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Root Cause Analysis of İstanbul Strait Disaster M/T Independenta Accident by Fishbone Method

İstanbul Boğazı Faciası M/T Independenta Kazasının Balık Kılçığı Yöntemiyle Kök Neden Analizi

Research Article

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Özet
Türk Boğazları'ndan yılda 8000'i aşkın tanker gemisi geçişi gerçekleşmektedir. Tehlikeli madde taşıyan bu gemilerin geçtiği bölgelerde de bir tehlike arz ettiği gerçeği ilgili ülkelerin tedbir almasına sebep olmuştur. Türkiye'de 1995 yılında Gemi Trafik Hizmetleri birimi kurularak boğazların gemi geçiş emniyeti konusunda adım atılmıştır. Bu tarihten önce büyük ve küçük birçok kaza meydana gelmiştir. Ancak Independenta tanker kazası bunların en büyüğüdür. 15 Kasım 1979 tarihinde 05:30 sularında Evrialy isimli kuruyük gemisinin Haydarpaşa mevkiinde demirli olan Independenta tankeri ile çatışması sonucu 94000 ton ham petrol taşıyan tankerde yangın meydana gelmiş ve 29 gün boyunca da sürmüştür. Independenta tankeri personellerinde 42 kişi hayatını kaybetmiştir. Patlama sesi İstanbul'un çeşitli yerlerinden duyulmuştur. Özellikle kıyı şeridinde yaşayan insanlarda büyük bir panik yaşanmıştır. Kaza sebebiyle yaklaşık 30000 ton ham petrol denize dökülerek kirliliğe sebep olmuştur.
Bu çalışmada, İstanbul Boğazı'nda meydana gelen en büyük tanker kazası, modern denizcilik bilgisi eşliğinde balık kılçığı yöntemi kullanılarak analiz edilmiştir. Analiz sonucunda kazanın insan hatasından kaynaklandığı belirlenmiştir.

Anahtar Kelimeler: M/T Independenta, Balık Kılçığı Metodu, Petrol Kirliliği, Kök-neden Analizi

Abstract
More than 8000 tanker voyages pass through the Turkish Straits annually. Indications that the information monitored by these ships containing dangerous goods poses a danger have led to precautions being taken. In Türkiye, the Vessel Traffic Services unit was established in 1995 and steps were taken regarding the safety of ship passage in the Straits. Many large and small accidents occurred before this date. However, the Independenta tanker accident is the biggest of them all. As a result of the collision of the dry cargo ship named Evrialy with the tanker Independenta, which was anchored in Haydarpasa, at around 05:30 on 15 November 1979, a fire broke out in the tanker carrying 94000 tons of crude oil and lasted for 29 days. 42 crew members of the Independenta tanker lost their lives. The sound of the explosion was heard from various parts of Istanbul. There was a massive panic, especially among people living along the coastline. Due to the accident, approximately 30000 tons of crude oil spilled into the sea and caused pollution.

In this study, the largest tanker accident that occurred in the Istanbul Strait was analyzed using the fishbone method with modern maritime knowledge. As a result of the analysis, it was determined that the accident was most likely caused by human error.

Keywords*:* M/T Independenta, Fishbone Method, Oil Pollution, Root-Cause Analysis

1. Introduction

Maritime transport accounts for approximately 90% of world transportation in today (Yorulmaz & Avcı, 2022). According to the operations carried out in the maritime sector, dangerous and very dangerous occupational classes coexist (Yorulmaz & Sezen, 2023). Tanker transportation, one of the important parts of maritime transportation, poses great risks and dangers due to the cargo it carries. The most common type of accident on ships is fire. The consequences of fire accidents on tankers are very severe for the ship, personnel and the environment. It creates serious effects due to the characteristics of the cargo carried (flammable, volatile and toxic), and therefore the results of the accident can be devastating and even fatal (Büyük and Bayer, 2022).

Hazardous and Noxious Substance (HNS) leakage creates major pollution in the world's seas and negatively affects the ecosystem (Cunha, Moreira and Santos, 2015). Ecosystems affected in this way will negatively affect not only the economic level of the country, but also the organisms at the environmental level, and will cause damage to the country's resources such as food, tourism and trade (Kan and Tezcan, 2020).

Over the years, many serious accidents have occurred in the Turkish Straits, especially at the entrance of the Istanbul Strait, causing marine and environmental pollution. These accidents caused loss of life, serious ecological damage to coastal historical artifacts, cultural assets, marine life and underwater resources, and disrupted maritime traffic. In addition to causing environmental disasters, many tanker accidents around the world also pose potential dangers to the Turkish Straits and trigger social unrest (Kurumahmut, 2006).

According to 2023 statistics, 9287 tanker ships passed through the Istanbul Strait (MTI, 2023). This means that approximately 25 tankers pass through the Istanbul Strait daily. With its geographical structure, narrowness, strong currents, sharp turns, variable climatic conditions and approximately 140 non-stop ships passing every day, approximately 25 ships carrying dangerous cargo and 2,500 regional maritime traffic movements carrying 2 million people, the Istanbul Strait is the most important natural narrow water in the world.

Considering the number of ship passages and geographical structure in the Straits, Turkish Straits Vessel Traffic Services was established based on the recommendation decision numbered 388 of the National Security Council dated 27.12.1995. Thus, it was ensured that the ships passing through the straits navigated in accordance with the traffic order and completed their passage safely.

Before the establishment of Vessel Traffic Services, on November 15, 1979, at around 05.30, the tanker Independenta, carrying 94,000 tons of oil, and the dry cargo ship Evrialy collided in the south of the Istanbul Strait. 42 of Independenta's crew died and the ship continued to burn and drifted towards the land. 30,000 tons of 94,000 tons of oil burned, and the rest splashed into the sea, causing serious pollution in an area of 5.5 square kilometers (Erik, 2015).

The Independenta tanker, which burned for 29 days, went out due to the impact of the storm. Due to the conditions of the period, the extent of the pollution could not be fully revealed. However, it has made its name in Turkish maritime history with both the pollution caused by crude oil spilled into the sea and the atmosphere of panic it created.

In this study, it was aimed to carry out a root cause analysis using the fishbone method of the Independenta disaster, which is still the biggest accident in the Istanbul Strait even after many years.

2. Material ve Methods

Nearly 45 years have passed since the Independenta tanker accident. Due to the conditions of those times, no accident report was prepared and made accessible. Therefore, the occurrence of the accident was determined by newspaper reports and witness statements.

There are various ways to determine the cause of an accident. The root cause of an accident can be determined using methods such as the why-why method, fishbone method, and fault tree analysis. Researchers can analyze using any of these methods depending on the nature of the event. In this study, fishbone method was used, one of the root cause analysis methods. The accident of Independenta was occured very early from usage of analyzing method. Data of this accident was not available easily and lots of important data were missed or not recorded. Due to the missing data and the fact that a lot of time has passed since the accident, it would be more accurate to analyze using methods such as brainstorming. This method was preferred because the fishbone method also includes the brainstorming method.

Fishbone chart, also known as Ishikawa diagrams (graph) or cause-effect chart, it is noted as one of the problem-solving tools created by Dr. Kaoru Ishikawa at Tokyo University (Clary

and Wandersee, 2010). It is called fishbone due to appearence. The main reasons are determined using the brainstorming technique. Then, participants create sub-causes by adhering to the main causes. These sub-causes are also scored and the main cause is determined (Kerridge, 2012).

3. Results

The Independenta tanker crashed into the ship Evrialy and was burned as a result of sparks. First, a huge explosion occurred. It was so loud that its sound was heard from Bakırköy to Pendik. The windows of some houses in the coastal areas of Istanbul exploded and some buildings were damaged. Independenta, weighing 150 thousand tons, caught fire with that explosion. In the expert report prepared within the scope of the accident investigation, it was determined that the Evrialy ship had "major defects" and the Independenta tanker had "minor defects". Moreover, there was no pilot on either ship at the time of the accident (Bağçeci, 2022). The causes of this accident were analyzed using the fishbone technique and the problems in Figure 1 were revealed.

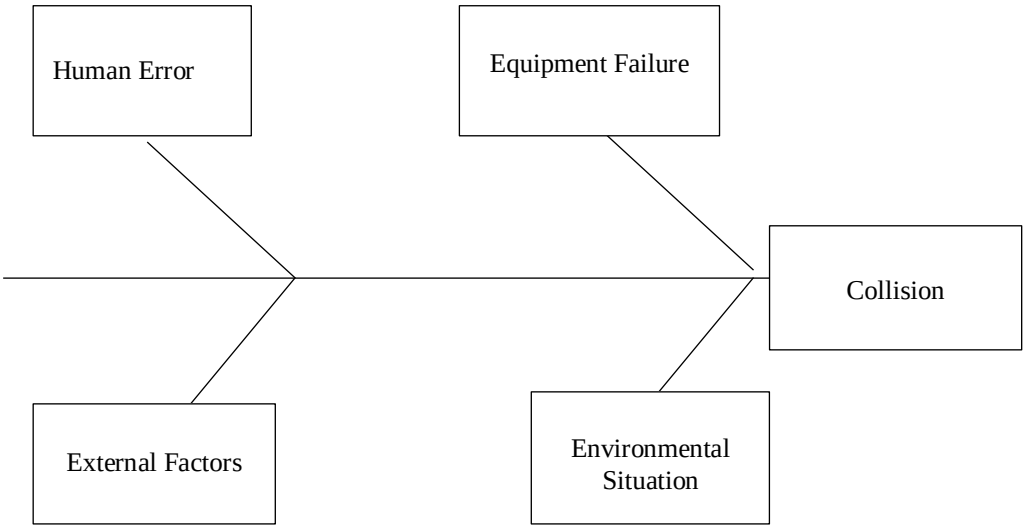

Figure 1. Hazard identification and risk assessment program flow chart

As seen in Figure 1, one main and four sub-problems were identified in the study. The main problem is collision ships and the sub-problems that are thought to cause this can be listed as follows.

- Some equipment errors may have caused the accident,
- Environmental conditions may have affected the ship's navigation and caused the accident,

- Human errors such as wrong decision making may have caused the accident,
- Some external factor such as giving wrong advice from authority may have caused the accident.

After the factors that may cause the accident are determined, the risk assessment of the post-accident situation is reduced to an acceptable risk level with control measures in line with legal obligations and workplace policy, so as not to cause harm or damage. The cause-effect diagram of the collision is given in Figure 2. By applying the fishbone method, the main causes and sub-causes that may cause a collision are separated in order of importance. According to this; main engine failure, rudder system failure, navigation aids failure, power system failure, lack of decision, communication error, lack of follow procedure, not obey the COLREG rules, heavy sea condition, restricted visbility, strong wind speed, wrong advice from the authority, inaccurate or incomplete weather report and lack of lights and buoys were found to be the reasons for the occurrence of fatalities.

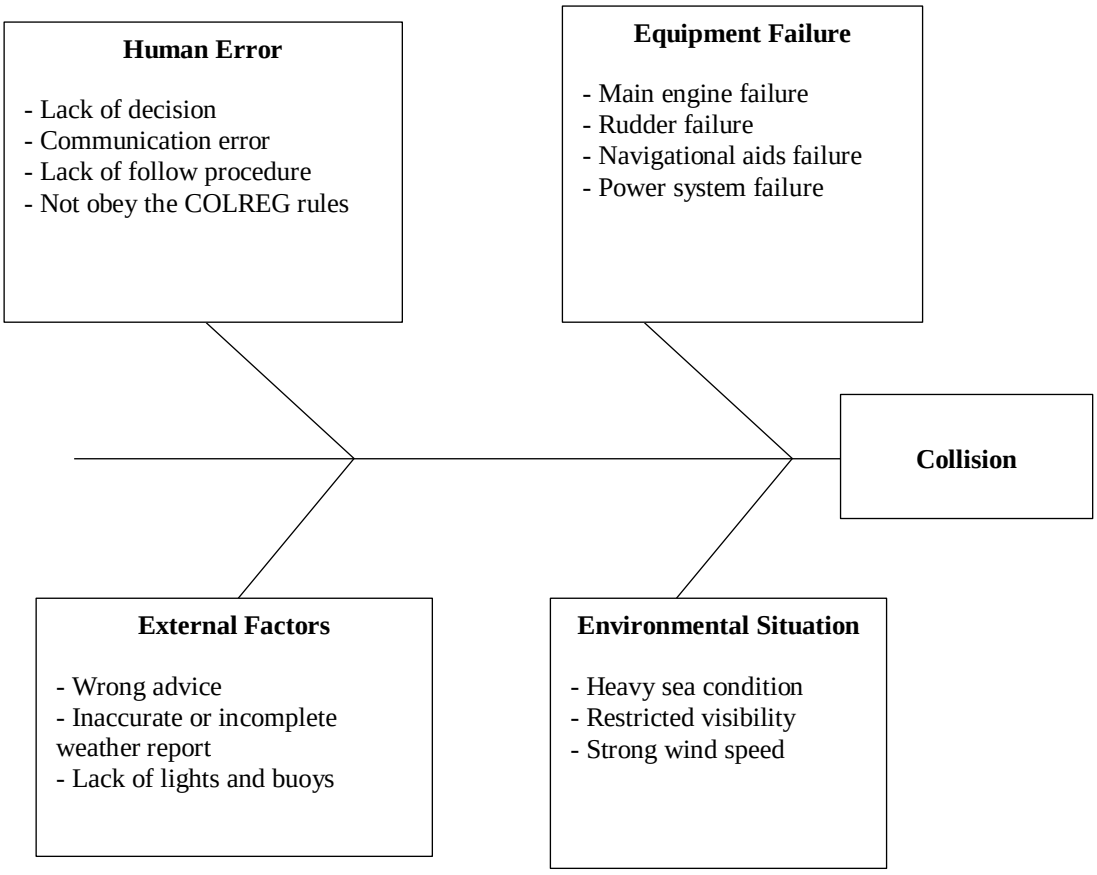

Figure 2. Cause-effect diagram of collision

4. Discussion

All reasons were listed and analyzed using the brainstorming technique, using the main and sub-causes diagram shown in Figure 2. According to this;

- It is possible that the ships had a machinery malfunction during their routine sailing and therefore they collided because they did not have the ability to maneuver effectively. Especially due to poorly maintained rudder major ship accidents occur in narrow waterways. With these rudders, ships change course very frequently in the straits. This situation causes rudder malfunctions. On the other hand, main engine failure may occurs frequently at ships. The reasons of engine malfuction can be poorly maintanence, using unsuitable spare parts, dirty bunker usage etc. The most common cause of ship accidents like the Independenta is the failure of navigation aids. Before invention of modern navigation aids as Electronic Chart Display and Information System (ECDIS), Automatic Radar Plotting Aid (Arpa Radar), Automatic Identification System (AIS), etc. simple aids were used on ships like classical radar. This has caused officers' skills to become more important than electronic navigation aids.

- Like most maritime accidents, this accident may have occurred due to human error. In particular, deficiencies in following established procedures and complying with the rules may be the main causes of the accident. Human error is the most important reason of the ship accident. According to accident reports and studies, %75 of the ship accident occured due to human error (Dominguez-Péry et al., 2021). When evaluated within the framework of this ratio, the cause of the Independenta accident is thought to be human error. It is very difficult to determine which ship caused this accident, especially since it occurred before the use of devices such as Voyage Data Recorder (VDR). In today's accidents, many accident-related data can be accessed in order to perform root cause analysis.

- Heavy weather conditions negatively affect ship navigation. Events such as wind and current prevent ships from drifting and progressing on the desired route. When the annual wind conditions of the Istanbul Strait are examined; Storms in the Istanbul Strait are more common in January can be seen. Storms from the beginning of September The number also begins to increase. Water in the Istanbul Strait from storms It has a great impact on movement, currents and navigation. Rains may also affect the course in the Istanbul Strait. For example, as visibility will decrease in heavy snowfall navigational safety is negatively affected. fog, mostly It is seen in March. It is rare in the summer months. Most good visibility, evening in November, December and January hours, and in other months at noon is happening (Koldem, 2006). The

accident occured at 15 November so can be said that visibility was good according to above data.

- Incorrect instructions and recommendations given by the relevant authority may cause a ship accident. In particular, incorrect and incomplete navigational warnings can lead to ship collisions. However, considering that both ships were navigating without pilot, it does not seem possible to give any wrong instructions. In addition, navigational aids are regularly checked in the Turkish Straits in the past and today. The area where the accident occurred is a port entrance with heavy ship traffic. It is believed that all necessary navigational aids are used and actively working.

5. Conclusion

The main and sub-causes that could have caused this accident were determined using the fishbone method. When we look at the environmental conditions, it turns out that the weather and visibility were not in a position to hinder navigation, according to the newspapers of that period and the statements of eyewitnesses. Considering the meteorological conditions of the Istanbul Strait such as current and visibility, restricted visibility, strong current and wind are not observed in November. For this reason, it would be wrong to say that meteorological conditions caused the accident.

It seems that there was no pilot on either ship at the time of the accident. There is no one on the ships except the ship's personnel. This eliminates the possibility of external guidance. Therefore external factors could not be the cause of the accident. Because at that time, there was no unit like VTS (Vessel Traffic Service) that monitored maritime traffic and gave external advice to ships. Therefore, the possibility of external guidance via radio is very low.

It is known that a pilot has just away from one of the ships and the other ship was waiting to get a pilot. It is known that both ships are ready to sail and there is no request for a delay in pilot hours. For this reason, the possibility of an error or malfunction in ship equipment is low. Human errors such as non-compliance with Colreg rules, lack of training, lack of communication and failure to follow procedures are likely to be the main cause of this accident.

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