THE RED-MED RAILWAY PROJECT A SERIOUS COMPETITOR TO THE SUEZ CANAL FOR CARGO CONTAINERS?

Salem Y. Lakhal
Université de Moncton, Canada
E-mail: salem.lakhal@umoncton.ca

Souad H'Mida
Université de Moncton, Canada
E-mail : souad.hmida@umoncton.ca

ABSTRACT

Israel and China have finalized a project plan initiated in 2012. This project received the green light from Israeli cabinet in March 2014. With this venture, China will build a cargo railway line connecting the port of Eilat in the Red Sea to the ports of Ashdod and Haifa on the Mediterranean coast in Israel. This project will be a shipping alternative to the Suez Canal. This statement is the corner stone of this paper and considered a hypothesis to be verified within this paper. The methodology used is based on the concept of "market position." The main conclusion, theoretically, the Red-Med railway could be an alternative to the Suez Canal for the 4,000 TFE Vessels containers transportation as far as costs are concerned. However, other issues, such as terrorism incidents, the security in the Suez Canal and the risk of its shutdown, must be considered too.

Keywords: Suez Canal, Red-Med Sea Railway Line, Israel, Egypt, container transport.

1.   INTRODUCTION

Establishing a railway line linking the Red Sea and the Mediterranean Sea is considered to be of strategic importance for Israel because it will serve as an alternative to the Suez Canal. For Israeli Prime Minister Benjamin Netanyahu, the strategic importance of this project is the possibility of linking Israel to the increasing and emerging economies of countries such as China and India (LEVITT, 2014).

Prime Minister Netanyahu states: "In the coming decade, new powers will arise and the State of Israel must create vital interests from a national strategy point-of-view. We have the ability to create an alternative transportation route that bypasses the Suez Canal – this is an insurance policy. Israel must become a continental land crossing route and create great power interests." (ANONYMOUS, 2012; SCOTT, 2014; ISRAELI-GOVERNMENT, 2012).

Based on thee geo-political picture in the Middle East, Israel continues to work on maintaining its security, its economic independence, and its resilience (LAKHAL, 2017). To ensure continued supply lines that are not interrupted by regional crises, Israel is working to develop and create convenient and fast shipping and supply routes, which connect the Mediterranean Sea to the Red Sea and provide access to the greater Asian oceans.

In this context, Israel imports raw materials, energy, and goods from countries in Asia and Africa, which is accomplished by vessels navigating through the Suez Canal, and, from there, to the ports of Ashdod and Haifa. However, there is no guarantee that the Suez Canal will remain open due to the failure of the Egyptian Government to impose its authority on the Sinai Peninsula since the coup on July 3, 2013.

In the event of a Suez Canal closure, the port of Eilat is a strong asset for Israel. The alternative route of going around Africa to enter the Mediterranean Sea is very expensive, while the port of Eilat could be a tangible alternative, which allows Israel to maintain its independence and not stay linked to its neighbours (Figure 1).

Current route

Europe → Suez Canal → Asia

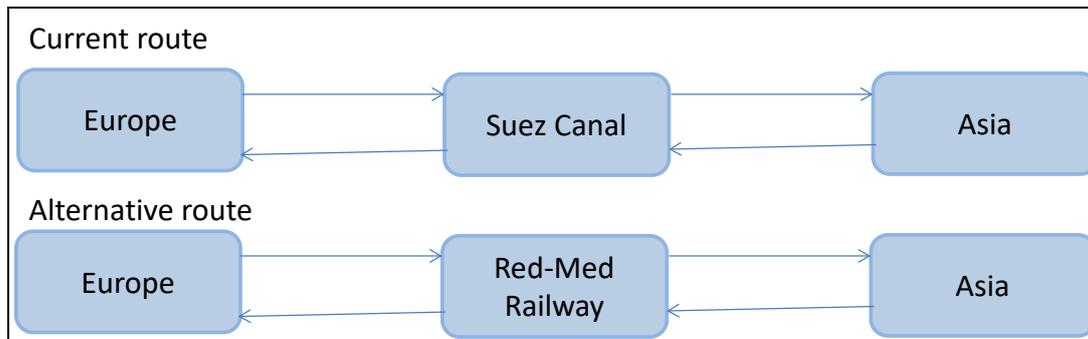**Alternative route**

Europe → Red-Med Railway → Asia

Figure 1: Current shipping through the Suez Canal route versus the alternate route via the Red-Med railway project.

Transportation from Eilat to the centre of Israel is not sophisticated, currently does not allow for a fast, large-scale transport of containers and goods. According to the Israeli point of view, it is not necessary to watch events in Egypt to understand that the port of Eilat is a strategic asset to Israel and to recognize that establishing a rail line from the port to the centre would increase its value.

According to Verisk (2015), the ongoing crackdown in Egypt against the political opposition would increase the potential for more frequent terrorist attacks. Whilst the government of President Abdul Fatteh Al-Sisi's hard-line security stance has reduced the likelihood of large-scale violent protests for the medium term, terrorist incidents have become more frequent and ambitious under Al-Sisi's time in office – including in Egypt's major urban hubs.

Over the past three years, a shift towards more frequent and widespread terrorist attacks have been registered as indicated in Figure 2 and 3. One-hundred-and-thirty terrorist attacks were recorded over the 2014/15 period (VERISK, 2015). This significant increase marks a more-than fourfold increase in the number attacks on the corresponding 2013/14 period (when there were 29 terrorist attacks in total). There were no recorded terrorist attacks in the corresponding 2012/13 period. The chaotic situation in Egypt gives compelling reason to Israel to go forward with the Red-Med Railway project.

900
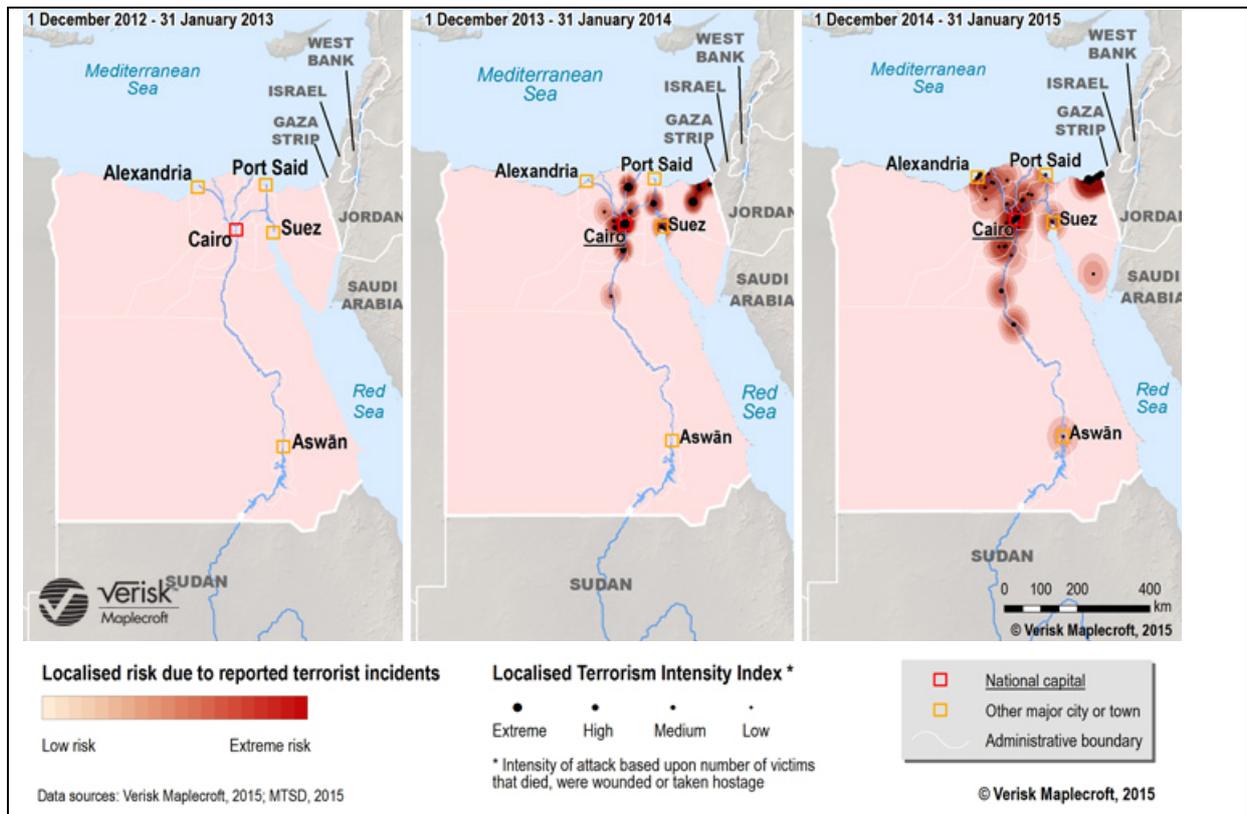
Figure 2: The increasing terrorism attack in Egypt
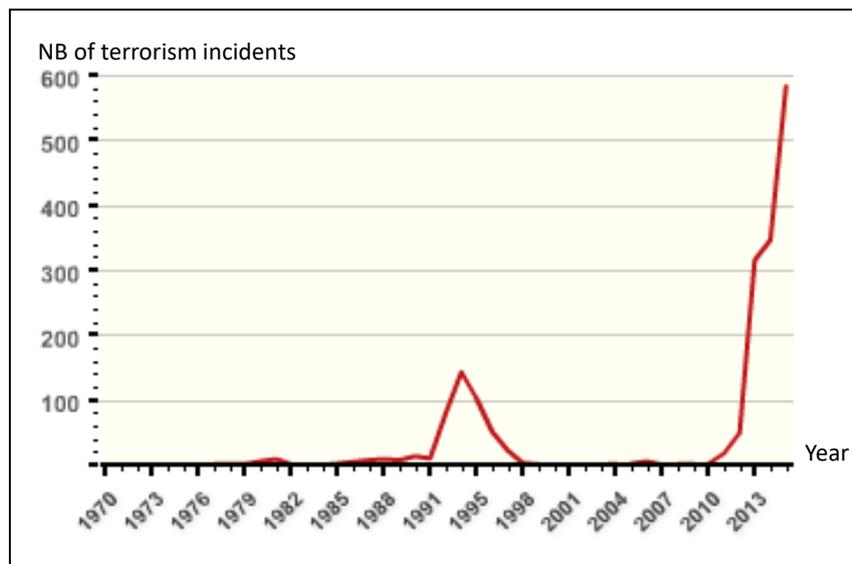
Figure 3: The evolution of number of terrorism incidents in Egypt
Source: https://www.start.umd.edu/gtd/search/Results.aspx?country=60

2. LITERATURE REVIEW

Despite some press articles related to the Red-Med railway project, there are a very few academic studies associated with bridging Asia to Europe by land transportation.

901

Looking for an alternative to the Suez Canal become an issue for Israel after the closing of the Suez Canal during the Sinai Campaign in 1956 and again after the June War of 1967 (GRADU, 1977).

The State of Israel was in a position to use the Negev land bridge as an alternative to the Canal, whereby freight could move between the Red Sea and the Mediterranean Sea. According to Gradu (1977), immediately upon the 1967 closure of the Canal, representatives of Israeli economic concerns began to look into the possibility of setting up such route.

Consequently, in 1970, a land bridge was established by the Israeli shipping line, Zim, to provide cargo service between Ashdod and the port of Eilat. Simultaneously, a 42-inch oil pipeline with a capacity equal to 60 million tons per year was laid via the Negev from Eilat to Ashdod.

The use of the continental bridge for cargo traffic and the pipeline for the oil transportation gave viability to the opportunity for a railway link between port of Eilat and the ports on the Mediterranean Sea. As container cargo increases, a railway project could be a strong alternative for this kind of freight.

An economic concern, Gradu (1977), reported that the Israeli Transport Ministry conducted a calculation of the difference in costs between the route around Africa and the continental bridge and found that despite several bulk transfer points, a large percentage of the cargoes could be transported at lower cost via a continental.

The Red-Med Railway could have an important historical dimension in the eyes of some Israelis. For example, Schlegel (2013) points to the Bible where God, through the prophet Ezekiel, says, "This is Jerusalem; I have placed her in the center of the nations, with countries round about her" (EZEK. 5:5).

Schlegel adds that Canaan-Israel is a narrow strip of land from the Mediterranean Sea to the Jordan River is 45 miles –sitting at the center of three continents: Asia, Africa, and Europe. The Israeli geographic position gives the country great importance as a land-bridge between the three continents, particularly between the two most ancient cradles of civilization – the Mesopotamia and Nile River basins.

Historically, Canaan-Israel has been coveted by empires in Asia, Africa, and Europe for this geo-political importance as a commercial and military hub connecting the continents. For Schlegel (2013), "The Sovereign God has chosen this land at the "center of the nations" to work His purposes for mankind Economy".

The research questions are:

(1) Could the Red-Med Railway provide a viable alternative to the Suez Canal for container traffic between Europe and Asia?

(2) Is the Red-Med Railway cost competitive compared to Suez Canal?

(3) Does the Red-Med Railway, as a possible complementary route to Suez, represent an opportunity to improve responsiveness and adaptability in supply chains?

The methodology used is represented in Figure 4, and it is the one used by Notteboom (NOTTEBOOM, 2012; NOTTEBOOM, 2011), based on the concept of "market position." This is made operational by analyzing and comparing transit times and generalized costs on a set of origin–destination relationships.
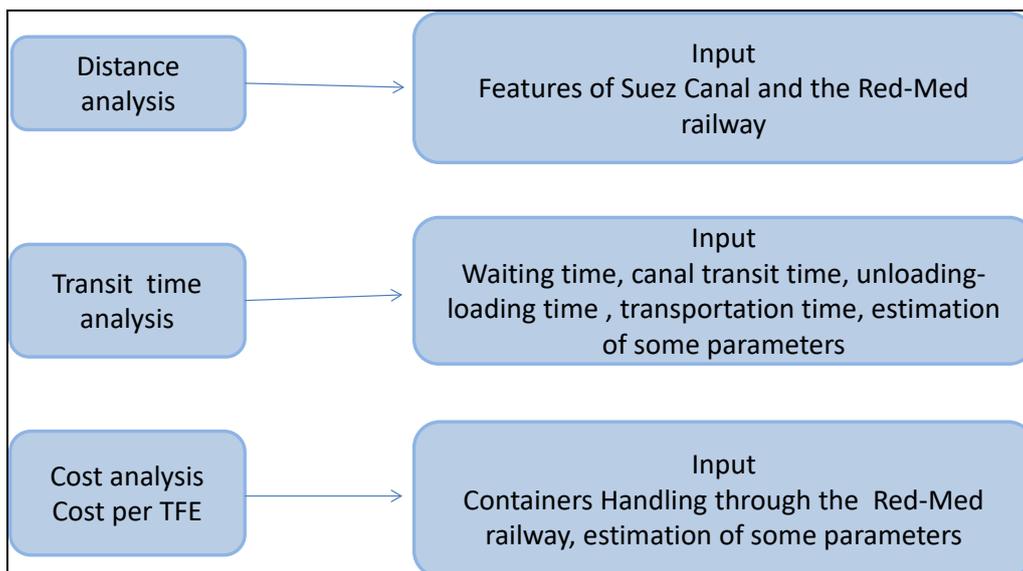

Figure 4: Methodology used

The paper is structured as follows: section 3 presents the logistic analysis of the transfer of vessels cargo charged by 8000 TFE (twenty feet equivalent) containers. Section 4 develops the competitive costs between the Suez Canal and the Red-Med railway. Section 5 draws up a set of conclusions.

3.   RED-MED RAILWAY AS AN ALTERNATIVE TO THE SUEZ CANAL FOR CARGO FREIGHT

The map in Figure 5 indicates the principal characteristics of the Red-Med railway project; some of these characteristics will be discussed later. On the other hand, the investigation on the relevant features of the Suez Canal to the Red-Med project are represented on Figure 6. In 2014, more than 38 million TFE containers were shipped by the Suez Canal (see Table 1 & 2).

3.1.   The determination of the transit time through the Suez Canal

The transit time from Port Said to Suez (southbound convoys) is between 14 and 16 hours, with the vessels arriving in a minimum of six hours before the transit time (EL-SHARKAWY, 2016). Then, between 20 and 22 hours are required to ship cargo through the Suez Canal.

The transit is organised by convoys in both directions. For example, convoys may begin at 0100 hours up to 0500 hours; therefore, the time of arrival at anchorage is 1900 hours. Vessels arriving at 1900 hours to 2100 hours may join the convoy but there is a surcharge of three percent (3%) of canal dues. Vessels arriving at 2100 hours to 2200 hours may join the convoy with an additional five percent (5%) of Canal Transit Dues.

Consequently, if a vessels misses the time limit window of arrival at anchorage and if it does not want to pay the surcharge, it must wait until the next convoy commences at 0700 hours to 0900 hours (EL-SHARKAWY, 2016). In this case, the vessel will have to wait six more hours, making the total transit time between 26 to 28 hours.

For convoys taking the south/north direction from Suez to Port Said (northbound convoy), there is only one convoy, which commences from 0500 hours to 1000 hours. The transit time is between 12 to 14 hours (LETH, 2016). The arrival time is 0200 HRS with a surcharge payment required varying between three percent (3%) to ten percent (10%) of the normal transit dues with a maximum between 7,000 to 20,000SDR (Special Drawing Rights) with 1SDR equal to 1.5USD (IMF, 2016). Vessels arriving after 0700 hours must wait 19 hours for the next convoy. For the northbound direction, the transit time could be between 15 and 37 hours.

904
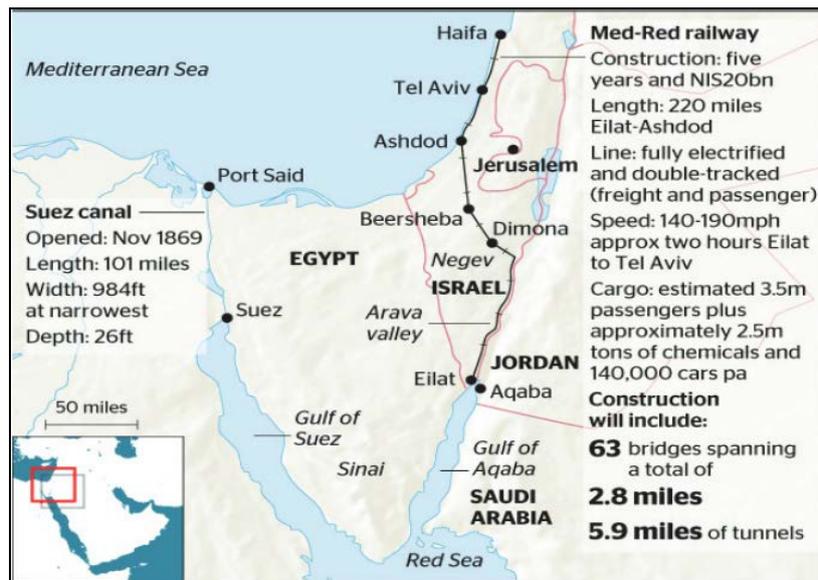
Figure 5: The Red-Med railway as an alternative to the Suez Canal

- Overall length: 192 km
- From Port Said to Ismailia: 78 km
- From Ismailia to Port Tawfik: 84 km
- From the Fairway Buoy to Port Said Light house: 22.5km
- Breadth at water level 300 m
- Width Between buoys 180 m
- Maximum permissible draught of ships 53 ft
- Depth of the Canal 19.5/20 m
- Cross Sectional area: 4000/4500 m2
- Pilotage is compulsory for all vessels over 300 tons
- Speed Limits: 11km/h -16km/h depending on Vessel type and tonnage of the vessel
- Average transit time is 14 hours
- Suez Canal Convoys: Navigation in the Suez Canal is around the clock, Ships transit the Canal in Convoys There are three convoys daily.

  Source: El-Sharkawy Group shipping & Trading (El-Sharkawy, 2016)
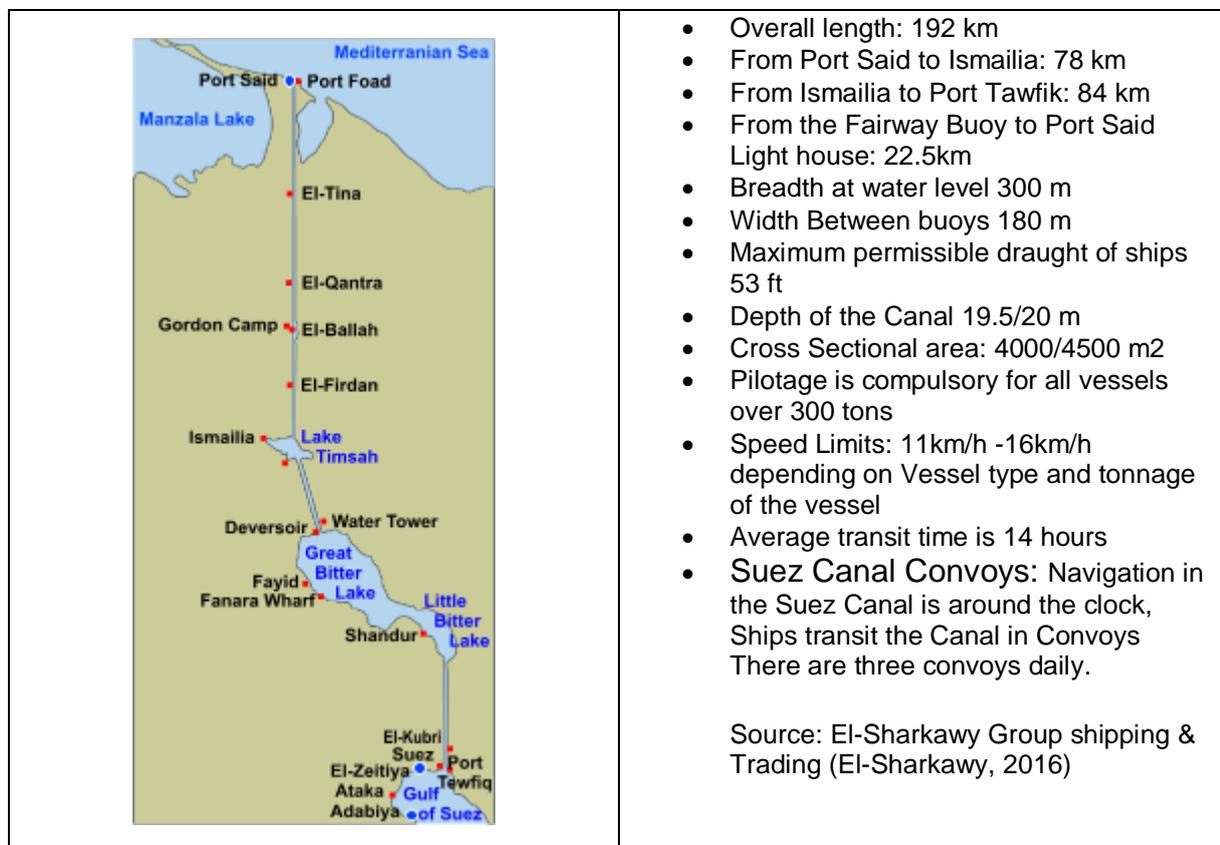
Figure 6: The main Suez Canal features

905

Table 1: Evolution of the nautical characteristics of the Suez Canal.

	Unit	1869	1956	1962	1980	1996	2001	2010	2015
Width at 11 m depth	m	--	60	89	160/175	180/200	195/215	205/225	205/225
Maximum draft of vessels	feet	22	35	38	53	58	62	66	66
Overall length	km	164	175	175	189.8	189.8	191.8	193.3	193.3
Doubled parts length	km	–	27.7	27.7	77	77	79	80.5	113.3
Water depth	m	8	14	15.5	19.5	21	22.5	24	24
Max. tonnage of vessel (DWT)	ton	5000	30,000	80,000	150,000	180,000	185,000	210,000	240,000

Source: Author elaboration based on data Suez Canal Authority.

Table 2: Traffic Containers through the Suez Canal from 2000 to 2014 (No. of TEU's by Ship Status)
Source: the Suez Canal Authority: www.suezcanal.gov.eg/TRstat.aspx?reportId=8

Year	Laden	Ballast	Total
2000	12,109,374	1,922,349	14,031,723
2001	12,331,156	1,820,251	14,151,407
2002	13,779,935	2,111,116	15,891,051
2003	15,937,527	2,948,329	18,885,856
2004	18,591,937	3,738,330	22,330,267
2005	20,567,661	4,689,745	25,257,406
2006	22,915,716	5,636,892	28,552,608
2007	26,301,928	7,838,735	34,140,663
2008	27,772,184	8,073,246	35,845,430
2009	24,746,307	5,023,627	29,769,934
2010	29,589,864	7,184,913	36,774,777
2011	31,653,579	6,988,327	38,641,906
2012	31,601,291	6,115,979	37,717,270
2013	32,270,166	5,892,106	38,162,272

Source: Author's calculation based on data Suez Canal Authority.
Note: the traffic containers statistics are no more available in the Suez Canal website (verified on 2106 Dec. 15)

3.2.   The determination of the transit time through the Red-Med railway

To determine the transit time through the Red-Med railway, variants to consider are the times to:

- unload the containers from the vessel;

- load the containers on the train;

- transport the containers to the other coast; and

- load the containers on another vessel to continue its route.

For example, if the containers originate in Eilat, the estimate includes the time needed to unload containers from the vessel, transfer the containers to the Ashdod

906

port, and load them to another vessel to continue the voyage to Europe. For most competitors, this time allows the comparison with Suez Canal to the Red-Med project.

3.2.1. Vessel unloading and train loading time

Considering an 8,000-container vessel and four cranes on the port deck working at the same time to discharge the vessel, the containers are taken from the vessel and put directly on the train wagons. Each wagon can transport four TFE containers. A train with 100 wagons could transport 400 containers in one voyage.

Depending on the efficiency of the cranes, it is possible to unload up to 50 containers in one hour. In this study, we chose a conservative estimate of one crane handling 40 containers in an hour (DUCRUET et al., 2014). Therefore, the time required to load 100 train wagons is 2.5 hours; considering some contingency factors, the time is rounded up to 3 hours loading time.

In connection with this project, the newspaper Yediot Aharonot published an article by attorney Yair Hazan six days after the outbreak of the Egyptian revolution, confirming that "port of Eilat turned to be a strategic asset during the unrest situation in Egypt."

3.2.2. Train transportation time from the Red Sea to Mediterranean Sea

The railway route between Eilat and Ashdod is 220 miles (SCOTT, 2014; UNISHIPING, 2016), which is the equivalent of 354 km. There is no indication of the Red-Med railway class compared to the United States; the Federal Railroad Administration has developed a system of classification for track quality. The class of a section of track determines the maximum possible running speed limit. Most mainline tracks in the United States own Class 4 tracks allowing a maximum speed equal to 60 mph (97km/h) (WIKIPIDIA, 2016).

In this analysis, the average speed is 75km/h, which is higher compared to the average train speed in Europe (RFI, 2014). According to MATHIOT (2009), former France President Sarkozy declared in 2008 that the average speed was 13Km/h. For long distances, average speeds differ in other areas. For instance between France-China (12000 km), it takes 10 days at an average speed of 50 km/h (Amedeo and Nodé-Langlois, 2009); and, for a 13000 km trip between East China to Madrid (Spain), it takes 22 days at an the average speed of 24.6km/h (RFI, 2014).

Therefore, for the Red-Med railway, 354 km could take between 4.5 to 5 hours, which is an optimistic assumption. For this analysis, it would take 5 hours to go to Ashdod from Eilat and another 5 hours to return.

Scott (2014) reported that Red-Med passenger railway could reach a speed of 140 to 190mph . Of course, the speed of a freight train is quite different to a passenger train; these parameters must be accurate as they are one of the cornerstones of the calculation. Troche (2005) studied the question and calculated the difference between a (i) passenger train used as a freight train and a (ii) wagon freight train. The speed of the latter is inferior when compared to the speed of the former. Furthermore, a speed of a 120km/h for a wagon freight train is considered high (Table 3).

Table 3: High-speed rail freight

Denomination	Maximum speed	Predominant vehicle
High-speed rail freight	>200 km/h	Modified high-speed passenger trains Fixed train-sets
Semi-high-speed rail freight	140-200 km/h	Both vehicles based on passenger train concepts and further developed freight wagons Fixed train-sets as well individual freight wagons
Conventional rail freight	<120 (140) km/h	Conventional freight wagons

Source: (Troche, 2005)

3.2.3. Train unloading and vessel loading

When the train arrives in Ashdod, the containers will be unloaded and reloaded directly on another vessel waiting. This operation will take three hours, which is the same time to unload the vessel and load the train. After that, the train will be loaded with containers from another vessel waiting in the port, taking 3 hours. Once loaded, the train will return to Eilat in 5 hours.

After returning to Eilat, the train will be unloaded (3 hours), and the cycle will begin again. The complete cycle takes a total of 22 hours (see Table 4).

Table 4: Train's time cycle to transfer a container load between Eiliat-Ashdod

NB	Hou	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Train																						
1	t1	Loading	Loading	Loading	Transport T1	Transport T1	Transport T1	Transport T1	Transport T1	Unload	Unload	Unload	Load	Load	Load	Transport (return)	Transport (return)	Transport (return)	Transport (return)	Transport (return)	Unload	Unload	Unload

If that work starts at zero hour, after three hours, train1 leaves for Ashdod and train2 starts loading, and so on. Seven trains will load before train1 returns after 21 hours and it takes 22 hours to load the 7 trains. Then, train 1 has to wait one hour, before begin loading again.

908

Using spreadsheet calculations, 70 hours are needed to unload an 8000TFE vessel, transfer the containers by train to Ashdod, and load them on other vessels (Table 5). If it is 4000TFE vessel, it will need ten voyages and 39 hours to make the transfer from Eilat to Ashdod.

Table 5: Time needed to transfer 8000 TFE from Eilat (Red Sea) to Ashdod (Mediterranean Sea)

The table is a Gantt-style schedule (hours 1–40 in the upper block and hours 41–80 in the lower block) showing, for 20 train numbers (NB 1–20) using trains t1–t7 cyclically, the successive operations: Loading, Transport (T1–T7), Unload, Load, Transport (return), Unload. A yellow cell marks "1 hour waiting time of train 1 before to return and start loading containers." In the lower block a vertical line at hour 70 marks "End of loading the last containers on the vessel."

3.2.4. Capacity estimation of Red-Med Railway

Assuming that there are two ways to avoid accident risks and to facilitate traffic coordination, we considered 10 minutes between each voyage. In 24 hours, 144 voyages could be scheduled. A train with 100 wagons transports 400 TFE containers. In 24 hours 57,600 containers or 20,736,000 per year could be transferred from one cost to another.

Is this capacity enough to compete with the Suez Canal? The number of containers traversed the Suez Canal in 2013 was 38,162,272 TFE northbound and

909

southbound; one way, would be 50% of this quantity 19,081,136 rounded to 20,000,000. Theoretically, the RED-MED railway could replace the Suez Canal.

3.2.5. How big should be the port of Eilat and Ashdod to replace the Suez Canal?

The 20,000,000TFE containers are equivalent to 2,500 vessels having 8,000TFE each. Considering that each vessel requires 62 hours to be unloaded, 2500 vessels need 155,000 hours. Assuming that the port is working 360 days a year, 17.69 rounded to 18 places or berths are required to load and unload vessels in the port. To handle 40 million containers (20 million each way), 40 berths are needed. A port with this capacity is considered a very large. For example, in 2013 the maximum traffic of containers was in the Port de Shenzhen (China) followed by the port of Singapore with traffic of 33 million and 32 million containers respectively. Furthermore, the Port of Singapore has 59 berths for container traffic (Table 6).

Clearly, to be an alternative to the Suez Canal, the Red-Med railway should be connected to two ports (Eilat and Ashdod) larger than the biggest port in the world. At present, the port of Ashdod's capacity is 1.3 million TFE. On the other side, the port of Eilat is a small one with 150,000 TFE, a 12-metre water depth and, because of its location, limited growth potential. Furthermore, the railway should be double-tracked and reserved totally for freight transportation, which is different to the project's scope that foresees a double track for freight and passenger transportation.

910

Table 6: Annual traffic in millions of TFE sorted by the important ports in the World

Rank	Ports	Countries	2015	2013	2012	2011	2010
1	Port of Shenzhen	China	24,205	33,617	32,529	31,739	29,069
2	Port of Singapour	Singapore	30,922	32,240	31,649	29,937	28,430
3	Port of Shanghai	China	36,537	23,278	22,940	22,570	22,509
4	Port of Hong Kong	China	20,073	22,352	23,117	24,384	23,699
5	Port of Busan	South Korea	19,467	17,686	17,046	16,184	14,157
6	Port of Ningbo-Zhoushan	China	20,627	17,351	15,670	14,510	13,144
7	Port of Tsingtao (Qingdao)	China	17,436	15,520	14,503	13,020	12,012
8	Port of Canton (Guangzhou)	China	17,590	15,309	14,743	14,260	12,550
9	Port of Jebel Ali (Dubaï)	Arab Union Emirates	15,592	13,641	13,270	13,000	11,600
10	Port of Tianjin	China	14,111	13,010	12,300	11,580	10,080
11	Port of Rotterdam	Pays-Bas	12,234	11,621	11,865	11,876	11,145
12	Port of Dalian	China		10,860	8,060	6,400	5,242
13	Port Klang (Kuala Lumpur)	Malaysia		10,350	10,000	9,603	8,870
14	Port of Kaohsiung	Taiwan		9,937	9,781	9,636	8,871
15	Port of Hambourg	Germany	8820	9,302	8,863	9,014	7,896
16	Port of Anvers	Belgium	9,653	8,578	8,635	8,664	8,468

Author elaboration based

On http://fr.wikipedia.org/wiki/Liste_des_plus_grands_ports_%C3%A0_conteneurs

To simplify the calculation, we made an assumption that the ports of Eilat and Ashdod are working 24 hours a day, 7 days a week, and 365 days a year. This is different to present working conditions; for example, the port of Eilat works six days a week (Saturdays are off) (Unishiping, 2016). In addition, the working hours are: in winter from 0600-1400hrs and 1530-2300hrs; in summer from 0530-1330hrs and 1600-2300hrs.

3.2.6. *How many trains should the Red-Med railway have to be an alternative to the Suez Canal?*

In section 2.2.4, the consideration was that to be an alternative to the Suez Canal, the Red-Med railway should conduct a train every 10 minutes. A train takes 22 hours to cycle for another load. Therefore, 22 x 6 = 132 locomotives and 13,200 wagons need to be in operation.

In conclusion, the Red-Med railway project could be an alternative to the Suez Canal but not with the initial scope. The port of Eilat and Ashdod should be expanded to be as large as the largest port in the world. In addition, a double track should be reserved to carry the freight transportation. Again, this is different from the

911

initial project scope considering a double track for freight and passenger transportation.

4.   THE COST COMPETITIVELY OF THE TRANSPORTATION THROUGH THE RED-MED RAILWAY

In this section, the cost to transfer a TFE container by Red-Med railway will be estimated and compared to Suez Canal route cost. Due the lack of information related to unloading 8000 TFE vessels in the Port of Eilat, loading on to 400 TFE trains, transporting the load 354 km to Ashdod, and loading on to vessels waiting in Ashdod, we have made reverse calculations by estimating the cost to transfer an 8000 TFE vessel through the Suez Canal.

The transfer time is rounded up to 24 hours (a day) from the transfer time (22 hours) estimated previously (section 3.1). The cost is: the charterage of one vessel at the rate 45,000USD/per day, plus the ship's operating cost, which is around 23,000USD, plus the Suez Canal toll, which is around 550,000USD, for an 8000TFE vessel with 60 per cent of load factor (NORDQUIST, 2013; LEE, 2013). The total will be 628,000USD or 78,5USD per container.

4.1.   The unloading and loading cost

The discharge cost is considered one of the performance indicators of the port and there is a lack of empirical and comparative academic studies on time-related port performance indicators in general. The discharging cost was evaluated by (MOGHADAM; NOORI, 2011) 5,3GBP / container in 2010; considering a five percent (5%) price increase, in 2015 the cost would be approximately 10USD / container. In Canada, the cost to load or unload a container is between 100 and 150 CAD equivalent to 80 and 120 USD, depending on the port (FROST; ROY, 2008).

Considering the GDP of Israel, Canada, and Iran, it appears that 10USD is too low and 80USD is too much. For this study, we considered 50USD for loading and unloading a container. To discharge or to charge 8000 TFE vessels would cost 400,000USD. The discharging cost is a result of an average container handling time, crane productivity, and gang productivity. This kind of metric is collected by shipping lines, e.g. Maersk with its Daily Maersk Efficiency Ranking (HONG et al., 2013).

912

4.2.   The train transportation cost

The average cost to transport a container by train is difficult to estimate because there is many characteristics and services that could be included or excluded to affect the price. Consequently, for example, the British railway recommends hiring a third party logistic service to manage the transport service. To estimate the price to transport a container, we chose the website of the New Zealand Railway: Kiwi Railway http://www.kiwirailfreight.co.nz/pricing.aspx.

The distance between Christchurch and Dunedin is comparable to the distance between Eilat and Ashdod. The price on March 11, 2015, was 805NSD, which is equivalent to 589USD. Considering that the GDP per capita is 15% more in New Zealand compared to Israel (WORLBANK, 2016), the 589USD cost is reduced by 15%, leaving the price at 515USD. This price is for the transportation of one container. Considering one third of the 515USD (171.7USD rounded up to 175USD), the cost to transport 8000 TFE containers from Eilat to Ashdod will be 1,400,000USD.

Comparing this result to data provided by VERNY and GRIGENTIN (2009) related to their study concerning container shipping on the Northern Sea route versus the Trans-Siberian Railway and the Suez Canal route, they found that the railway route is 30% more expensive. Consequently, the transfer of one container from Eilat to Ashdod through the Red-Med railway could be 78,5USD x 1.3 = 102USD. Therefore, a 400 TFE train would cost 40,800USD; the cargo of 8000 TFE would cost 816,000USD.

In conclusion, to transfer 8000 TFE vessel containers from Eilat to Ashdod could cost 400,000USD + 1,480,000USD = 1,880,000USD. Compared to the cost of 628,000USD to transfer via the Suez Canal, using the Red-Med railway will cost three times more.

5.   CONCLUSION

Theoretically, the Red-Med railway could be an alternative to the Suez Canal for the container transportation. The criteria of the transit time and the cost was discussed in this paper. The main results were: (i) concerning to the transit time, the Red-Med railway could compete the Suez Canal in the case of 4,000 TFE Vessels, but (ii) for a the transfer cost, a TFE container unloaded from a vessel in Eilat,

913

loaded on a train, transferred to Ashdod, and loaded on another vessel would cost approximately three time more than transit through the Suez Canal.

The cost will be also three times more than the Suez Canal for a transfer from Ashdod to Eilat. This conclusion indicates that the Suez Canal has the advantage as far as costs are concerned. However, other concerns, such as the security in the Suez Canal and the risk of its shutdown, must be considered. With a turbulent situation in Egypt and the increase of the terrorist attacks in the region as shown in this paper, a shutdown of the Suez Canal cannot be excluded.

In this situation, the Red-Med railway becomes vital for maritime transport. Additionally, it would compete with the route around the Cape of Good Hope. The cost of conveying a container along the Red-Med railway would not prohibitive, despite the fact that the operational costs of the Cape of Good Hope line can be relatively high.

In effect, to be a complete alternative to the Suez Canal in case of its closing, the Red-Med should be able to transfer around 20,000,000 TFE in each direction. Logistically, it is possible, but the infrastructures in the ports of Eilat and Ashdod should be extended to become comparable to the largest ports in the world. This constraint leads to nuance the statement: the Red-Med could be an alternative to the Suez Canal.

Therefore, the Red-Med could be an alternative for a certain percentage, for example, a fraction of 20% or 30% of the traffic. In a future research, the rate or the percentage that could assure the viability of Red-Med railway as an alternative to the Suez Canal for container transport could be determined optimally.

These conclusions are supported by a detailed analysis of container ship schedules with some assumptions about: the size of vessels, the average speed of the trains, the cost to load and unload containers on the vessels, and the working time of the ports of Eilat and Ashdod (24 hours a day, 7 days a week, 365 days a year). The reality could be different. All the assumptions are indicated clearly to allow verification, calculation, and adjustment.

It is important to mention that the Suez Canal is expected to see several improvements with a recent decisions made by the Egyptian Suez Canal Authority,

so that it may accommodate the increasing influx of containers between Asia and Europe.

We recognize, however, that this research has certain limitations. First, as the economic environment is continuously evolving, any results based on calculations are subject to change. The various expenses contributing to the general cost of exploiting the Red-Med railway are linked directly to independent external factors (the cost of the use of the infrastructure in the ports, a barrel of oil, political instability, security in Sinai Peninsula, etc.).

Second, all this discussion rests upon complex, uneven, and uncertain variables whose eventual outcome remains beyond our knowledge: terrorist activity and political arrangements, instability in Egypt, etc. Due to the paucity of reliable results on this subject, other qualitative and quantitative studies of container transport via other Route are doubtless necessary.

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917