopolitical risk and insurance innovation. Retrieved June 23, 2025, from https://www.munichre.com/

Neele-vat. (2025). Suez Canal shipping traffic recovery expected in 2025. https://www.neelevat.com/news/recovery-shipping-traffic-suez-canal-expected-in-2025/(Accessed May 23, 2025).

Norton Rose Fulbright. (2024). Legal considerations in war-related maritime insurance claims. Retrieved June 30, 2025, from https://www.nortonrosefulbright.com/

Oceans Beyond Piracy (2024). Maritime security and use of private armed guards. Retrieved June 23, 2025, from https://www.oceansbeyondpiracy.org/

OCHA (UN Office for the Coordination of Humanitarian Affairs). (2024). Gaza Humanitarian Situation Report – February 2024.

Reuters. (2024). Iran's support of Houthi naval threats raises Red Sea tensions. Retrieved June 23, 2025, from https://www.reuters.com/

Risk Intelligence (2023). The conflict in Gaza: direct and indirect maritime and port impacts of the ballistic threat. Retrieved June 23, 2025, from https://www.riskintelligence.eu/analyst-briefings/the-conflict-in-gaza-direct-and-indirect-maritime-and-port-impacts-of-the-ballistic-threat.

SAFETY4SEA (2023). How the conflict in Israel can impact maritime security and trade. Retrieved June 23, 2025, from https://safety4sea.com/how-the-conflict-in-israel-can-impact-maritime-security-and-trade/#:~:text=Security%20threat%20for%20vessels,being%20advised%20to%20do%20so.

SAFETY4SEA (2025). Traffic in Suez Canal is expected to normalize by March. Retrieved June 23, 2025, from https://safety4sea.com/traffic-in-suez-canal-is-expected-to-normalize-by-march/.

Sarı, İ. (2024). Iran's Strategy in the Bab el-Mandeb Strait and Houthi Attacks. Ortadoğu Araştırmaları Merkezi (ORSAM). Retrieved June 23, 2025, from https://www.orsam.org.tr/en/irans-strategy-in-the-bab-el-mandeb-strait-and-houthi-attacks/.

Statista. (2024a). Impact on Red Sea vessel shipped crude oil exports caused by the Israel-Hamas conflict from October 7th 2023 to February 9th 2024. Retrieved May 23, 2025, from https://www.statista.com/statistics/1396873/red-sea-crude-oil-exports-israel-hamas-war/

Statista (2024b). Impact of the Israel-Hamas war on shipping in the Red Sea - statistics & facts. Retrieved May 23, 2025, from https://www.statista.com/statistics/1450000/impact-on-red-sea-vessel-shipped-crude-oil-exports-caused-by-the-israel-hamas-conflict/.

Statista (2024c). Quarterly volume of freight unloaded in the Red Sea port of Eilat in Israel from 1st quarter 2022 to 1st quarter 2024. Retrieved May 23, 2025, from https://www.statista.com/statistics/1477893/israel-quarterly-volume-of-freight-unloaded-in-eilat-port/.

Stock logistic (2024). The Gaza conflict and its impact on international trade. Retrieved May 23, 2025, from https://www.stocklogistic.com/en/actuality/el-conflicto-de-gaza-y-su-impacto-en-el-comercio-internacional/.

Swiss Re Institute. (2024). Global reinsurance market outlook – 2024. Retrieved June 30, 2025, from https://www.swissre.com/institute/research/topics-and-risk-dialogues/global-reinsurance-outlook.html

United Nations Trade&Development (UNCTAD) (2024a). Retrieved May 23, 2025, from https://unctad.org/news/suez-and-panama-canal-disruptions-threaten-global-trade-and-development.

United Nations Trade&Development (UNCTAD) (2024b). Economıc Impact of The Destructıon In Gaza. Retrieved May 23, 2025, from https://unctad.org/publication/preliminary-assessment-economic-impact-destruction-gaza-and-prospects-economic-recovery.

United Nations Trade&Development (UNCTAD) (2024c). Suez and Panama Canal disruptions threaten global trade and developmentNumber of transits per day, 28 days rolling average, October 2018–October 2024. Retrieved May 23, 2025, from https://unctad.org/news/suez-and-panama-canal-disruptions-threaten-global-trade-and-development. (Accessed May 23, 2025).

UN DP (2024). Potential Socioeconomic Impacts of the Gaza War on Egypt: A rapid assessment, https://www.undp.org/sites/g/files/zskgke326/files/2024-05/final_rapid_assessment_impact_of_gaza_on_egypt_19-5-2024.pdf., p. 22, 24

US Department of Transportation Maritime Administration (USDTMA) (2024). 2024-004-Southern Red Sea, Bab el Mandeb Strait, Gulf of Aden, Indian Ocean, Somali Basin, Arabian Sea, Gulf of Oman, Strait of Hormuz, and Persian Gulf-Threats to Commercial Vessels. Retrieved May 23, 2025, from https://www.maritime.dot.gov/msci/2024-004-southern-red-sea-bab-el-mandeb-strait-gulf-aden-indian-ocean-somali-basin-arabian-sea

U.S. Department of Defense (USDD) (2024). Operation Prosperity Guardian: Multinational naval task force launched. Retrieved June 23, 2025, from https://www.defense.gov/News/News-Stories/Article/ArticleID/

UTIKAD (2023). Savaşın ilk faturası denizyoluna çıktı. Retrieved June 23, 2025, from https://www.utikad.org.tr/Detay/Sektor-Haberleri/35797/savasin-ilk-faturasi-denizyoluna-cikti

World Bank (2024). Port infrastructure stress in the Eastern Mediterranean – a logistics perspective. Retrieved June 30, 2025, from https://www.worldbank.org/

Vtw (2024). Maritime Security in the Red Sea and Gulf of Aden. Retrieved June 23, 2025, from https://www.wtwco.com/en-ch/insights/2024/06/maritime-security-in-the-red-sea-and-gulf-of-aden.

Zhang, B., Chen, X, Liu, H., Ye, L., Zhang, R. and Zhao, Y. (2025). Assessing the Impacts of the Israeli–Palestinian Conflict on Global Sea Transportation: From the View of Mass Tanker Trajectories, Journal of Marine Science and Engineering, pp. 1-2,18 https://www.mdpi.com/2077-1312/13/2/311.

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