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An Analysis of Multimodal Route via Iraq to the Mediterranean and Europe compared to the Suez Canal

By

SAFAA ABDULHUSSEIN JAIYZ ALFAYYADH

Republic of Iraq

A dissertation submitted to the World Maritime University in partial Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

In

MARITIME AFFAIRS

(PORT MANAGEMENT)

2010

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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(With the Name of Allah, the Most Beneficent, Most Merciful)

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Abstract

Title of dissertation: **An Analysis of Multimodal Route via Iraq to the Mediterranean and Europe compared to the Suez Canal.**

Degree: **MSC**

Multimodal transport contributes significantly to the concentrations of international and domestic trade. There are several competition means, by which the different modes of transport perform to attract more cargo to be moved. The users of multimodal transport are concerned about its cost effectiveness and the level of service provided by these modes. In most cases, sea transport is the cheapest mode of transport compared with air, road and land transport, but it takes longer time due to the ship speed and time spent in ports. Canals can act as bottlenecks for sea transport through increasing transit time, limiting the vessel size and high canal dues, which increase transport cost.

The dissertation analyzes the possibility of introducing an alternative multimodal transport to the Suez Canal route in order to ascertain the competition between them. By calculating transport costs for the existing and proposed routes, the Suez Canal route has advantages in terms of cost effectiveness, environmental friendliness and being more certain in the current situation for international trade between Europe and Asia. Another detailed analysis was carried out to evaluate the significance of the new route to the Middle East and Arabian Gulf countries. It discussed the potential benefits and contributing of the new multimodal route to the economic growth of the region, particularly in Iraq and Syria. The efficiency and reliability of the new route are the conditions for increasing its competitiveness and attractiveness in the long term. Further, the crude oil transport by pipelines from the gulf countries to the Mediterranean for transshipment to Europe and the US is a cheaper and greener transport system than the existing one.

**Key Words:** Multimodal transport, cost effectiveness, Suez Canal route, analysis, economy growth, transport efficiency and reliability.
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List of Abbreviation

AHP                  Analytic Hierarchy Process
BC                   Bulk Carrier
C.I.I.T.I             Italian Consortium for Iraq Transport Infrastructure
CIF                  Cost, Insurance and Freight
CO₂                 Carbon Dioxide
CV                   Container Vessel
DWT                  Dead Weight Tonnage
EASA                 European Aviation safety Agency
EDI                  Electronic Data Interchange
EMSA                 European Maritime Safety Agency
ERA                  European Railway Agency
EU                   European Union
FEZ                  Free Economic Zone
FMCDM               Fuzzy Multiple Criteria Decision Making
GC                   General Cargo
GCPI                 General Company for Ports of Iraq
GDP                  Gross Domestic Product
GHG                  Green House Gases
GPO                  Global Port Operator
GT                   Gross Tonnage
Gvt                  Governorate
H&M                  Hull and Machinery
IMB                  International Maritime Bureau
IMO                  International Maritime Organization
IOM                  Iraqi Oil Ministry
IMOP                 Iraqi Ministry of Planning
IRR                  Iraqi Republic Railways
ISPS code            International Ship and Port Facility Security Code
JBIC                 Japan Bank for International Cooperation
JIT                  Just In Time
km/h                Kilometer per hour
MARPOL               Marine Pollution Convention
MT                   Multimodal Transport
NM                   Nautical Mile
NOx                  Nitrogen Oxides
P&I                  Protection and Indemnity
RORO                 Roll On Roll Off
SC                   The Suez Canal
SCA                  Suez Canal Authority
SECA                 Sulphur Emission Control Area
SOx                  Sulphur Oxides
TEN-T                Trans European Transport Network
TEU                  Twenty Equivalent Unit
<table>
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<td>TSR</td>
<td>Trans Siberian Railway</td>
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<tr>
<td>TTI</td>
<td>Taxas Transport Institute</td>
</tr>
<tr>
<td>UK</td>
<td>The United Kingdom</td>
</tr>
<tr>
<td>ULCC</td>
<td>Ultra Large Crude Carrier</td>
</tr>
<tr>
<td>UNCTAD</td>
<td>United Nations Conference on Trade and Development</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>US</td>
<td>The United States of America</td>
</tr>
<tr>
<td>$ m p.a</td>
<td>Million US Dollars per Annual</td>
</tr>
<tr>
<td>WMU</td>
<td>World Maritime University</td>
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<td>WTO</td>
<td>World Tourism Organization</td>
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Chapter 1

1. INTRODUCTION

1.1. Background

Today, the maritime industry is a major component of an integrated economy, making up a substantial part of every country's GDP and national employment. Traditionally, this industry in every country has established its unique advantage of competitiveness due to its domestic demand and location in the international market. However, with the globalization of the world economy and international market formalization, the maritime industry faces double pressure from other modes of transport and the change of demand.

The alteration of the market situation is the main dominating element of transport need. Although sea transport has moved most cargo in terms of volume and value, the modal shift of transport has been dramatically growing especially over short distances for cargo when the advantages of economies of scale do not have a big effect on transport cost. Moreover, the reduction of the environmental threats by multimodal transport (MT) encouraged the diversification of transport modes. Since the market is always changing according to development in different regions, the potential ability of the Middle East and Africa to develop could dominate the future market, which urges the hinterland connections to develop accordingly. The Arabian Gulf countries' economies mostly depend on oil exportation which make them relatively comfortable but the depletion of oil reserves could be a future threat. Therefore, to overcome such difficulties these countries should explore other sources to generate their income (Valsson, 2006).

Today, ports and shipping are apparently interrelated with other relevant factors in the logistics and supply chain and an economically significant factor for competitiveness in the shipping industry (Ma, 2010a).
The strategic position of Iraq connects the Middle East with Europe via Turkey by highways and rail transport and with the Mediterranean via Syria and Jordan by multimodal transport. A new route has been proposed from Asia to Europe via the Arabian Gulf by constructing a new hub port in the north of the Gulf to be connected by railway, highway and waterway connections with Syria and Turkey, which have hinterland connections with Europe.

The shipping lines are keen to use whatever routes that could be possible if they are cost effective. Therefore, the new routes could be appropriate alternatives to the present one due to piracy threats and future market development. On the other hand, due to draft limits because of the sedimentation problems in the current ports of Iraq and the long distance of the port approach, the new location of the port might have geographical advantages and competitiveness with regional ports in terms of importing and exporting cargo to increase the market share.

Furthermore, the location of the new seaport project might have advantages due to consumption growth in the named region which will find a new industrial market leading to manufacturing production centers. This dissertation will analyze the cost effectiveness in order to draw conclusions on whether or not the alternative routes can compete with the Suez Canal in terms of cost, security (piracy) and the environment. Moreover, it seeks to analyze the impacts of the new port on Iraqi’s economy, especially with the new trend of development in transport infrastructure and the country’s trade.

1.2. Significance of the Research

Ports have a significant function for the national economy of a country due to the economic and social impact which is demonstrated by any country's economy increasing by 1.4% when the port efficiency increases by 1% (Ma, 2010b).

The demand for having a port for cargo and ships to import and export cargo increases in terms of services and facilities where the cargo is transferred from one
mode of transport to another. The most important elements affecting competition between ports are as follows: port tariff, terminal throughput, market share, market concentration, port location, accessibility, port infra/superstructure and hinterland connections (Carriou, 2010b). Ports have always been considered as vital gateways for the export and import of raw materials, semi-manufactured and manufactured products from/to different markets located worldwide, especially in industrial countries (UNCTAD, 1998).

The increasing demand of trade between Asia and Europe due to globalization of trade, in addition to security problems related to piratical attacks in the Gulf of Aden will probably increase the waiting time of ships that use the Suez Canal. Therefore, the alternative route could be a competitor for the existing route in such sea transport. It is also hoped to attract more shipping lines to call the new deep sea port, which is proposed to be constructed in the north of the Arabian Gulf to cope with the development of Iraq as a logistic centre in the region.

The new route can improve the economic situation for Iraq, Syria, Jordan and Turkey which obviously will contribute part of these countries' GDP from transport and logistics, which is considered trade improvement. The research took point of views and benefits of both the ports and the shipping companies into consideration.

1.3. Research Objectives and Scope

The dissertation will discuss the present situation of existing routes and the advantages of new routes for international trade and supply chains by analyzing their cost effectiveness. In addition, the opportunities of a new concentrated market and Iraq's economic benefits will be analyzed, as well as the selection of routes and ports by shipping lines as these are the most important elements since they are the users of the new routes. Therefore, the research will analyze the available infrastructure for Iraq's transport system and the cost of infrastructure of new multimodal transport in order to demonstrate the probable advantages which could be acquired by ship
owners and cargo owners. Moreover, the environmental impact of the new route will be discussed in terms of gas emissions and the impact of new constructions on the ecosystem and the life of organisms.

An analysis of the present situation of the traffic in the Suez Canal will be carried out with regard to the tendency of constructing bigger vessels in order to get benefit from economies of scale which require deeper water and wider approaches, which needs considerable investment by the Suez Canal Authority (SCA) to cope with such development. Finally, the dissertation provides comprehensive recommendations for the application of all requirements for a modern and efficient port that could improve the transport sector in Iraq and the country's GDP.

1.4. Research Methodology

The research adopted a qualitative study by approaching available data about the multimodal transport in the region. The methodology used for the purpose of research was classified into three main methodologies: First, a literature review to study previous researches which have been carried out by different authors and organizations contributing to the importance of the topic selection. Second, an assessment of the current situation for existing routes between East and West (Asia↔Europe) using annual reports of the Suez Canal and calculating the distance of the new route as well as the old one and determining the operation cost for vessels in both cases.

Finally, based upon data available about previous performance of Iraqi ports and the obstacles that prevented them from development, an analysis of the past and present situation of the Iraqi transport system and anticipated growth of demand for cargo and passengers was done. An assessment of the suitability of the transport system was also measured in terms of how much it could positively or negatively impact (i.e. bottleneck) on the economic development.
The research structure has been divided into six chapters in order to cover the scope of the research. The first chapter reviews the background and introduction of the proposed route, the significance of the research, the objective of the research, scope of research, research methodology and limitation of the research. It concentrates on how the shipping lines are the decision makers about which route and port have the preference to be chosen.

In order to realize the decisive factors affecting the selection of port and route by carriers and shippers, a literature review has been carried out in chapter two. Further, the multimodal transport (MT) system definition and its consequence are covered in this chapter. Due to the role of MT in international trade and economy, many literatures were written. The dissertation explains the influential factors affecting the efficiency of global advanced transport network. Although, the suggested route has been studied by a limited number of researchers, the dissertation attempted to mention possible studies related to the subject matter.

Chapter three assessed the land bridge systems in United States of America, the European MT system and the Trans Siberian railway system. Each system has its special features according to the geography of the countries, the technology used for serving cargo transport and the objectives of introducing the mentioned MT systems. The intention of discussing those MT systems was to illustrate the reasonability of suggesting the new route as an efficient integrated transport system.

Chapter four analyses and assesses the cost comparison between the existing route and new suggested route, the distance comparison, the capacity of Suez Canal and the factors that may affect the cargo flows. The crude oil transport from the Gulf States to Europe and the US by pipelines through Syria is assessed with available details. The expected factors that would influence the competition level between the two routes are discussed such as crossing borders, port efficiency, security concerns, environmental concerns, economy of scale and bunker price.
Chapter five analyses the significance of the new route for Iraq and its economy by assessing the current situation of the transport system and the forecasted increasing demand for efficient integrated transport system. An identification of bottlenecks facing the port sector particularly is carried out in the dissertation in order to provide comprehensive justification for the needs of improving the transport network to handle this increase of cargo.

Chapter six provides a conclusion for the level of competitiveness between the existing route and new one in terms of cost effectiveness, time saving and the potentiality of a new regional trade area in the Middle East. Some recommendations are given for developing the integrated transport system in order to make the new MT system more realistic and reliable.

1.5. Limitation of the Research

This dissertation is limited to the economic impact of introducing a new transport system to create a competitive route for shipping companies and give more choices to the shipping industry. It does not cover the legal framework for the carriage of goods by the various modes of transport. The current political situation of the region is considered as a current inconsistence, so the paper will focus on transport factors without discussing the political factors. The assessment of land transport cost will be based upon the current costs in Iraq because there in not sufficient data available about Syrian transport system costs, which have an impact on the outcome of total transport cost.
Chapter 2
Literature Review

2.1. Port and Route Selection

In a competitive market, the decision of route and port selection is more demanding on shippers and carriers because they are not separate entities any more due to trade globalization and market variety. The importance of the topic has led to several studies by a number of authors concerning the subject matter, because it is a crucial element in competition between ports themselves and sea transport with other modes of transport. According to the expert system approach, the port selection is determined by a number of factors such as distances, compatibility between ships and ports and vessel characteristics (Jansson & Shneerson, 1987). UNCTAD (1992) has emphasized “on time delivery as a major concern by most shippers and freight forwarders” (as cited in Tongzon, 2009, p.188).

In a study made by UNCTAD (1998) regarding the impact of ports and shipping, it is stated that the port should be located close to an attractive regional market and other smaller ports which have limited capacity in order to be a transshipment and hub port attractive to shipping lines. Wedly, Choo and Schoner (2001) have noted that the Analytic Hierarchy Process (AHP), which was initiated by Saaty, was developed to be a technique for evaluating the process of decision making and port attractiveness to be chosen by shippers and carriers. Tzong (2001) noted that the reasons for the port of Singapore's leading position in the world are the strategic geographical location, high productivity, port connectivity, sufficient infra/superstructure, and proper supportive policy by the government. According to Malchow and Kanafani (2001) the Multinomial Logit Model can be used to specify the factors of port selection. They practiced the model for a specific commodity exported from the USA to eight different ports and found that the most significant factor was the oceanic distance and the inland distance whereas ship capacity and number of voyages were not so significant. Similarly, Tiwary, Itoh and Doi (2003)
selected 14 port-carrier options in their model in order to examine the Chinese shippers' behaviour. They discovered that the most influential factors were the distance from origin (imported cargo), distance from destination (exported cargo), port congestion, and the availability of capacity in shipping lines. Chou, Chu and Liang (2003) suggested an Equilibrium model and a fuzzy multiple criteria decision-making model (FMCDM) considering port administrators, carriers and domestic shippers as market players in the Taiwanese market to estimate factors dominating the port selection with a different approach. They realized the characteristics of a port with the revenue gained by the shippers as well as carriers were the most influential factors affecting port choice.

Lirn, Thanopoulou, Beynon and Beresford (2004) observed that the main factors of port and route selection are the cost of carriers, location, physical/technical infrastructure and port administration by using the Delphi method for global carriers and major ports in the world. Song and Yeo (2004) specifically deliberated the Chinese ports using AHP in order to assess the competitiveness of the ports with regional ports to attract more cargo and traffic. They found the dominating factors were: strategic location, port facilities, service quality and cargo volume. The system dynamic model was used by Hong and Menachof (2004) to assess the relative attractive factors of the port of Busan in which the port revenue, port investment and competitive port investment were taken into consideration in the model as most major factors.

Hwang and Tai (2005) found that the main factors affecting the port choice were handling efficiency and draft of the harbor as port internal factors, cargo source of hinterland and frequency of routes as port external factors and savings in operating cost for shipping lines. They used three criteria: previously available data, a questionnaire survey, and the Gray decision model in their assessment of East Asian ports. Using a Likert-style questionnaire, Ng (2006) surveyed the top 30 shipping lines in North Europe to monitor the attractive factors of ports in this region and
found that in addition to the cost effectiveness, geographical location and time efficiency, the quality of the service had to be taken into consideration. Another study made by Ugboma, C., Ugboma, O. and Ogwude (2006) monitored the reaction of Nigerian shippers applying AHP to select the port when they import and export their cargo. The researchers used a model with six criteria among which the frequency of vessels call and port efficiency were the most prioritized. They found that the port of Lagos was preferable among other regional ports. Panayides (2006) noted that the selection of transport does not exclusively flow from the need of a product, but also from numerous needs for cost minimization, enhancing reliability and adding value to transported goods while they are moved from the point of production to distribution centers.

According to Muller (2006), the selection of ports and routes is affected by shippers' expectations of high quality service, lower cost, and short delivery time of cargo even though they prefer to pay a higher price to get goods delivered in time. According to the World Bank (2007), it is reported that the main influential factors of port choice were the inland transport system (road, rail, waterways, and pipeline) and price quality ratio of port services.

Chang, Lee and Tongzon (2008) examined the differences of port selection behaviour of 158 international container carriers worldwide with specific routes using exploratory factor analysis and confirmatory factor analysis with various criteria factors. The survey revealed that the port should follow different strategies because it was concerned about how container lines adapted to port selection factors rather than the effectiveness of the port. Nevertheless, this research is inapplicable for some shipping types like dry bulk and wet bulk.

Wiegmans, Hoest and Notteboom (2008) interviewed 12 major container carriers in the Hamburg-Le Havre range and they also exhibited in their model the hinterland connection, reasonable port traffic and immediate availability of consumers.
Furthermore, the total portfolio of the ports and environmental issues has been considered as additional criteria. Thus they found that the speed, handling cost, reliability and hinterland connection have an impact on the port selection. By using the system theory, Magala and Sammons (2008) looked at the whole supply chain instead of taking the port as a part of an individual element to realize that the total logistic cost, the quality of services and the reliability of the supply chain were the major factors of port choice.

Mangan, Lalwani, and Fynes (2008) have considered that the ownership model of ports and the relationship between the public and private sectors have a significant impact on ownership reform. On the other hand, deregulating the ports' ownership allowed the Global Port Operators (GPOs) involvement that provide efficient and cost effective services in many ports in the world in order to be chosen by major carriers. The contracts of carriage of goods and INCOTERMS used in the contract have an influential impact on which mode of transport should be used as well as the port of destination. For instance, if it was agreed to use the CIF term, the seller be assumed to carry the cargo by sea and the port of destination should be specified if using other terms (Donner, 2009).

According to Moon (2009) the ideal port to be called by vessels should have adequate depth of water within the harbor and its approaches, minimum tide and current volatility, free of fog and ice, appropriate anchorage area inside/outside the harbor and efficient inland connections with value added service facilities. The current tendency of international transport to decide about routes and port selection mostly depend on a number of factors such as the shipping service pattern (Liner, Tramp and Industrial), the logistics concept and the best quality services with cost effectiveness (Ma, 2010).

Regardless of the model used and the researcher, two links could be dominating the selection of ports by carriers as well as shippers. The sea link, which is related to port
location, accessibility, and distances between ports, whereas the land link is decided by port efficiency, facilities for value added activities and connectivity with the hinterland, which require effective multimodal transport systems to cope with the cargo transported by sea.

2.2. Multimodal Transport (MT)

Due to different destination and time factors, cargo and passengers can be transported by more than one mode of transport (sea, rail, road, air, and pipelines) or by combining different modes together. The following definition is given by UNCTAD (2000, p.5)

International multimodal transport means the carriage of goods by at least two different modes of transport on the basis of a multimodal transport contract from a place in one country at which the goods are taken in charge by the operator to a place designated for delivery situated in a different country.

The consequence of recent trends in global trade, such as multimodalism, containerization, e-commerce, information technology, safety, security and environmental issues, forced the international community to have a positive reaction to reform many systems and legislation like the Rotterdam Rules to cover the legal side of such development. Since the MT concept has a very wide range and many researchers discussed it in detail, this paper is limited to mentioning some of them.

An analysis of the MT system between Maghrab and Western European countries by Martino and Morvillo (2005) using an empirical analysis found that the structure of the transport chain, which includes the infrastructure of the system and the interchange points, such as seaports, would influence the transport system. The strategies of operators to be efficient and the level of interoperability of the transport chain have an influential impact on the MT reliability.
According to Whitehurst (2005), the efficient MT managed by a multimodal transport company with a centralized decision making can cope with the shippers' requirements, geographical markets, production cost, transport technology and competitor strategies. Therefore, the control of modes properly managed in terms of cost effectiveness, will result in benefiting from economies of scale and environmental friendliness decently monitored.

In Indonesia, which is an archipelago with 17,000 islands, the MT has a crucial impact on the country's transport system in terms of local transport among islands and international transport with other countries. Obviously, the sea transport represents a larger part in the system for moving passengers and goods. In such a country the efficiency of nodes, such as ports, is considered as the main influential factor of transport cost and MT system efficiency, as noted by Lubis, Isnaeni, Sjafruddin and Dharmowijoyo (2005).

Woodburn, Allen, Browne and Leonardi (2008) discussed the international MT system crossing the borders between countries by road and rails. The customs clearance, political decisions, security and the globalization of trade have a decisive ability to enhance the MT. For example, the most efficient international MT system can be seen in Europe due to the elimination of most constraints between the EU countries, which encourages global producers to have their assembling and production centers distributed. Litman (2009) suggested the main factors affecting the MT were the traveling time, the operating cost of the used mode, the environmental impact of the transport mode, speed, and congestion delays. The research focused on ground transport taking into consideration the highway and rail and was comprehensive for such specific modes.

MT plays a role as a major part of the recent competitive economy, particularly in the shipping industry. Today, many carriers prefer to have full control of logistics and deliver the goods to the shelf of the retail rather than keep them in the port
premises. Therefore, efficient MT is one of the decisive factors in the total supply chain. In fact, it seems reasonable to evaluate how it is significant to this dissertation. The cooperation between inland transport companies, shipping companies, railway companies, and appropriate highways illustrate the efficient movement of goods.

2.3 Alternatives to the Suez Canal

A modern transport model was studied by the Italian Consortium for Iraqi Transport Infrastructure to generate the distribution of the traffic flows in the multimodal network in Iraq and abroad. As a matter of fact, the implications of the Iraqi network on international traffic are worth mentioning. Consequently, the network description also has to cover a large part of the transport network away from the Iraqi border. After the beginning of the stabilization of Iraq, it was expected that new corridors will be opened (i.e. through Syria) or that old corridors will be restored (i.e. via Iraqi southern harbors). This will, probably, be moving the attention away from the corridor used during the embargo (C.I.I.T.I, 2008).

Although, this study has shown the demand trend increasing in terms of general cargo and passenger traffic, the first factor is mainly related to the capacity of the Iraqi transport system to operate in a competitive fashion in an international market of transport services. An additional factor is the capacity of the Iraqi transport system to not only support but to act proactively for the economic development of the country. In other words, since the achievements of the Iraqi economy are intimately linked to the efficiency of the transport system, the suitability of the transport system is also measured in terms of how much it can positively or negatively impact (i.e. bottlenecks) on the economic development. Moreover, the study discussed the advantages of new routes for ports and Iraq's benefits in addition to the benefits for the shipping lines as the most important users of the new routes. Therefore, this dissertation will analyze the cost of new multimodal transport routes in order to demonstrate the advantages for ship owners and cargo owners as well.
A dissertation was written by Mohsenpour (2004) on a similar topic comparing the cost of carriage of goods between the north-south corridor through Iran and the Suez Canal route. The writer concluded that "Using a new route as a new possibility in transport can reduce costs, save time and provide better flexibility". Especially for valuable cargo, which is more dependent on time rather than cost, the fast multimodal transport can be the alternative if a new production market is introduced, because the market is moving from one region to another.

Ma (2009) said a "land bridge can be a terrible threat to maritime transport, especially the ones across the Euro-Asia continent". It could also be the idea of introducing a new market in Iraq, especially for agricultural products, to serve the Arab Gulf countries if the new logistic system is introduced.

This dissertation will discuss the possibilities of having new markets of a free trade area in the Arabian Gulf countries and also, if Turkey joins the EU, their impacts on new multimodal transport routes. Obviously, the domestic data is not sufficient to prove the competitiveness of new routes without making an international transport analysis, because the shipping industry tends to be globalized rather than localized. In particular, the effect of climate change can have an impact on shipping routes between the Far East, Europe and the United States of America.
Chapter 3
3. Selected Existing Multimodal Transport Systems

3.1 The land Bridge in the US

The location of the United States of America between the two biggest markets in Europe, crossing the Atlantic Ocean, and Asia, crossing the Pacific Ocean, resulted in developing land bridge routes for freight movement. According to Muller (1999), it started in the mid 1960s to connect different modes of transport such as railroads with waterways and roads when cargo was being containerized. The cargo that was shipped by ocean vessels from Europe to the western parts of the US has to pass through the Panama Canal, which takes more time and involves higher cost. The same applies to the cargo moved from Asia to the eastern parts of the US as shown in Figure 3.1. Therefore, the efficient West/East land bridge links the ports of New York, New Jersey and Hampton Roads on the East coast with the ports of Los Angeles, Long Beach, Portland and Seattle on the West coast of the US as gateway ports to hinterland markets.

Figure 3.1 The North American Landbridge.
Source: http://people.hofstra.edu/geotrans/eng.
The major part of container transport is carried by the railroads by using the double stack trains and trucking which is not only for cargo moved in and out of the United States but also for domestic transport. According to the US Department of Transport (2006), the trucking services represented 34% of the total domestic freight transported in terms of ton-miles for distances less than 500 miles, followed by rail transport 31%, pipelines 16% and short sea shipping 11%. On the other hand, for distances more than 500 miles, rail transport was the dominant mode as shown in Figure 3.2.

Nonetheless, the inland waterways traffic is increasing in some parts of the US on the Mississippi River between Texas and Louisiana. Similarly, the regular lines between the port of Portland and Idaho have increased the cargo movement linking the East with the West by waterways transport (Port of Portland, 2009).

![Figure 3.2 Comparison of major Modes in the US](image)


The transport system in the US has mostly relied on road transports for carriage of goods between states. Nonetheless, environmental concerns due to road congestion, since trucking is the major pollutant in land transport, and the cost comparison with
other modes pressed the US government to reassess the transport system. The Texas Transport Institute TTI (2002) studied the economic impact of road congestion and found that the total congestion cost was $67.4 billion, illustrated as 3.6 billion hours of extra traveling and 5.7 billion gallons of fuel consumed in congestion (as cited in Brown and Hatch, 2002). As a result, railroad transport became an alternative to trucking by carrying the loaded trailers (trailer piggyback) to move them by train between states to reach their final destination. Moreover, the US Department of Transport has seriously emphasized short sea shipping along the coast lines to develop the transport system by eliminating the impact of congestion on the economy and to reduce exhaust gas emissions generated by road transport. Nevertheless, the combined transport system in the US is functioning as an efficient transport system, especially in door-to-door services. In the United States specifically, goods can be transported by ocean going vessels for the international trade whereas the domestic carriage of goods by rail is considered to be efficient. The railroad transport is preferable for long-haul transport between the West and East, whereas trucking is the most significant mode of transport for pick-up and delivery of cargo and ocean carriers for international transport (Muller, 2010).

Although there is trade imbalance between the West and East of the US, the MT system in the US is considered to be efficient due to a number of factors:

- The transport and communication networks in all modes are developed and internal, regional and international connections enhanced.
- The U.S. Government has adopted the latest technology and created a favorable business environment through adopting proper policy and regulatory frameworks.
- The developed programs for outsourcing of some activities, particularly in the field of communications and land, sea and air transport. The privatization policy, while controlling the competition among the service suppliers, resulted in a high service level of the transport sector.
- The MT function within one country, which means that borders crossings and customs cannot be seen as obstacles and bottlenecks to the transport system.
Moreover, it enjoys the advantages of standardization of rules, documentation and uniform railroad gauge.

- The continental strategic location of the U.S. between the two biggest markets in Asia and Europe.
- On top of all the mentioned factors, the information exchange with the clients by the EDI system is efficient and reliable.

Although the MT system is recently performing a considerable role in the transport sector, the expansion project of the Panama Canal can be foreseen as a challenge. The extended Canal, projected to be operational in 2014, will have locks 427 m long, 55 m wide and 18.3 m deep (Panama Canal Authority, 2006). In other words, cape size bulk carriers and the super-post panamax container vessels will easily be able to pass through the Canal. Therefore, the trade between the East and West of the US with Europe and Asia might increase using shipping rather than land transport due to the economies of scale and environmental concerns.

3.2 Trans European Transport Network (TEN-T)

Recently, the enlargement of Europe and removing the barriers between European countries demanded an integrated transport system in order to establish significant connections between the different parts of Europe. The Commission of the European Communities (2001) issued a White Paper, which emphasized the need for optimizing the transport system in order to meet the requirements of the development and enlargement of the EU.

The commission found the improvement of the transport sector significant, because of its economic impact representing 10% of GDP of the EU countries. The total expenditure would run to 1000 billion euros and would create ten million jobs. Therefore, the paper recognized this and projected two revision stages for the 1996 guidelines of developing the TEN-T. First in 2001, the focus was on the removal of bottlenecks in the whole transport network, instead of emphasizing development
within transport corridors. In addition, priority was given to MT corridors by increasing the capacity and improving the traffic control within the EU countries.

As a second stage, in 2004 a new revision was made to focus the concern of the community on the concept of "motorways of the sea" to enhance the links between EU ports with rail, road, and waterway connections. As a result, intra-Europe shipping and railroad system improvements intended to alleviate bottlenecks that were caused by congestion of roads within the EU. The White Paper presented the needs of attracting the private sector in order to achieve an adapted infrastructure and adequate facilities benefiting from their expertise as well as private capital investments.

According to the European Commission (2005, p.7) it is projected by the EU that by 2020, TEN-T will include 89500 km of roads and 94000 km of railways, including around 20000 km of high-speed rail lines suitable for speeds of at least 200 km/h. The inland waterway system will amount to 11250 km, including 210 inland ports, whilst there are a further 294 seaports and some 366 airports.

Obviously, this project requires big investment and budget provisions to be allocated by the EU countries to support the proposed network. The European Commission prioritized 30 axes to be completed and included in the project funding with an estimated cost of EUR225 billion, whereas the total TNT-T investment will exceed EUR 600 billion (INE, 2010).

Figure 3.3 shows the connections between different EU countries and various modes of transport. The MT system in the EU reduces the transport cost for all EU countries through the advantages of geographical location of several countries and development. Therefore, the combined transport system in the Netherlands serves most of the cargo imported by sea for Germany through the port of
Rotterdam by rail, roads, waterways and pipelines. Similarly, most of the cargo unloaded in the port of Antwerp goes to France by rail, road and inland waterways whereas the port of Marseille has been connecting the southern part of France and neighboring countries. Moreover, the port of Hamburg is the hub port for transshipped cargo to the Baltic Sea countries.

The objectives of the EU transport policy were not only for more efficiency and lower cost but also for a sustainable and environmentally friendly network. Thanks to the MT system, the air pollution and road accidents would be reduced through applying strict European legislation and standards, which lead to significant improvement in air quality of European cities.

Figure 3.3 Trans-European Transport Network (TEN-T)
Source: http://ec.europa.eu/transport/publication/doc

With regard to safety, the EU has adopted a comprehensive set of legislations covering all the key factors affecting safety and specialized safety agencies have
been set up for rail transport (ERA), aviation (EASA) and Shipping (EMSA). On the other hand, the regulations for driving and hours of rest for truck drivers, encourage shippers to shift the mode from road transport to RORO vessels or trains with their trucks. The integration of MT is often happening between the Scandinavian countries, Germany and the Baltic Sea countries which link Northern Europe with the South via Germany. Furthermore, rail wagons are loaded in RORO vessels between the Port of Trelleborg in Sweden to Germany and Poland to allow trains to move between EU countries for transport of passengers as well as goods.

The inland waterways transport by barges is also playing a very considerable role for the transport sector. Presently, this sector has grown to compete with other means of transport such as railways and roads. It was reported by the port of Antwerp that the proportion of its hinterland container traffic transported by rail in 2009 had fallen from 11% to 10%, whereas the share of the waterway barges had grown from 32.4% to 34.8%. Likewise, the railroad shares fell from 13% to 11% for transported containers from the port of Rotterdam, whilst the barge shares increased from 30% to 33% (Containerization International, 12, July 2010). These facts were also presented by the port of Rotterdam and the port of Antwerp during a field study of the Port Management student of World Maritime University (WMU) in February 2010.

There are about 40 container terminals along the banks of the Rhine River between Rotterdam/Antwerp and Basel in Switzerland, which is located about 870 km from the sea. This route facilitates the cargo movement by barges from the Atlantic coast to the markets in Germany, France, and Switzerland with more than one million containers being transported from Rotterdam and Antwerp. Similarly, the Rhone River serves the inland waterways transport in France from the Mediterranean Sea through Marseille, whereas the Seine River plays the same role from the port of Le Havre. Some other rivers like Elbe and Weser are used
for similar purposes between Hamburg and Bremen in Germany and the Danube from the Black Sea (UNESCAP, 2004). The attraction of the new English Channel Tunnel for more traffic to transport goods and passengers between the UK and the southern part of Europe can be seen as a land transport alternative for coastal shipping (Ma, 2009).

The reliability of the MT system in the EU influenced the total supply chain and the integration of the EU with neighboring regions in addition to the world economy. Especially, the development of transport and communication technology had notable impacts on the revolutionary increase in the globalization trend. Therefore, many international companies benefited from such developments in the transport sector by diversifying their activities among different production and assembling centers. In other words, manufacturing of some parts of a specific product can be produced in various countries due to the expertise and cost advantages and all parts can be assembled in another country.

Basically, these changes of the market structure are challenges associated with the needs of efficient transport, particularly after the implementation of JIT systems by global producers. Transport has become a crucial logistics element to control the inventory cost by offering a high service level to achieve significant customer satisfaction. In addition, the differences in the national economies of countries have affected the market balance and the funding shares of transport related project investments by different countries. Other challenges for the transport sector have been noted by the European Commission (2008) as follows: First, it is forecasted that the average age of the European population will be 65 or more by 2060. In the past, people of such age traveled less than younger people but recently they tend to travel more, which means an increase in the demand for transport system improvement and capacity. Second, the migration to Europe might increase the population by 56 million in the next 50 years creating pressure on transport requirements. Likewise, the internal mobility of labor forces within
and between EU countries will increase due to the elimination of barriers. Third, the impact of the transport sector on green house gas (GHG) emissions as the most polluting sector urged it to mitigate its effect on the environment and to take practical steps to achieve this aim. Finally, urbanization, which tends to be European inhabitants' preferred life style, increases dramatically, which will demand more transport and cause congestion as well as GHG emissions.

Nevertheless, the MT system in EU is functioning as a successful player in the economy and market flows of the EU countries due to several factors:

- The liberalization of trade adopted within the EU region has created a high level of competition between the players within one mode of transport and between different modes. Such competition, under the control of the EU community, has improved the quality of transport services.
- The concern of all members of the EU to develop transport policy and the legal framework to unify the different associated institutional, organizational and social changes.
- The enlargement of the EU resulted in barriers coming down between the EU countries which means the crossing of borders for passengers and goods became simpler. Moreover, the Customs agreements in the EU region have strongly influenced the cargo flows across borders of the EU countries.
- The contribution of technological evolution and innovation has been enhancing the transport sector safety and security to be reliable.
- The comprehensive planning system for long and short terms with regular assessment of the plans.
- The adequate connections between different modes such as ports efficiency and train stations.
- The permanent funding for transport network projects by different means of financial support.
- The active partnership between the public and private sectors which involved private capital and interest in the transport sector.
3.3 Trans Siberian Railway (TSR)

The trade between Europe and Asia in recent years has been growing steadily, indicating a need for transport improvement and expansion. The TSR is the longest transcontinental railway that originated in Moscow to link Europe and Russia with the Far East via the Port of Vostochny in Vladivostok. Historically, the TSR was used efficiently in the First World War to transport troops and arms from the US via Vladivostok to Russia when the German submarines precluded provision of arms through the Baltic Sea (Liliopoulou, Roe & Pasukeviciute, 2005).

The double-track railroad line is designed to transport about 130 million tons of cargo annually including about 600,000 containers. The distance to be covered by the TSR is around 9,780 km, and it takes 15 days between Beijing and Hamburg, whereas it takes around 35 days via the Suez Canal (Lukov, 2008). The different distance between the sea transport via SC compared to the TSR shows a considerable saving in favour of the TSR, which has lead to increased traffic from Russia to China as shown in Figure 3.4. Therefore, there are efforts and overall positive indications that have been taken by the Russian Government and the private operators of the TSR to achieve enduring efficient and competitive railway services.

According to Tsuji (2010), the TSR development phases in the last 40 years resulted from a number of reasons as follows:

- Between 1970 and the 1980s the utilization of the route was mostly for transit movement from Japan to Europe and the Middle East. Because of the new set of freight rates for transit cargo, 30% lower than sea transport, implemented by the Soviet Union, the number of containers reached 110,000 TEU in 1983.
- In the 1990s, the route suffered a loss of its competitiveness with deep sea shipping due to the unclear picture after the collapse of the Soviet Union.
• In 2000, the third phase started when the crude oil prices increased to influence the demand for food consumption and electronics in Russia. Therefore, the Russian trade with Korea and China increased the use of TSR.

• In 2006, the Korean car manufactures started new production bases in Russia because of the elimination of the rebates for transit cargo which lead to higher prices for cargo transported to Russia. The production bases in Russia, imports of production parts from Korea by the TSR increased to reach about 710,000 TEU in 2008. Mostly containers were transported as imports (358,416 TEU) and exports (322,221 TEU) to and from Russia, whereas only 29,035 TEU was transit cargo (Containerization International, as cited in Muller 2010).

• In 2009, the economic crisis affected the TSR transport because of the drop of freight rates in the shipping sector which shows more flexibility than TSR. Furthermore, the Russian economy was also influenced badly by the global financial crisis, which caused a sharp decrease in transport demand.

Figure 3.4 Trans Siberian Railway TSR
Pulling all phases together, the demand of transport using the TSR has been fluctuating, especially for transit cargo because of the price inelasticity of supply (railway services). In other words, when the demand for TSR services decreases, the price of the services should also follow the same curve according to the law of demand and supply (Ma, 2009). The changeable freight rates of sea transport have a considerable impact on the competition between the two modes during the downturn periods as shown in Figure 3.5. In addition, the numerous service providers in deep sea shipping create a high level of competition to satisfy the costumers. On the other hand, there are not many service providers for railway transport, which creates practically a monopoly.

Even though the TSR services are relatively faster (11 days difference from Kobe, Japan to Hamina in Finland) than sea transport, the advantage of economies of scale originating from the vessels' size compared to the railways' capacity made shipping more desirable than TSR, especially when the time factor is relatively unimportant compared to transport cost for low value cargo such as coal.

In addition, the trade imbalances between eastbound and westbound cargoes due to lack of cargo to be transported eastbound, resulted in large numbers of empty containers having to be transported, which increases the transport cost for shippers.

The TSR system can be developed more and would reach the highest level of competition with existing sea routes by reducing the burden of documentation and eliminating the border crossing obstacles to minimize the transit time of goods while transported. On the other hand, the standardization of the railway gauge with European railways would minimize the waste of time due to different gauging. Theoretically, the railroad gauge can be standardized, but it is difficult to implement due to high investments needed for construction of new railroads either in Europe or Russia, which is not going to happen.
Figure 3.5. Price Fluctuation: TSR vs. Deep Sea transport

Source: Tsuji (January, 2010)

The switching of trains at Russian borders for the rail connection between Duisburg in Germany and Moscow is evidence of time consuming work due to gauge variation (International Containerization, 2010). Moreover, the cooperation between the countries benefiting from the TSR in terms of economic and legal aspects would lead to a participative transport policy to fulfill the requirement of an efficient mode of transport. Ports also need to operate efficiently and to be cost effective as part of the total supply chain on the TSR routes. There are many other MT systems that can be mentioned, such as the land bridge from the Far East to Europe via Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan). The land linkages of these countries with China and Mongolia in the east, the Russia Federation in the north and with Iran and Pakistan in the south can play a significant role for transport between Asia and Europe (UNCTAD, 2000). The combination of land transport from China with sea transport through the Caspian Sea is considered as MT competing to some extent with the existing sea route as far as distances are concerned. Nevertheless, the burdens of crossing borders and high transport cost due to lack of economies of scale and port charges are still encouraging the shippers to move their cargo by sea.
Chapter 4

4. Distance and Cost Comparison between the Suez Canal and New Routes

4.1 Distance

Transport cost is mainly determined by the fixed and operating cost for the mode that is used for a specific route, such as the infrastructure and superstructure cost. On the other hand, the distance of movement for goods and passengers has an impact on both fixed cost for railway and road infrastructure and operating cost for all transport modes. This dissertation attempts to analyze two multimodal options as alternatives to existing routes. First, unloading the cargo that is shipped from the Far East and South Asia to Europe in a hub port proposed to be located in the North of the Arabian Gulf (South of Basrah in Iraq) as shown in Figure (4.1).

![First option of proposed routes](www.Maps.Google.com and author)

Figure 4.1 First option of proposed routes.

The unloaded cargo is to be loaded on trains and trucks and transported to the Port of Tartous in Syria to be loaded and shipped to Europe via the Mediterranean and vice versa for cargo from Europe to Asia.

Table 4.1 The distance comparison between existing route and new routes (via Iraq and Syria)

<table>
<thead>
<tr>
<th>Routes via Suez canal</th>
<th>Distance NM.</th>
<th>Time</th>
<th>Routes via Iraq and Syria</th>
<th>Distance NM</th>
<th>Time</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shanghai-Rotterdam</td>
<td>10409</td>
<td>30 days 23 hours</td>
<td>Shanghai-Rotterdam</td>
<td>10048</td>
<td>29 days 22 hours</td>
<td>96.5%</td>
</tr>
<tr>
<td>Singapore-Marseille</td>
<td>6506</td>
<td>19 days 9 hours</td>
<td>Singapore-Marseille</td>
<td>6221</td>
<td>18 days 12 hours</td>
<td>95.6%</td>
</tr>
<tr>
<td>Dubai-Rotterdam</td>
<td>6129</td>
<td>18 days 6 hours</td>
<td>Dubai-Rotterdam</td>
<td>4543</td>
<td>13 days 13 hours</td>
<td>74%</td>
</tr>
<tr>
<td>Mumbai-Rotterdam</td>
<td>6296</td>
<td>18 days 18 hours</td>
<td>Mumbai-Rotterdam</td>
<td>5590</td>
<td>16 days 16 hours</td>
<td>88.8%</td>
</tr>
<tr>
<td>Australia-Marseille</td>
<td>9800</td>
<td>29 days 4 hours</td>
<td>Australia-Marseille</td>
<td>9896</td>
<td>30 days 11 hours</td>
<td>101%</td>
</tr>
</tbody>
</table>

Source: www.searates.com

The distances and traveling time are shown in Table 4.1. The new routes have an advantage for being shorter in terms of distance and time than the existing route between Asia and Europe if the distances considered were the only determination factors and the other factors were not taken into consideration. A voyage starting in Shanghai transiting the Suez Canal to Rotterdam is 10,409 miles and takes about 31 days while using the new routes, so the distance would be 10,048 miles and takes

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1 Vessel speed assumed 14 knots
2 The distances were taken in nautical miles both for sea and land distances to standardize the measurement.
3 The traveling time between Um Qasr-Tartous is assumed to be 48 hours by train or truck without taking cargo handling time into consideration.
about 30 days which is 361 miles shorter with one day difference. The differences in distance and time for a voyage between Singapore and Marseille are similar. The distance from Dubai through the SC to Rotterdam is 6,129 miles and takes about 18.25 days but for the new routes it would be 4,543 miles and takes about 13.5 days in which the difference in distance is 1,586 miles and in time 5 days. Furthermore, the distance from Mumbai to Rotterdam is 6,296 miles and takes 19 days through the SC when the suggested route is 5,590 miles and takes about 17 days.

Obviously, the shorter distances for transport are preferable to carriers and shippers due to the relationship with cost and time. Therefore, the transport between Asia and Europe would be cheaper if the distance was the only factor of concern. In practice, there are other factors, which have decisive impacts on the measurement of transport system effectiveness and carriers decision of route selection.

A second option, instead of transporting the cargo via the Port of Tartous, is that cargo would be moved via Turkey to Eastern Europe by crossing the Black Sea and connecting this route with the Viking intermodal train which links Ukraine, Belarus,
and Lithuania. Moreover, the routes can be connected with central and western Europe via Istanbul as shown in Figure 4.2.

Table 4.2 The distance comparison between existing route and new routes (via Iraq and Turkey)

<table>
<thead>
<tr>
<th>Route via Suez Canal</th>
<th>Distance¹ miles</th>
<th>Route via Iraq and Turkey</th>
<th>Distance miles</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Shanghai-Hamburg</td>
<td>12264</td>
<td>Shanghai-Hamburg</td>
<td>9435</td>
<td>77%</td>
</tr>
<tr>
<td>2 Shanghai-Klaipeda</td>
<td>12726</td>
<td>Shanghai-Klaipeda</td>
<td>9085</td>
<td>71.4%</td>
</tr>
<tr>
<td>3 Shanghai-Genova-Munich</td>
<td>10563</td>
<td>Shanghai-Munich</td>
<td>9181</td>
<td>87%</td>
</tr>
<tr>
<td>4 Shanghai-Rotterdam</td>
<td>11978</td>
<td>Shanghai-Rotterdam</td>
<td>9573</td>
<td>80%</td>
</tr>
</tbody>
</table>

Source: www.searates.com

The land bridge between the proposed hub port in the North of the Arabian Gulf and the port of Samsun on the coastline of the Black Sea has an advantage of being shorter than existing routes as shown in Table 4.2.

Although the distance measurement is inaccurate due to the terrain differences for the land, the distance from Shanghai to Hamburg via the SC is 12,264 miles and through the new connections it is 9,435 miles, which is much shorter than the existing route. Likewise, the distances from Asia to West Europe and the Baltic Sea countries are shorter by using the proposed routes.

In fact, the Viking intermodal connection as shown in Figure 4.3 might support the idea of the new model since it has been constructed and has been working properly as an efficient mode of transport linking the Baltic Sea with the Black Sea. On the other hand, crossing the borders and the number of ports influences the time of transport especially with three different regions and countries if the cargo were carried by the new land bridge. The joint railway with a distance of 1,734 km from

¹ The distances were converted into miles and taken as straight lines between cities.
Odessa and Ilyichevsk ports in the Ukraine crossing Belarus to the port of Klaipeda in Lithuania is functioning as a successful and attractive intermodal transport system as shown in Figure 4.4. The journey of the Viking train takes 48 hours between the mentioned ports and there are train departures twice a day (Kaminskas, 2008).

Furthermore, the route between the Port of Odessa in Ukraine and the port of Samsun in Turkey by RORO services, which is 394 nm and takes about 1 day by a ship, can play an important role in connecting the Middle East with Eastern Europe and Russia. Similarly, it could be connected between the proposed new port in Iraq and port of Samsun by a land bridge with highways and railway with a distance of 897 miles which may take two days. Therefore, the transport time of cargo from Shanghai to Klaipeda via the new routes will take approximately 23 days while using the SC route takes about 32 days.

Nevertheless, even though the distances of the two proposed options as alternatives for the SC, are shorter in terms of transport time, the assessment of the comparison by using the distance factor is insufficient to convince the carriers of the cost effectiveness of the new routes.
4.2 Transport Cost and Freight Rate

4.2.1 Sea Transport Cost

In order to determine the total cost of a shipping company, it is necessary to have an estimate and analysis of the cost components which affect the freight rates and ship owners' earnings. The freight rates have been volatile depending upon the market fluctuations which have an impact on the shipping income and expenditure. Moreover, the competitive market has a decisive influence on shipping companies to behave as price takers or makers. Recently, the freight rates have been mostly decided by the market which forced shipping companies to adjust their cost accordingly.

According to Stopford (2009) the shipping total cost can be divided into five categories:

1. The operating cost which includes ship's expenses for daily operations such as crew wages, stores, and daily maintenance. It also includes the insurance cost and management expenses.
2. Periodic maintenance costs based on the requirements of periodic inspection by maritime authorities and classification societies to ensure the condition of the ship hull as well as the machinery. The periodic maintenance is mostly done by dry-docking.

3. Voyage costs are related to specific voyage expenses which are considered variable such as fuel consumed, port charges and canal dues.

4. Capital costs represent a significant portion of a shipping company's cost and are affected by the way of funding (loan with interest or using company's liquidity) to purchase ships and the ship status, new or second hand.

5. Cargo handling costs are related to loading, stowing and unloading the cargos which are particularly important in liner services.

Figure 4.5 General Cost Classifications for Bulk Carriers

Figure 4.5 shows the general cost classification for bulk carriers as an illustration of the significant impact on voyage cost that changing the vessels' routes may have.
Although the cargo handling cost can be affected by changing the routes and port of call, the component of the mentioned total cost most affected is the voyage cost. The crew wages, daily maintenance, capital cost and periodic maintenance of vessels are relatively not strongly affected by a ship's route. Marine insurance costs increases significantly on some routes that have a threat accumulation such as piracy, wars, and strikes causing high transport costs. For instance, the companies raised the insurance premium for vessels proceeding to the Arabian Gulf due to the Gulf war in 2003 and such increase still have an impact on the transport cost.

Shipping companies tend to control the total cost of operating their vessels through reducing the manning costs using a minimum number of crew onboard ships. Furthermore, the number of ports of call for bigger vessels in liner shipping is reduced due to the time consumed in ports and high cost of port charges. Nevertheless, the fuel consumption is the highest cost for operating a shipping company representing 30.4% of the total cost for bulk carriers as shown in Figure 4.5. On the other hand, the port charges and canal dues are a considerable part representing 10% of the total cost. The fuel consumption can be measured by the efficiency of the vessel engine by indicating the age of engine and the technology used for design, the ship's configuration and the degree of hull fouling as ship design related factors. Moreover, the sailing distance, speed of vessel, vessel's state (laden or ballast conditions) and weather conditions have corresponding external effects on fuel consumption (Drewry, 2007).

Maritime freight rates reflect the shipping companies' total cost, which vary from one firm to another according to a company's policy and efficiency. However, there are other factors influencing the freight rate as suggested by Hoffmann (2010) as follows: first, the distances that cargo has to be moved by vessels from production to consumption areas. It is worth mentioning that doubling the sea transport distance resulted in raising the transport cost by about 15-20%, which can be seen in Table 1. The voyage cost 40% and (fuel oil + diesel oil 76%). (0.76*40=30.4%)
4.3. Although the correlation between the distance and cost is relatively low, distance still has a notable impact on the transport freight rate when it is superimposed in time cost. In other words, if goods are transported for the same distance but different in duration, the transport cost will be different due to the factors involved to determine transport cost such as fuel consumption and speed.

Table 4.3 Freight Rates of Carrying a FEU from Dalian in May 2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dubai/UAE</td>
<td>1200</td>
<td>Bahrain</td>
<td>1800</td>
<td>Tema/Ghana</td>
<td>4600</td>
</tr>
<tr>
<td>Colombo / Sri Lanka</td>
<td>1300</td>
<td>Um Qasr / Iraq</td>
<td>3000</td>
<td>Santos/Brazil</td>
<td>4800</td>
</tr>
<tr>
<td>B.Abbas/Iran</td>
<td>1300</td>
<td>Port Sudan</td>
<td>3300</td>
<td>Valparaiso/Chile</td>
<td>5200</td>
</tr>
<tr>
<td>Calcutta/India</td>
<td>1700</td>
<td>Rotterdam</td>
<td>3500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Second, the vessel sizes have an impact on transport cost owing to economies of scale advantages as shown in Table 4.4. Instead of transporting 100 tons, the reduction of cost might reach about 40-50% when transporting 10,000 tons of cargo.

The shipping lines tend to build bigger ships to reduce transport cost and offer cheaper services in order to compete with other companies and modes of transport. Third, the trade imbalances actuate the freight rates due to the availability of goods to be carried in both ports of origin and destination. The occurrence of imbalance for a country's import and export leads to receiving more cargo with loaded ships. On the other hand, ships ought to find a cargo nearby otherwise they will sail in ballast conditions without earning money. Therefore, the transport cost will increase, especially when the demand for transport is high with shortage of supply. Fourth, the value and type of cargo decide the freight rates and routes also due to the insurance
and time factor concerned in such goods. Therefore, increasing the value of goods by 1%, the insurance companies increase the insurance cost by 0.3-0.4%.

Table 4.4 Economies of Scale in Bulk Shipping (including bunkers)

<table>
<thead>
<tr>
<th>Cargo Capacity DWT</th>
<th>Investment $M</th>
<th>Bunker Cons tons/day</th>
<th>Operating Cost $m p.a</th>
<th>Operating Cost $ / dwt</th>
<th>Bunker Cost $ / dwt</th>
<th>Capital Cost $ / dwt</th>
<th>Total Cost $/dwt p.a</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000</td>
<td>26</td>
<td>21</td>
<td>1.2</td>
<td>40.6</td>
<td>56.7</td>
<td>93.5</td>
<td>191</td>
</tr>
<tr>
<td>47,000</td>
<td>31</td>
<td>24</td>
<td>1.4</td>
<td>30.3</td>
<td>41.4</td>
<td>71.4</td>
<td>143</td>
</tr>
<tr>
<td>68,000</td>
<td>36</td>
<td>30</td>
<td>1.8</td>
<td>26.0</td>
<td>35.7</td>
<td>58.2</td>
<td>120</td>
</tr>
<tr>
<td>170,000</td>
<td>59</td>
<td>50</td>
<td>2.0</td>
<td>12.0</td>
<td>23.8</td>
<td>38.2</td>
<td>74</td>
</tr>
</tbody>
</table>


Fifth, the competition level among shipping companies increases the options for shippers to select lower freight rates with high service level depending on the market shares of carriers. Finally, the port efficiency and characteristics have a direct impact on ship turnaround time whereas efficient ports reduce time losses for vessels that earn only while sailing.

Regarding cost comparison, the dissertation takes into consideration the operation cost and fuel consumption as a voyage cost only for general routes as in Table 4.5. On the other hand, the port dues and canal charges will be considered for the specific route to illustrate the primary cost effectiveness for compared routes. Obviously, the fuel consumption varies according to ship purpose and speed so that the container vessels consume more fuel due to the high speed needed to maintain port calls scheduled. Nevertheless, the value of cargo that is moved in containers is mostly higher than cargo on other types of vessels which compensates the higher operating and voyage costs.

On the other hand, the refrigerated cargo requires faster transport capability where container vessels have to compete with other modes of transport. The operation cost
is calculated based on the manning cost, H&M Insurance, P&I Insurance, repairs and maintenance, stores, spares and administration cost.

Table 4.5 The operation and bunker cost for three types of vessels.

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Size</th>
<th>Operating Cost $/day(^1)</th>
<th>Fuel Cons(^2). ton/day</th>
<th>Bunker Costs(^3) $</th>
<th>Total Cost $/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Vessel CV</td>
<td>4,048 teu</td>
<td>6,855</td>
<td>117</td>
<td>50,369</td>
<td>57,224</td>
</tr>
<tr>
<td>Bulk Carrier BC</td>
<td>Panamax 65-73,000 dwt</td>
<td>5,745</td>
<td>33</td>
<td>14,207</td>
<td>19,952</td>
</tr>
<tr>
<td>General Cargo GC</td>
<td>17-20,000 dwt</td>
<td>4,055</td>
<td>24</td>
<td>10,332</td>
<td>14,387</td>
</tr>
</tbody>
</table>


The total cost of sea transport of different types of vessels calculated in Table 4.6 excludes the port dues in the port of origin (Shanghai) and port of destination (Rotterdam) because they will be similar on both routes. Moreover, the capital cost and cost of periodic maintenance were also counted out.

The total cost was calculated as follows:

**Total Cost=Voyage duration*total daily cost+ SC charges.**

Moreover, the vessel load was assumed to be 75% of its full load because of the trade imbalances and different ports of call, especially for container vessels. In other words, the total transport cost was distributed on 75% of the vessel's full load for the bulk carrier and container vessel. The attractive tariff of the Suez Canal tended to encourage more traffic and bigger ships through the different pricing system.

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\(^1\) Operating cost estimated by Drewry for 2008 and assumed to be the same in 2010

\(^2\) As estimated by Stopford (2009).

\(^3\) The price of IFO380 in Fujairah $430.50 on 30\(^{th}\) June 2010.BWI (Bunker World Index)
depending on vessel type and size. On the other hand, the compulsory escorting of bigger ships by tug boats increases the transit charges in addition to waiting time for entering the canal.

Table 4.6 Total Cost of Sea Transport via Suez Canal for Different Vessels.

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Size</th>
<th>Route via Suez Canal SC</th>
<th>Vessel Speed</th>
<th>Time Days</th>
<th>Suez Canal charges(^1) $US</th>
<th>Total Transport Cost $US</th>
<th>Transport Cost(^2) Per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>4,048 teu</td>
<td>Shanghai-Rotterdam</td>
<td>23</td>
<td>18 days 21 hours</td>
<td>248,298</td>
<td>1,564,450</td>
<td>515 $/teu</td>
</tr>
<tr>
<td>BC</td>
<td>Panamax 65-73,000 dwt</td>
<td>Shanghai-Rotterdam</td>
<td>14</td>
<td>30 days 23 hours</td>
<td>215,897</td>
<td>830,409</td>
<td>15 $/ton</td>
</tr>
<tr>
<td>GC</td>
<td>17-20,000 dwt</td>
<td>Shanghai-Rotterdam</td>
<td>12</td>
<td>36 days 3 hours</td>
<td>67,920</td>
<td>585,852</td>
<td>34 $/ton</td>
</tr>
</tbody>
</table>

Source: Suez Canal Authority (2010) and Author.

4.2.2 Inland Transport Cost

Essentially, an efficient transport system is important for cost reduction and customer satisfaction to provide competitive services. The demand for such significant transport systems has increased in the last decades which placed strong demand on extra infrastructure and shifting of cargo between modes of transport. Although there

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1 Only transit cost taken into consideration without any extra charges
2 Assumed the vessel loaded with 75% of its total capacity for Container and Bulk carriers.
are several factors affecting the transport mode selection, such as cost effectiveness, economies of scale and environmental concerns, the accessibility to consumption centers by trains and trucks secured the desirability of inland transport. The different functions of transport modes together with logistics development imposed transport integration. Such a transport network should have significant control on costs and quality of services. On the other hand, the huge infrastructure needed obliged the national governments to invest sufficiently because of the substantial role of transport as the country's backbone.

Similar to sea transport, inland transport costs are divided into: First, capital cost for infrastructure construction for railroads as well as highways. The capital cost includes train wagons, building railroad infrastructure, railway stations and all facilities installed for operating the trains. On the other hand, inland trucking transport includes the cost of trucks, pavement of roads and all junctions with other modes of transport. Second, operation and maintenance costs such as fuel, maintenance and manning for both railways and trucking transport (Blauwens, DeBaere & Voorde, 2002). In addition, the congestion cost caused by the decline of speed of traffic due to going beyond the capacity of infrastructure, which influences the total cost.

The infrastructure cost is the crucial element of the total supply chain cost in addition to malfunction cost resulting from road and rail accidents, which add extra costs on transport. Therefore, the multiplicity of cost components and objectives of inland transport systems resulted in complicated transport pricing. The impact of the transport sector on the social life of people, environment and economy has promoted the interest of developing the services and to look over the sustainability of an efficient transport system. Owing to huge infrastructure needed for inland transport, such as highways, railroads, bridges, piers, locks and tunnels, the inland transport is considered to be more expensive but faster compared with sea transport (Muller, 2010). Moreover, the significant advantage of economies of scale that sea transport
benefits from resulted in cheaper services. On the other hand, the transport speed factor assisted the inland transport to be preferable in situations where a particular commodity ought to be handled within a short time.

Consequently, the high prices of transport services reflected the engagement of several cost elements that require government subsidies to strike a balance between a more equitable distribution of resources among people and the need for stimulating an efficient transport system.

Regarding the new route, the inland transport efficiency and reliability are the key factors of the prosperity of the route for being comparable with existing routes. Thus, the cost comparison of cargo transport provides a thorough understanding of the price differences of combined MT, as shown in Table 4.7.

Table 4.7 The Combined cost of Sea/Land transport

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Route via Iraq and Syria</th>
<th>Sea Transport Cost</th>
<th>Land Transport Cost $US (Truck)</th>
<th>Land Transport Cost $US (Rail)</th>
<th>Cargo Handling Cost And Port Dues $US</th>
<th>Total Cost $US</th>
<th>Transport Cost per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>Shanghai-Rotterdam</td>
<td>972,808</td>
<td>2,621,849</td>
<td>1,376,471</td>
<td>575,972</td>
<td>2,925,251</td>
<td>923 $/teu</td>
</tr>
<tr>
<td>BC</td>
<td>Shanghai-Rotterdam</td>
<td>558,656</td>
<td>4,096,639</td>
<td>2,150,735</td>
<td>509,670</td>
<td>3,219,061</td>
<td>55 $/ton</td>
</tr>
<tr>
<td>GC</td>
<td>Shanghai-Rotterdam</td>
<td>467,577</td>
<td>1,071,429</td>
<td>750,000</td>
<td>173,319</td>
<td>1,390,896</td>
<td>69.5 $/ton</td>
</tr>
</tbody>
</table>

Source: Iraqi Inland Transport Company (2009), GCPI (2010) and Author.

Interpreting the cost calculations in both tables (4.6 and 4.7) illustrates the cost effectiveness of existing routes when taking the cost in separation from other

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1 Port Dues, land transport cost considered the same in Iraq and Syria
influential factors. The existing route's total sea transport cost for different kinds of cargo gives a logical appearance of low transport cost compared to the proposed routes. The transport cost of transporting one TEU via the Suez Canal is $515 taking into consideration only the operating cost and voyage cost and leaving aside the capital cost in order to seek a comparison. On the other hand, the cost of moving one TEU through the new route would be $923, which exhibits the additional cost of transport in the current situation and price comparison. However, the numbers are not 100% accurate due to the unavailability of information about current Syrian inland transport costs, port dues and other cost elements. The scenario applies to the variation of transport cost for bulk cargo between the existing route and the proposed new one. However, the calculations primarily show a deviation of inland transport for bulk cargo that is a greater cost than inland transport for containers. The total cost considered was the railway transport cost for the inland part of cargo movements as part of the total transport chain from China to the Netherlands for the suggested route cost calculations.

Table 4.8 Cost Comparison for cargo transport through two route options

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Route</th>
<th>Total Time days</th>
<th>Cost via Suez Canal</th>
<th>Total Cost via new route</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Via SC</td>
<td>New Route</td>
<td>Total</td>
</tr>
<tr>
<td>CV</td>
<td>Dubai-Rotterdam</td>
<td>11</td>
<td>8</td>
<td>877,762</td>
</tr>
<tr>
<td>BC</td>
<td>Dubai-Rotterdam</td>
<td>18</td>
<td>12.5</td>
<td>575,033</td>
</tr>
<tr>
<td>GC</td>
<td>Dubai-Rotterdam</td>
<td>21</td>
<td>14.5</td>
<td>370,047</td>
</tr>
</tbody>
</table>

Source: Suez Canal Authority (2010), Iraqi Inland Transport Company (2009), GCPI (2010) and Author
For regional transport, the cost analysis of transporting different kinds of goods from Dubai in the UAE to Europe demonstrated the higher cost of MT using the new routes. Although the new route has an advantage of saving time, which affects the total sea transport cost, the expensive inland transport increases the total cost and reduces the benefits of saving time for the integrated transport system (Table 4.8).

Obviously, the second option of the new suggested route via Turkey to the eastern part of Europe will be even more expensive than the first option due to longer inland transport distances for cargo. As mentioned earlier, the cost is not the only decisive factor of route selection, though it is the most important one, especially for shippers' and carriers' concerns, but many clients would like to pay more for the time factor, reliability, and service level. Therefore, other factors have to be discussed in this dissertation to provide comprehensive recommendations for carriers whether or not the new route is beneficial for them and the total transport system.

### 4.3 Crude Oil Transport

The major product of the Middle East region is mainly crude oil, which can be transported by different modes of transport depending on transport distance. Oil tankers are a desirable means of transport for crude oil between continents because it is considered as a cheaper mode of transport for such long distances. On the other hand, pipelines are the most significant transport mode between countries such as the European inter-continental transport of oil by pipelines. Obviously, crude oil carriers have been getting bigger to carry more cargo and taking advantages of economies of scale. Therefore, the serious pressure on the Suez Canal and the Panama Canal to extend their capability of allowing bigger ships has lead to investing huge amounts of money for such extensions.

Regarding oil transport, the new route has advantages to compete with the existing Suez Canal route if the crude oil is transported by pipelines from Iraq to Europe via Syria. The long distance of sailing from the Arabian Gulf through the Suez Canal
contributes in higher costs of transport, whereas the new route would shorten the distance. Moreover, the added cost of Canal dues for transiting the Suez Canal cannot be seen in the case of the new route, which would make it more preferable as a cost effective corridor. In the current situation, Iraq exports its oil from northern oil fields by pipelines to the Mediterranean via the port of Ceyhan in Turkey. There are two pipelines between Kirkuk in Iraq and the port of Ceyhan in distance of 600 miles\(^1\), designed to transport about 1.1 million barrels of crude oil per day (Kumins, 2006). These pipelines are playing a crucial role for an efficient mode of transport and economically beneficial for both countries (Iraq and Turkey). The distance between Kirkuk and Tartous in Syria is about 480 miles, which is shorter compared with existing pipeline routes, but the political disputes between Iraq and Syria in the past impeded the cooperation to construct pipelines. The situation in Iraq will probably lead to more understanding for developing crude oil transport between Iraq and Syria, which serves the economy of both countries. For exporting crude oil from southern oil fields, the oil terminals in the Gulf are loading about 80% of total exports to different markets (IOM, 2010).

Pipelines transport is considered to be cost effective in terms of transport cost and operation because usually the maintenance cost is very low as well as the operation costs. Moreover, the time of transport is relatively constant in normal conditions when the pumping system is well maintained and operated. The investment of building the infrastructure and superstructure for pipelines transport is relatively low compared to other modes. In comparison with other modes, pipelines are not suffering from problems of delays for the transit of cargoes across borders in addition to the documentation procedures of customs clearances. Moreover, crude oil can be transported by pipelines from the fields to the refineries without the need to go through ports or terminals.

\(^1\) British mile= 1.609 km
The mentioned limitations of draught in the Suez Canal, forced the ULCC tankers to sail via the Cape of Good Hope and also the security instability in the Gulf of Aden encouraged smaller tankers to change their routes. The suggested new route can be a viable alternative for the transport of Arabian Gulf countries' oil to Europe and the US. Oil can be transported from Iraq by pipelines via Syria to be loaded in oil tankers in the Mediterranean to be moved to final destinations. Of course, the efficiency and capacity of the loading terminal together with pipelines will have a considerable impact on the competitiveness of the new route with the Suez Canal.

In addition, pipeline transport is considered to be friendlier to the environment compared to other modes of transport, such as sea, road, and railway transport, which gives an advantage and competitiveness with other modes as well as the Suez Canal.

4.4 Suez Canal Capacity and Efficiency

Together with the Panama Canal, the Suez Canal plays a crucial role in global maritime transport. The Canal served the shipping industry by connecting the European markets with Asia, which assisted the ship owners to take benefit of a shorter route compared with sailing around the Cape of Good Hope. Moreover, the geographical location of the Suez Canal, which connects the Indian Ocean with the Atlantic Ocean through the Red Sea and Mediterranean respectively, distinguished it to be economically significant.

The development of vessel sizes encouraged the enlargement of the Suez Canal accordingly. The largest ships able to pass through the Canal when it was opened in 1869 were of 5000 tons. Today, ships of 240,000 DWT and draught of 22 meters can pass through the canal properly. The total length of the SC is 193.3 km, and it takes about 12-16 hours to transit the Canal. Due to the limitation of the Canal's width, the Suez Canal navigation rules impose a convoy system to manage vessels' sailing. There are three convoys for ships passing the Canal, two southbound convoys from
Port Said at 00:00 hours and 07:00 hours and one northbound from Suez at 06:00 hours (Suez Canal Authority, 2010).

For such limitations, the SC is limited to receiving 81 vessels per day, which can be considered as an opportunity for the new route to share the extra traffic in case of exceeding the Suez Canal capacity. Although the figure in Suez Canal reports shows that the traffic has not reached this limit, the trade and maritime industry are always changeable to reshape a new market and demand which might increase the number of vessels that wish to pass through the Canal. Moreover, the waiting time for vessels that have arrived after the convoy departure time adds extra cost on transport, which was not taken into account in the total cost calculations, because it is variable. Nevertheless, the current situation of the Suez Canal is that it is considered to be more desirable due to the cost effectiveness compared to other routes.

4.5 Regional Integration and Crossing Borders

Due to the Iraqi location, the suggested route has to pass through the borders with Syria for both southbound and northbound transit of cargo connecting the Mediterranean with the Arabian Gulf. On the other hand, Iraq has a border with Turkey to be transited when moving cargo between Europe and Asia via Iraq and Turkey. The increasing stability of the region will presumably result in redirection of existing international trade flows toward more convenient routes, which up to now have been barred for political reasons or threats of wars.

Currently, the security situation is deeply affecting the border crossing processes, which increases time spent at borders for cargo inspections, resulting in high transport costs. Despite that, the future improvement of the security situation and reforming regional cooperation can probably lead to development of smooth transit of goods. Historically, Iraq was an inland transit route from the Arabian Gulf to Europe and from Saudi Arabia to Turkey (IMOP, 2008). The project of new routes requires involvement of regional governments in planning, design, execution,
maintenance, and operation in the transport sector to overcome the current bottlenecks.

It is worth mentioning that during previous wars between Iraq and Iran, goods were mostly imported through Jordan and Turkey by inland transport. Moreover, the Syrian approach was used to transport cargo to Iraq during the embargo. In other words, the regional governments have been cooperating to redirect the transport flows according to their needs. Likewise, such cooperation resulted in producing a sort of standardization of railway gauging between Iraq and Syria. On the other hand, the existing inland transport infrastructure is insufficient to cope with the proposed volume of traffic. For an efficient transport system, the necessity of smooth cargo flows requires eliminating constraints in order to have a developed multimodal transport network. Consequently, identified essential requirements for trade facilitation are the need for deregulating the integrated regional transport system and implementing a common transport policy that has to be agreed by these countries.

According to Hoffmann (2010), the standardization of cargo movement processes, procedures, documents and information will improve the cargo flows at the countries borders. This can be achieved through harmonizing the national procedures and processes with international standards and regulations. Moreover, developing transport procedures and simultaneously simplifying them anticipates the elimination of excessive elements and duplications of formalities. In addition, travel time reduction is a crucial element in transport costs, which includes the time for crossing the borders to exchange the documents and security checks.

Accomplishing a reduction of the time factor is a significant issue in a contemporary multimodal transport system. Also, the practices of different authorities at borders might be the constraints that are impeding the cargo flows from delivering impeccable on time services to the clients. In such circumstances, the transport and logistics costs will increase and also create unreliability of service scheduling by
carriers. Previously, the calculations of land transport considered one day for the transit time of cargo from Basra (Iraq) to Tartous (Syria) assuming crossing the borders would run without stoppage. On the contrary, there is currently border congestion due to the mentioned situation so that the transit time could be more than one day, which will increase the total inland cost.

For the suggested routes, easy crossing of the borders would make a fundamental contribution to the competitive transport network. In addition, the smooth and prompt proceeding of goods across borders gives the suggested routes comparative added value and also increases the costumers' satisfaction level. It is obvious that the railways transport can play an important role for minimizing transit time, if there is a cooperative operation and control by the two governments (Iraq, Syria). Both countries are getting economic and social advantages from developing a cooperative multimodal system so they have to emphasize on evolving transport related matters with similar concern. As a matter of fact, the Customs system can play a discrete function to facilitate the cargo movement through the borders by having sufficient cooperation between customs authorities in all countries which take part in such MT. For instance, the intelligence customs system is considered to be the prosperity feature of multimodal transport in the European Union. The customs activities and procedures might cause delays for cargo flows such as bottlenecks, yet they may effectively leverage transport clients by using developed technology and information interchange.

Coherent regional trade encounters the need for well developed transport facilitation for international movement of cargo. Moreover, the need for trade liberalization and free trade among regional countries urges the regulators and decision makers to take running and operating the business jointly into consideration. Therefore, there are several dialogs between regional countries (Iraq, Syria and Turkey), which started recently to develop a free trade region and the MT system.
4.6 Port Efficiency and Cargo Handling

Port throughput and efficiency have a distinct impact on transit time of goods and total transport cost. Although the geographical location of a port has a significant effect on its attractiveness, the efficiency of cargo handling services of ports that are connected to efficient hinterland connections became the interest of shippers and carriers (UNCTAD, 1999). For the suggested routes, ports are crucial elements to be considered for analyzing the total transport cost and transit time. Shipping companies tend to minimize the number of port calls to reduce transport cost and time that is consumed for cargo handling. In particular, the selection of hub ports by container vessels mostly depends on the cost effectiveness of a port and its productivity. Of course, such challenge for the new route will affect the carriers’ choices whether they will continue to use the existing Suez Canal route or not. Unless the port operators in both countries, Iraq and Syria, prove with evidence that cargo flows will run smoothly, ports are perceived to be bottlenecks for the new MT.

In Table 4.1, the transit time differences between the Suez Canal route and new route were about two days in favour of the new route without taking the cargo handling and ships berthing/unberthing time into account. If the vessel spends one day for unloading the cargo in the suggested new port in Iraq and one day for loading the cargo again in the port of Tartous, the transit time is going to be the same for the new and existing routes. On the other hand, for transporting goods to Europe via Turkey by inland transport there will be one cargo handling activity taking place in the port in Iraq, which leads to reduced transit time. In such case, the port performance and productivity are assumed to be extremely good by port operators through the latest developed cargo handling equipment to minimize the transit time as much as possible. Moreover, the partnership between the public and private sectors has an important influencing impact on major port investment and operation. The dissertation is going to discuss the current situation of Iraqi ports in detail in the upcoming chapter.
4.7 Factors influencing the competition with the Suez Canal

4.7.1 Security Concern

Recently, piracy in the Gulf of Aden and along the Somalia coastline has widened an alarming deterioration of the security situation for vessels passing through the Suez Canal as shown in Figure 4.6. Consequently, the international trade is directly affected by increasing international transport costs, which have become more expensive due to the serious increase of insurance cost. In addition, the employment of security guards onboard ships and paying ransoms have added extra voyage cost in order to avoid the piratical attacks. The number of successful vessel attacks and attempts has risen over the last years due to the instability of the political situation.

The impact of such a threat may encourage the carriers to find other alternatives, as IMO (2008, p.2) stated, "without adequate and coordinated protection for shipping, the current situation of Somalia might cause ship operators to avoid transiting through the Gulf of Aden, using the Cape of Good Hope instead"

![Figure 4.6 The number of Piracy attacks divided by regions in 2009](source: IMB's annual report (2010, January))
In addition, the piracy attacks endangered innocent seafarers from different parts of the world, which may also lead to increasing the insurance cost for personnel as well as their salaries. Generally, the global trade will be affected if the piracy phenomenon continues. Obviously, the alteration of sailing routes via the Cape of Good Hope will increase transport time and cost. In such a situation, the new suggested route may play an important role for cargo movement between the Far East and Europe. On the other hand, the current situation in the region, particularly in Iraq, is facing several difficulties which can act as obstacles for the transport system. As mentioned earlier in Table 4.3, the high freight rates for moving cargo to Iraq resulted from the risks associated with the security situation, which caused insurance companies to claim higher insurance premium to compensate for unforeseen losses. Other most frequently expected problems are the damage or loss of cargo during its inland movement, which might add extra costs. Hence, the competitiveness of the new route with the Suez Canal depends on the improvement of the security situation to reduce additional transport cost and introducing a developed and efficient MT system in the region.

Regarding security, both routes have competitive pros and cons. The existing route is threatened by piracy attacks and hijacking of ships sailing in the Gulf of Aden in spite of the international efforts to enforce international laws and regulations. However, the success of the new route depends on the stability of the security situation in the region.

4.7.2 Environmental Concern and Air Pollution

Gases that are emitted from ships' engines can be categorized into three main polluting substances: Nitrogen Oxides (NOx), Sulphur Oxides (SOx), and Carbon Dioxide (CO$_2$) (Alexandersson, 1991). Maritime accidents may cause huge damage to the environment, which affects the ecosystem due to oil spills resulting from vessel collisions and grounding and gas emission from ships. Heretofore, the shipping industry has reasonably been considered as the least polluting mode of
transport in terms of air pollution (IMO, 2008). Emissions from ships can be caused by emission of exhaust gases, cargo emissions, emissions of refrigerants and other emissions (IMO, 2009). The quality of fuel used for the propulsion system and generating electivity has an impact on the air quality and gas emissions. Therefore, a number of countries have insisted that shipping companies use high quality fuel with low sulphur contents, such as the Sulpher Emission Control Area (SECA) in the Baltic Sea. The dissertation attempts to evaluate the environmental impact of the new route on air quality to estimate the significance of the suggested MT.

A significant potential for reducing the CO₂ emission is attainable through a combined transport system. From Table 4.9 it is obvious that the new route has an advantage of being more environmentally friendly in terms of CO₂ emissions for integrated sea and rail transport compared with road transport.

Table 4.9 CO₂ emission comparison between existing and new routes

<table>
<thead>
<tr>
<th>Transport mode</th>
<th>Unit Volume of CO₂ g/t.km</th>
<th>Distance Shanghai-Rotterdam Via SC km²</th>
<th>CO₂ emission kg/ton</th>
<th>Distance Shanghai-Rotterdam Via new route km</th>
<th>CO₂ emission kg/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>shipping⁴</td>
<td>38</td>
<td>19277</td>
<td>732.5</td>
<td>17359</td>
<td>660</td>
</tr>
<tr>
<td>Railroad</td>
<td>120</td>
<td></td>
<td>732.5</td>
<td>1250</td>
<td>150</td>
</tr>
<tr>
<td>Truck</td>
<td>180</td>
<td></td>
<td>732.5</td>
<td>1250</td>
<td>225</td>
</tr>
<tr>
<td>Total CO₂ emissions</td>
<td></td>
<td></td>
<td>732.5</td>
<td>Ship+ rail</td>
<td>810</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ship+ trucks</td>
<td>885</td>
</tr>
</tbody>
</table>


Railway transport is mostly desirable because of its accessibility to hinterland connections without suffering from traffic congestion as in road transport. However,

¹ g/t.km = grams of CO₂ per ton of cargo transported on kilometer.
² Distance is converted from nautical miles to km.
³ CO₂ emission from Container vessels.
the gas emissions caused by cargo handling operations and maneuvering operations 
with tug assistance have not been measured, which will increase the quantity of CO₂ 
emissions. On the contrary, trucking transport combined with sea transport causes 
greater amounts of CO₂ emissions, which are undesirable for green transporters and 
international concerns due to its effect on global warming and climate changes. In 
general, the CO₂ emissions from ships transiting through SC are less than new route, 
which gives competitive advantage for the existing route. However, road transport is 
making considerable efforts to reduce the GHG emission comparing with sea 
transport due to the lifespan of trucks being much shorter than ships and the 
possibility of applying latest technology happening with road transport (Cariou, 
2010a). Developing the MT system for the new route would introduce a competitive 
transport system to serve moving goods by greener modes of transport. The 
calculations of CO₂ emissions based on container vessels, which are the highest 
emitting type of vessels compared to others like tankers and bulk carriers. 
Consequently, the transport of goods by those ships will produce less emission than 
carrying goods by container vessels giving more advantages to the existing route in 
terms of CO₂ emissions.

Furthermore, ports can play an important role in eliminating the impact of GHG 
emissions through a decent environmental policy and strict legal instruments. For 
example, cold ironing might be provided for vessels to reduce exhaust gases 
generated from auxiliary engines for generating electricity when ships are berthed. 
Nevertheless, the shore power supply price is double or more compared with the 
price of electricity generated by ships auxiliary engines (Helsinki Commission, 
2005). In addition, the Arabian Gulf region is rich in oil resources, which enables 
them to offer high quality fuel with appropriate prices to attract more traffic and 
reduce gas emissions. An efficient port can ensure effective ship turnaround time by 
minimizing waiting time, cargo handling time and time for delivery of goods. For the 
land side, the smooth flows of goods through ports contribute to protecting the
environment from damage caused by road congestion, which increases fuel consumption and gas emissions.

On the other hand, the usage of the Suez Canal is playing a significant function in the sense of shortening sailing distances and fuel consumption to reduce transport cost as well as gas emissions compared with old routes. The estimation of gas emissions is difficult due to the uncertainty of transit time on both routes and also the waiting time in the Suez Canal and new route. Moreover, the engine efficiencies and speed of ships and railways can have a strong effect on the quantity of air polluting gases. For competition, both the Suez Canal authority and the operators of the suggested new route can initiate a green tariff with an environmentally friendly pricing system in order to contribute to eliminating air pollution and become more environmentally competitive.

As a result of global warming, melting of the ice in the Arctic Ocean has been intriguing shipping lines to pass through the northeastern passage. This route will shorten the sailing distance between European ports and northern Asia by up to 50% compared to the Suez and Panama Canal routes, taking only 15 days (Peresypkin and Vasilyev, 2009). In this regard, the usage of that route will threaten the Suez Canal traffic as well as the new suggested route due to the time saving and cost effectiveness of the northeastern routes. However, this situation cannot be seen in the near future, because that route is still unsafe for ship navigation due to the presence of ice and its hidden risks. Therefore, the Suez Canal remains the most beneficial choice compared with other sea routes due to its comparative advantages mentioned earlier.

### 4.7.3 Economies of Scale

As mentioned before, the advantage of increasing the transport mechanism in the economy of scale proved by lower transport cost per unit was shown in Table 4.4. Moving cargo by sea transport with bigger vessels afforded preference for the shipping industry to be cheaper than other modes taking advantage of economy of
scale. In particular, transfer of goods between continents and over long distances is mostly accomplished by ocean going vessels especially for low value cargo. This illustrates that the usage of the Suez Canal is cost effective in the sense of economy of scale for shipping. However, the limited capacity of rails and trucks could have confined the ability of inland transport to transfer all amounts of goods transported by ships. Even if a new MT system successfully managed to compete with the Suez Canal route, it could not be a complete substitute due to the limited capacity of inland transport. Of course, it can be expanded to the extent of higher capacity to share some traffic with the Suez Canal, yet it would be impossible to convey about 335 million tons of cargo that passed through the Suez Canal in 2009 by inland transport (Suez Canal Authority, 2010).

4.7.4 Bunker prices

Bunker price is obviously the most crucial element of transport cost, as discussed previously. For a country like Iraq, which is one of the most oil-rich countries, the Government can take practical measures to support the transport sector, particularly the MT system in the country, through the reduction of fuel prices. This would reduce transport costs in general and give the status of competitiveness with other routes.

It is natural that high fuel prices directly benefit the country, but long-term projects such as sustainable transport are also considered beneficial for job creation for citizens which are admirable investments compared with incomes derived from oil. There should be an in-depth study on the impact of lowering oil prices in the sense of attracting ship owners through the provision of coherent evidence that these measures will reduce transport costs for them. Iraq can do that even in the Mediterranean Sea through transferring fuel by pipelines to Syria and providing bunkers for ships loading and/or unloading the cargo there. Therefore, Government subsidization of bunker prices can act as a key factor of the competitiveness of the new route.
Chapter 5
Analysis of the Significance for Iraq of the New Route

5.1 Transport Cost for Trade between Iraq and Europe

The European countries and the United States are the biggest trading partners of Iraq, where most goods are exported to and imported from these countries. Apart from crude oil exported to these trading partners, the manufactured productions, humanitarian needs, medication and raw materials for the rehabilitation of Iraq were imported from these countries. Table 5.1 shows the volume of trade exchange taking place among these partners, which clearly demonstrates the need for different means of transport.

Table 5.1 Iraq's top 10 Export and Import Trading Partners, 2003

<table>
<thead>
<tr>
<th>Exports (millions of U.S. $)</th>
<th>Imports (millions of U.S. $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States 4,466.5</td>
<td>Jordan 693.1</td>
</tr>
<tr>
<td>Canada 797.7</td>
<td>Vietnam 537.8</td>
</tr>
<tr>
<td>Jordan 769.3</td>
<td>United States 347.2</td>
</tr>
<tr>
<td>Italy 724.5</td>
<td>Germany 253.2</td>
</tr>
<tr>
<td>Morocco 481.1</td>
<td>Russia 240.2</td>
</tr>
<tr>
<td>Brazil 398.4</td>
<td>United Kingdom 237.7</td>
</tr>
<tr>
<td>Spain 302.3</td>
<td>France 190.7</td>
</tr>
<tr>
<td>Netherlands 269.8</td>
<td>Italy 186.9</td>
</tr>
<tr>
<td>Japan 99.5</td>
<td>Australia 178.8</td>
</tr>
<tr>
<td>Australia 27.6</td>
<td>Japan 84.1</td>
</tr>
</tbody>
</table>


Nevertheless, the trade with the Far East countries such as Japan, China and the Republic of Korea has been growing due to the market changes and price of manufactured goods. Turkey became the most important trade partner for import and export cargo produced in Turkey as well as cargo produced in European countries.

The transport of goods from Europe and American countries carried by ships would be transited through the Suez Canal or moved by land transport via Syria, Turkey and
Jordan. The assessment and analysis of cost comparison might give incentives to transporters for using a new route to move goods from European countries to Iraq. Likewise, for transporting goods from Asian countries to Syria, Turkey and Jordan can be committed by traders via Iraq.

Table 5.2 Transport Cost Comparison for Trade between Iraq and Europe

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Size</th>
<th>Route via SC</th>
<th>Transport Cost per unit</th>
<th>Route via New Route</th>
<th>Transport Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>4,084</td>
<td>Rotterdam-Baghdad</td>
<td>1151 $/teu</td>
<td>Rotterdam-Baghdad</td>
<td>1125 $/teu</td>
</tr>
<tr>
<td>BC</td>
<td>65-73,000 dwt</td>
<td>Rotterdam-Baghdad</td>
<td>38 $/ton</td>
<td>Rotterdam-Baghdad</td>
<td>34 $/ton</td>
</tr>
<tr>
<td>GC</td>
<td>17-20,000 dwt</td>
<td>Rotterdam-Baghdad</td>
<td>49 $/ton</td>
<td>Rotterdam-Baghdad</td>
<td>40 $/ton</td>
</tr>
</tbody>
</table>

Source: Iraqi Inland Transport Company (2009), Suez Canal Authority and Author.

Taking into account the transport cost calculations in Table 5.2, the shift of transport direction for cargo imported from and exported to European countries is giving advantages for the new route being more cost effective compared with the Suez Canal route. The same applies for the trade between Syria, Jordan and Turkey with Asian countries using the suggested corridor. The analysis of the redirection of existing international transport flows toward more convenient routes might be beneficial for global trade and transport economy.

Transport costs are calculated for the two routes as follows:

1. For cargo transported from Rotterdam to Baghdad via Suez Canal
   
   \[
   \text{Transport cost} = (\text{days at sea } \times \text{daily cost} + \text{SC dues} + \text{Land Transport}^1) / \text{no. of units}
   \]

2. For cargo transported from Rotterdam to Baghdad via Syria
   
   \[
   \text{Transport cost} = (\text{days at sea } \times \text{daily cost} + \text{Land Transport}) / \text{no. of units}
   \]

\(^1\) From new suggested port to the City of Baghdad.
The port dues in both ports (port of Tartous and port of Basrah) are not including total cost determinations and the same tariff is considered to be applied due to unavailability of data from Syrian ports. Obviously, redirecting the cargo flows in the Middle East region might create a new market due to the competitiveness of the new route with the currently used one. Table 5.2 shows that the transport cost per unit for moving one TEU from the port of Rotterdam to the final destination in the City of Baghdad is less when using Syrian ports and land transport network compared with proceeding to the port of Basrah. Of course, crossing the border between Iraq and Syria can represent a bottleneck for smooth flows between the two countries, which should be facilitated by sufficient cooperation between them. The time for the cargo transport would also be about four days shorter compared with the existing route if the port performed the cargo handling operations efficiently. Meanwhile, it has to be remarked that an efficient integrated transport network can redirect the carriage of goods for the regional countries, which have the potential for economic growth.

5.2 Current situation of Iraqi ports and approaches

The topography of Iraq can be divided into three major areas, namely the Highland Area of the northern region (about 20%), the Alluvial Plain Area created by the Tigris and Euphrates rivers in the central region (30%), and the Desert Plateau Area of the western region (40%). About 70% of the whole area is characterized as a tropical desert type climate with annual precipitation of 50-200mm, whilst the northern area is categorized as Mediterranean climate, which would have annual precipitation of 400-1000mm.

Iraq has a short coastline of about 48 km lying between the national boundaries of Iran and Kuwait, with all its ports situated within the Al Basrah province. Almost all port facilities are situated at river or river estuary locations and according to JBIC (2006) can be territorially divided into four major areas:

1. The Um Qasr Area is Iraq's biggest sea port facility consisting of 22 berths for general cargo, container handling, grain and other bulk cargoes, with a designed
water depth of 12.5 m. The port is located on the Khor Abdullah Channel at a distance of 56 nm from its entrance.

2. The Khor Al Zubair Area is situated 20 km north of the port of Um Qasr; the Khor Al Zubair Port facility was constructed as a Free Economic Zone (FEZ) and industrial port with 12 berths of 12.5 m designed depth. The port was constructed between the years of 1975 and 1980 and is designed to handle general cargo and specialized bulk materials, such as fertilizer, phosphate, petrochemicals and export scrap iron together with iron ore imports.

3. The Al Faw Area is on the western bank of the lower Shatt Al Arab Channel. Port facilities in this area consist mainly of oil unloading jetties and are utilized to refuel the Iraqi fishing fleet.

4. The Al Maqal (Basrah) and Abu Flus Area is located on the western bank of the upper Shatt Al Arab Channel. The port of Abu Flus contains 3 berths with maximum draft of 5.2 m at the river bar handling traditional general cargo and RORO, whilst Al Maqal Port contains 14 berths but its traffic is very limited because the access to the port is cut off by a pontoon bridge down river.

Figure 5.1 Locations of Major Ports in Iraq
Source: JBIC, 2006
In addition to the ports described above, there are also two oil terminals (Al Basrah and Al Amaya) located in the north of the Gulf for exporting crude oil as shown in Figure 5.1.

With the exception of the port of Abu Flus, the capabilities of ports in the Shatt Al Arab Channel were seriously hindered following the Iran-Iraq War of 1980 to 1988. The majority of trade was transferred to the ports of Um Qasr and Khor Al Zubair which remained relatively undamaged during that conflict. In order to handle the large volume of essential goods needed for the Iraqi reconstruction, these ports (Um Qasr and Khor Al Zubair) have recently been rehabilitated to be restored to their original capacity. Since completion of an urgent dredging project by the UNDP in 2003, 50,000 dwt size vessels have been able to enter Um Qasr Port at the high tide level and the function of the port has been recovered to a limited extent. However, the required water depth was not achieved for the whole area of the channel and port basin, and consequently, the utilization of cargo handling is only 50% of the port sector's former capability (JBIC, 2006).

In the past, the operational efficiencies of Um Qasr and Khor Al Zubair ports fell well below their potential capabilities because the channel and berth depths were too shallow to accommodate large, deep draught vessels. Moreover, the difficulties of channel accessibility because the wrecks of ships sunk during the previous successive wars impeded ships' safe navigation when entering the ports. In addition, the lack of cargo handling equipment caused by the embargo resulted in a decrease in the efficiency of the ports. As a result, major cargoes required for the northern part of Iraq and the capital region of Baghdad have to be imported through Aqaba Port in Jordan and large vessel shipments for the southern part of Iraq via neighboring Kuwait. Transport distances for imported goods are, consequently, longer and with delays for inspection and customs clearance of trucks at the borders. The high transport costs resulting from importing goods through neighboring countries are then passed on to the Iraqi inhabitants in higher prices for imported commodities.
In response to the urgent need for transport system improvement, it has been decided by the Iraqi Government that extraordinary efforts must be made for the purpose of developing the transport sector. This was illustrated by examining possible ways for developing port approaches, ports and inland transport connections. The Government has realized that the transport sector needs significant resources and policy changes in order to cope with regionally and internationally evolving standards to enable Iraq to leapfrog over rivals in this sector by adopting the latest technology and a desirable business environment through adopting a proper policy and regulatory framework (IMOP, 2008). Consequently, the capital and maintenance dredging activities continue ongoing in order to deepen the berths and channels to enhance the ability of accommodating bigger vessels taking advantages of economies of scale. Moreover, most of the wrecks have been removed, particularly from the Um Qasr and Khor Al Zubair channel, which were functioning as obstacles for navigation (GCPI, 2010).

It is worth mentioning that tangible results have been noted for the capacity building of the transport system due to these practical steps which were demonstrated by increased traffic and income. Nevertheless, the ports and transport system still need to be developed in an appropriate and effective manner in order to confirm their technical, economical, and environmental soundness. An identification of bottlenecks impairing the transport functions would result in restoring the ability to attract cargo. Therefore, this dissertation attempts to identify and analyze the bottlenecks in order to have a clear idea about the need for improving the existing transport system or investing in the new route.

5.3 Identification of Bottleneck for Iraqi Transport System

5.3.1 Port Accessibility and Safe Navigation

Keeping approaches and berths in appropriate depth is necessary to improve the ability of ports to receive several sizes of ships due to the tendency of building bigger ships, especially oil tankers, container ships and bulk carriers, which require deeper water. Shipping companies and ship masters are concerned about the safety
of their ships and environmental damage because of groundings in shallow water, which will have an impact upon the hull in addition to engine problems and the environment.

If ship owners expect that problems would occur to their vessels while carrying cargo proceeding to ports, they will certainly change the destinations to protect ships from any danger. As a normal result, a port would lose its clients, who will attempt to find other ports that offer good facilities. However, for monopolistic services, shipping companies are obliged to use smaller ships with shallower drafts to avoid grounding in port approaches, but they will lose the benefits of economies of scale as shown in Table 5.3. This would lead to high freight rates and expensive transport services paid by the consumers. However, the port dues depend on ships' gross tonnage (GT) so that the port income will decrease and suffer from economic failure. For example, a bulk carrier with an 11m draft can carry about 57,000 tons of grain. Reducing draft to 10m, the cargo will be reduced to 48,000 tons, which results in loss of 9,000 tons of cargo of the ship's carrying capacity.

<table>
<thead>
<tr>
<th></th>
<th>Year 2004</th>
<th>Year 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max (DWT)</td>
<td>Average (DWT)</td>
</tr>
<tr>
<td>Bulk Cargo</td>
<td>55,000</td>
<td>35,700</td>
</tr>
<tr>
<td>Container</td>
<td>25,000</td>
<td>4,050</td>
</tr>
<tr>
<td>Bagged Cargo</td>
<td>40,000</td>
<td>9,710</td>
</tr>
<tr>
<td>Ro/Ro 21 berth</td>
<td>15,000</td>
<td>1,060</td>
</tr>
<tr>
<td>Overall</td>
<td>-</td>
<td>2,290</td>
</tr>
</tbody>
</table>

Source: JBIC, 2006

In general, the Iraqi waterways and port approaches are in urgent need of capital and maintenance dredging because of extensive sedimentation. The main commercial port constitutes an important infrastructure link for the economic revival of Iraq, and the sedimentation problem is creating a serious obstruction to efficient and cost
effective port operations. It has been estimated that it will require capital dredging in the order of 24million.m$^3$ and a yearly maintenance dredging of around 11million.m$^3$ to re-establish the design depths for all of the Iraqi major ports (Hassan, Abild & Jorgensen, 2006).

As a result of the natural shaping of the seabed in the north of the Arabian Gulf, which is like a soft mud in addition to dust that comes from the desert, and because of the high speed currents (4-5knots), the sediments will be solicited and carried by these currents during the high tide period toward ports. When the water loaded with sediments reaches the port area, the currents start to slow down in the slack water period; consequently, the heavy molecules of sediments will fall down on the river bed and thus day by day the river depth decreases. The second reason is due to the connection between the Tigris and Afloat rivers, which spring from Turkey and Syria respectively. They run across from the north of Iraq down to the north of the Arabian Gulf. They irrigate the arable lands in addition to land washing before cultivating it; then the drain water returns back into the rivers with sediments proceeding to port approaches and falling down in the port area during the slack water period as mentioned before. This periodic problem of deterioration of the channel and port depths is considered to be a big challenge for the performance and efficiency of the ports. Therefore, the need for a deep-sea port urged the decision makers to meditate seriously how to overcome such challenges.

Previously, the poor condition of navigation aids, the presence of wrecks and siltation of the channel presented major hazards to shipping and limited the operational capabilities of the ports due to the restricted sizes of vessels that are able to access Iraqi ports. Moreover, such conditions of unsafe navigation discouraged the carriers from calling these ports and encouraged them to change the destination to neighboring ports. Today, the situation is improving due to the efforts of the Iraqi Government by investing in different projects. Many wrecks have been removed from the channel and port areas as well as the rehabilitation of tender vessel for
maintaining the channels and providing proper navigational aids. However, the long distance of ports approaches requires continuous dredging and channel maintenance, which needs large amounts of money. In this respect, the need for making the channel shorter is also significant by constructing a deep-sea port in the north of the Arabian Gulf, which would be more accessible.

5.3.2 Land Transport Network System

The transport network system used at major ports comprises both rail and road for cargo moved by ships. In general, rails are serving as passenger carriers and freight services in most countries. A single-track main line link operated by the Iraqi Republic Railways (IRR) is located within the transport corridor connecting the port of Um Qasr with Al Basrah and other northern cities (IRR, 2009). The Iraqi railway system is connected with other neighboring countries such as Syria and Turkey for transporting goods. The rail network does not function effectively at present due to serious deterioration and damage to the tracks and rolling stock. However, many attempts have been carried out by relevant authorities to enhance the network system in order to get over the incompetence embarrassment and to cope with the increasing demand for proper transport services.

The major ports are connected with the northwest of Al Basrah city and other population centers all over the country by road links. The roadways are generally connected with international highways crossing the borders with Kuwait, Jordan, Syria and Turkey. These roads are used to transport all types of cargo, utilizing various types of privately operated trucks. During the recent reconnaissance surveys made by the JBIC (2006), it was reported that most of the road network linking the ports with the main network needs overlay and also a new layer due to the pavement layer being missing in the original design. The condition of the pavement layer of these roads is partially damaged, with many cracks evident on the road surface due to repetitive use and overloading. A road maintenance programme to repair the cracks followed by overlay is taking place, but it would be insufficient to handle the
forecasted traffic increase, which means that new roads have to be constructed. As a result of the uncertainty of availability of trucks for several reasons, the transport of goods by trucks from major ports to all cities threatens the port productivity because of the practice of direct delivery operations of goods. The commodities are mostly food imported by the Ministry of Commerce to be distributed to all provinces according to a plan set by this Ministry. The plan compels trucking companies to move the goods to a specific province, which is probably unsafe due to the security situation. As a counteraction, the trucking companies refuse to carry these cargoes, which would remain onboard ships or in port sheds. This situation is probably not permanent because it depends upon the improvement of the current conditions, which is hoped to be changed.

In parallel to the need for access channel and berth rehabilitation and increasing their capacity, the hinterland transport network would become a bottleneck unless the development of this sector is progressed and paid sufficient attention to decision makers in the country.

5.3.3 Ports Capacity and Performance

As the city of Basrah expanded in the 1960s, the need for building a new port to accommodate larger ships with deep draught urged the decision makers to introduce new ports. Um Qasr Port was chosen to be the future commercial port in Iraq with a maximum capacity of 13.6 million tons per year (GCPI, 2010). The major Iraqi ports (Um Qasr and Khor Al Zubair) are chosen to be assessed in order to present the current capacity and performance level.

The majority of quayside cranes in the port of Um Qasr are over 20 years old and many, particularly at the south berths are not functioning properly. The total number of cranes is 55 distributed as 38 rail mounted cranes at the north berths and 17 cranes at the south berths. In general, the cranes are of the level luffing portal jib crane design with capacities of 3 tons to 15 tons, although there are also 2 gantry cranes of
40 tons capacity for handling containers at berth 20 and 2 older gantry cranes at berth 5. The two gantry cranes at berth 20 are relatively new, supplied by ZPMC in 2001 and working efficiently, but there are break downs due to lack of spare parts. The port is also equipped with two Liebher 100 ton mobile container cranes, which have been installed and are now operational. The have almost doubled the port's ship-to-shore container capability (JBIC, 2006).

There are 10 reach stackers operable with insufficient efficiency because four of them are more than 9 years old, the lack of original spare parts and the tropical weather, which affects the function of the engines as well as other types of equipment. Moreover, there is an insufficient number of trailers and container terminal tractors to facilitate the transport of containers within the port. Similarly, the cargo handling equipment in Khor Al Zubair Port can be described as quayside cranes which are over 25 years old and a number of them are non functional. The port has 17 rail mounted cranes with capacities of 5, 8 and 15 tons which are not working efficiently and two lever lifting cranes. The port does not have a specialized container terminal nor container handling equipment.

As mentioned earlier, the port is designed for industrial purposes. Consequently, the port has specialized bulk handling machines and equipment installed but none of them are currently working. There are 4 ship loaders for export of urea (fertilizer) with a capacity of 1500 ton/hour, 2 ship unloading and one for the raw iron, one stacker in raw iron stockyard of 300 ton/hour capacity and one stacker of 600 ton/hour capacity with reclaimers of 1500 ton/hour. Nonetheless, the ports located along the Shat Al Arab are facing the challenge of shallow water in the river entrance, which limits the size of vessels that can call the ports. Thus, the ports have limited capacity and are used for importing goods and vegetables by RORO ships, container ships and small wooden dhows, which have shallower draughts.
In general, Iraq is suffering from the lack of electrical power supplies due to the absence of electricity sector development during the last three decades and also because of the increased demand for electricity due to population growth and economy. Consequently, the ports are also experiencing difficulties in availability of electricity provided by the national network. To enable the ports to operate, diesel generators are needed because they depend on diesel generators, which are intended for emergency use only. To such an extent, these emergency generators are insufficient to operate all port equipment such as gantry cranes, and also it is more expensive compared with the main electricity due to the use of expensive fuel.

Considering other port facilities, in previous years, the fresh water to the port stations was supplied through pipelines from the Al Maqal pumping station in the city of Basrah, but this source is no longer available. Piped water, which is brackish and unsuitable for drinking or washing, is supplied from local wells but even these run dry after two hours of pumping. Fresh water is currently delivered to the ports and visiting ships by tankers for the consumption of port workers as well as ships. Currently, there are no developed port reception facilities to deal with vessels disposals, such as garbage, sewage and oily bilge water as a requirement of the implementation of the IMO regulations such as MARPOL73/78.

The port performance and operational capability have to be analyzed in order to understand the current level of operation, identifying the bottlenecks in the ports as well as the potential areas for development. In general, Iraqi ports are considered feeder ports receiving cargo mainly from Dubai ports for private shippers. Goods imported by ministries like the Ministry of Commerce are moved directly from production centers to Iraqi ports. The ports can be identified as second generation according to the UNCTAD classification of ports, which are used for cargo handling and storage operations. Moreover, the ports have suffered from neglect during the last three wars that Iraq has faced since 1980, which has had an impact on port performance and capacity. These reasons have become a challenge for the
development of port productivity to be able to handle increasing traffic caused by the rebuilding of the country and increased demand for goods.

Considering the facts of the service time of cargo handling, the ports performance indicates more than two days for loading and unloading a container vessel of 600 TEUs. Hence, the ship turnover time would be more than adequate and affordable for shipping lines, which are usually concerned about the time consumed in ports. Further, a bulk carrier of 50,000 dwt might spend at least seven days for unloading the grain. Such low productivity resulted from the unavailability of sufficient cargo handling equipment in addition to the absence of modern operational techniques. Although it has been noted that some of the old pieces of equipment are workable, they are in need of major maintenance or replacement. Even the equipment that is currently working may have a limited life due to inadequate maintenance resulting from unavailability of spares, particularly for the older equipment. Therefore, the ports have not reached the designed capacity, which gives a greater opportunity for enhancement of current port productivity in terms of increasing the cargo handling capacity and accommodating more calling vessels.

Obviously, time is an influential factor for port selection by shippers and carriers as discussed earlier. The ports are mostly using bureaucratic routine for data exchange among departments of the ports and with other authorities such as customs, and this routine is considered as one of the ports' bottlenecks. The application of electronic data interchange (EDI) in the transport network would assist the improvement of cargo flows and satisfy the customers to some extent by eliminating red-tape processes, which take plenty of time. In addition, the use of such new technology reduces labor costs, which would lead to reducing the total transport cost.

5.3.4 The current security situation

It is understood that the most significant problem affecting the country's trade and the transport system to operate in a commercially viable manner is the lack of security due to the presence of terrorism, compounded by the foreign intervention on
the decision making in Iraq. As mentioned before, this resulted in high freight rates for transporting goods to Iraq, which contributed to high prices of commodities to be paid by the citizens. Such situation has a notable impact on the transport system, particularly in ports and on borders. For example, in the ports all containers have to be inspected to ensure that there are no explosive materials that can be used for bombs and to prevent illegal smuggling. Even though this procedure is considered rational for a country suffering from such conditions, the delay of cargo transiting the port would lead to accumulating cargoes in the port's yard, which reduces the possibility of utilization of the ports.

It is worth mentioning that there are great efforts and practical steps being made by GCPI to apply the requirements of the International Ship and Port Security Code (ISPS code) commencing from 2006. Donations have been made by several countries to establish an advanced security operations center and train the security officers in World Maritime University and Japan. The magnitude of the challenge facing the country led to the extraordinary support for this important sector to develop the transport system. This dissertation assumed that the current security situation would improve in the near future.

5.3.5 Red Tape Procedure and Corruption

According to Global Integrity Commons (2008), Iraq is one of the countries that is suffering serious challenges of corruption in most of its organizations and ministries. This is affecting the performance of all sectors including the transport network as a bottleneck for public interest. Hence, many investors are scared away from investing in different fields as mentioned earlier. As a result, complicated red tape procedures have been implemented as anti-corruption tools to secure the government system, which has led to more obstructions and is time consuming. By trade facilitation, the transport sector will be improved through introducing advanced EDI systems for operations control, automated payment and electronic documents taking the expertise of developed countries. Further, replacing the bureaucratic procedure by a
computerized system contributes to providing a market oriented system and creates a high level of customer satisfaction and also by using a single window experience for trade (Hoffmann, 2010). Therefore, extraordinary effort has to be stretched in order to introduce preventive anti-corruption procedures to assist the smooth flow of goods.

5.4 Increasing Demand for Transport

Essentially, oil is a major contributing factor to Iraq's GDP, influencing the economic growth and the country's development. It is reported that crude oil exports had achieved 3.5 million barrels per day in 1979, which was the highest level ever reached (Kumins, 2006). Currently, the country is exporting about 1.82 million barrels a day due to the destruction of oil fields resulting from successive wars and the long embargo (IOM, 2010). Therefore, this sector has suffered from lack of advanced technology and investments.

The Iraqi Government has contracted big companies like BP, Shell, Chevron and Total to increase the capacity of production to 4.5 million barrels per day within the next 5 years. Consequently, the country's economy would affirm a quantum leap leading to over press the transport system in order to move all the country's rebuilding materials, household and other human needs when the personal income would increase. Moreover, the equipment and machinery that will be needed for developing the oil fields under the mentioned contracts increase the demand for sophisticated transport systems that could provide reliable services.

Most of the fields that are contracted to help boost the output of crude oil are located in the southern part of the country nearby the port areas, which would definitely increase the traffic and cargo transiting through the Iraqi ports. Further, the oil export operations would mainly be taking place through the oil terminals in the Gulf focusing on evolvement of pipeline systems. The demand for carriage of goods by more than one mode of transport may lead to introducing the MT system in Iraq.
Without a proper national port system, future expansion of the commercial relations will be restrained by the existing port capacity or will be using facilities in other countries. However, transshipment via other ports is not a suitable measure since it can only increase delivery time and costs (C.I.I.T.I, 2008).

Table 5.4 Iraq's GDP Growth Estimates

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP (Million USS 2006)</th>
<th>Oil GDP (Million USS 2006)</th>
<th>Non-oil GDP (Million USS 2006)</th>
<th>GDP growth (%)</th>
<th>Oil GDP growth (%)</th>
<th>Non-oil growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>65,270</td>
<td>40,913</td>
<td>24,358</td>
<td>26.5</td>
<td>22.0</td>
<td>33.0</td>
</tr>
<tr>
<td>2008</td>
<td>79,898</td>
<td>47,868</td>
<td>32,031</td>
<td>22.4</td>
<td>17.0</td>
<td>31.5</td>
</tr>
<tr>
<td>2009</td>
<td>95,090</td>
<td>54,090</td>
<td>40,999</td>
<td>19.0</td>
<td>13.0</td>
<td>28.0</td>
</tr>
<tr>
<td>2010</td>
<td>110,543</td>
<td>59,499</td>
<td>51,044</td>
<td>16.3</td>
<td>10.0</td>
<td>24.5</td>
</tr>
<tr>
<td>2011</td>
<td>126,023</td>
<td>64,259</td>
<td>61,763</td>
<td>14.0</td>
<td>8.0</td>
<td>21.0</td>
</tr>
<tr>
<td>2012</td>
<td>140,687</td>
<td>68,115</td>
<td>72,572</td>
<td>11.6</td>
<td>6.0</td>
<td>17.5</td>
</tr>
<tr>
<td>2013</td>
<td>154,252</td>
<td>71,521</td>
<td>82,732</td>
<td>9.6</td>
<td>5.0</td>
<td>14.0</td>
</tr>
<tr>
<td>2014</td>
<td>167,898</td>
<td>74,411</td>
<td>93,487</td>
<td>8.8</td>
<td>4.0</td>
<td>13.0</td>
</tr>
<tr>
<td>2015</td>
<td>181,365</td>
<td>76,659</td>
<td>104,705</td>
<td>8.0</td>
<td>3.0</td>
<td>12.0</td>
</tr>
<tr>
<td>2016</td>
<td>194,593</td>
<td>78,371</td>
<td>116,223</td>
<td>7.3</td>
<td>2.2</td>
<td>11.0</td>
</tr>
<tr>
<td>2017</td>
<td>207,459</td>
<td>79,614</td>
<td>127,845</td>
<td>6.6</td>
<td>1.6</td>
<td>10.0</td>
</tr>
<tr>
<td>2018</td>
<td>219,794</td>
<td>80,443</td>
<td>139,351</td>
<td>5.9</td>
<td>1.0</td>
<td>9.0</td>
</tr>
<tr>
<td>2019</td>
<td>231,956</td>
<td>80,900</td>
<td>151,057</td>
<td>5.5</td>
<td>0.6</td>
<td>8.4</td>
</tr>
<tr>
<td>2020</td>
<td>243,861</td>
<td>81,022</td>
<td>162,839</td>
<td>5.1</td>
<td>0.2</td>
<td>7.8</td>
</tr>
</tbody>
</table>


Table 5.4 presents the GDP growth estimation for Iraq by explaining the division of crude oil and non oil activities contribution. The relationship between transport flows and economic aggregates supported by GDP growth can contribute to mutual benefits due to the high correlation of generating an attraction for transport clients. Further, the relationship between transport flows and socio-economic variables create attraction for passengers and freights. In most situations, the local passenger transport is contingent on the national income per capita and the technological development in the economy along with institutional structure and stability.

The international movement of passengers very likely depends upon the business areas for investors and attractive locations for tourism. Table 5.5 shows the forecasted growth of domestic transport among Iraqi cities. This estimation of
passengers flows are based on the normal conditions of the country, which can be debatable due to uncertainty of the stability of the country.

Table 5.5 Estimated Total Passenger Flows at Governorate level (Number of passengers per day)

<table>
<thead>
<tr>
<th>Gvt</th>
<th>2007</th>
<th>2013</th>
<th>2018</th>
<th>2023</th>
<th>2028</th>
<th>2033</th>
<th>2038</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duhok</td>
<td>22,583</td>
<td>35,427</td>
<td>48,295</td>
<td>61,517</td>
<td>75,063</td>
<td>89,067</td>
<td>103,682</td>
<td>109,852</td>
</tr>
<tr>
<td>Ninewa</td>
<td>116,761</td>
<td>183,173</td>
<td>249,701</td>
<td>318,062</td>
<td>388,104</td>
<td>460,507</td>
<td>536,071</td>
<td>567,973</td>
</tr>
<tr>
<td>Sulaimaniya</td>
<td>39,995</td>
<td>62,744</td>
<td>85,332</td>
<td>108,948</td>
<td>132,940</td>
<td>157,741</td>
<td>183,625</td>
<td>194,552</td>
</tr>
<tr>
<td>Ta’meen</td>
<td>50,031</td>
<td>78,487</td>
<td>106,994</td>
<td>136,286</td>
<td>166,298</td>
<td>197,322</td>
<td>229,700</td>
<td>243,369</td>
</tr>
<tr>
<td>Arbil</td>
<td>39,342</td>
<td>61,719</td>
<td>84,135</td>
<td>107,169</td>
<td>130,769</td>
<td>155,165</td>
<td>180,626</td>
<td>191,375</td>
</tr>
<tr>
<td>Dilia</td>
<td>49,529</td>
<td>77,699</td>
<td>105,920</td>
<td>134,918</td>
<td>164,628</td>
<td>195,541</td>
<td>227,394</td>
<td>240,926</td>
</tr>
<tr>
<td>Anbar</td>
<td>53,091</td>
<td>83,289</td>
<td>113,539</td>
<td>144,623</td>
<td>176,471</td>
<td>209,393</td>
<td>243,752</td>
<td>258,258</td>
</tr>
<tr>
<td>Baghdad</td>
<td>260,022</td>
<td>407,917</td>
<td>556,072</td>
<td>708,309</td>
<td>864,288</td>
<td>1,025,527</td>
<td>1,193,805</td>
<td>1,264,849</td>
</tr>
<tr>
<td>Bahil</td>
<td>42,974</td>
<td>67,417</td>
<td>91,903</td>
<td>117,063</td>
<td>142,842</td>
<td>169,490</td>
<td>197,302</td>
<td>209,043</td>
</tr>
<tr>
<td>Karbala</td>
<td>34,086</td>
<td>53,474</td>
<td>72,896</td>
<td>92,852</td>
<td>113,300</td>
<td>134,437</td>
<td>156,496</td>
<td>165,809</td>
</tr>
<tr>
<td>Wasit</td>
<td>43,590</td>
<td>68,384</td>
<td>93,220</td>
<td>118,742</td>
<td>144,890</td>
<td>171,920</td>
<td>200,131</td>
<td>212,041</td>
</tr>
<tr>
<td>Salah Al Din</td>
<td>52,912</td>
<td>83,007</td>
<td>113,155</td>
<td>144,334</td>
<td>175,874</td>
<td>208,684</td>
<td>242,927</td>
<td>257,384</td>
</tr>
<tr>
<td>Najaf</td>
<td>37,519</td>
<td>58,858</td>
<td>80,236</td>
<td>102,202</td>
<td>124,708</td>
<td>147,974</td>
<td>172,254</td>
<td>182,505</td>
</tr>
<tr>
<td>Qudsiana</td>
<td>37,846</td>
<td>59,373</td>
<td>80,937</td>
<td>103,095</td>
<td>125,798</td>
<td>149,266</td>
<td>173,759</td>
<td>184,100</td>
</tr>
<tr>
<td>Muthanna</td>
<td>27,409</td>
<td>42,999</td>
<td>58,615</td>
<td>74,663</td>
<td>91,105</td>
<td>108,101</td>
<td>125,839</td>
<td>133,328</td>
</tr>
<tr>
<td>Dhi Qar</td>
<td>41,445</td>
<td>65,018</td>
<td>88,633</td>
<td>112,898</td>
<td>137,760</td>
<td>163,460</td>
<td>190,281</td>
<td>201,605</td>
</tr>
<tr>
<td>Maysan</td>
<td>30,713</td>
<td>48,183</td>
<td>65,683</td>
<td>83,665</td>
<td>102,089</td>
<td>121,134</td>
<td>141,011</td>
<td>149,403</td>
</tr>
<tr>
<td>Basrah</td>
<td>50,494</td>
<td>79,213</td>
<td>107,984</td>
<td>137,347</td>
<td>167,836</td>
<td>199,147</td>
<td>231,825</td>
<td>245,621</td>
</tr>
<tr>
<td>Total attraction</td>
<td>1,030,342</td>
<td>1,616,380</td>
<td>2,203,447</td>
<td>2,806,693</td>
<td>3,424,763</td>
<td>4,063,676</td>
<td>4,730,481</td>
<td>5,011,992</td>
</tr>
<tr>
<td>Yearly average growth rates</td>
<td>7.79</td>
<td>6.39</td>
<td>4.96</td>
<td>4.06</td>
<td>3.48</td>
<td>3.09</td>
<td>1.16</td>
<td></td>
</tr>
</tbody>
</table>


Iraq’s cultural endowment and cultural heritage can have a considerable impact on the cultural tourism that may attract tourists to explore the historical inheritance stretching back thousands of years. On the other hand, the presence of many holy places may attract the religious tourism as distinctive poles of attraction. The potential of passenger transport growth is shown in Table 5.6.

The World Tourism Organization WTO (2003) forecasted that the inbound rate of passenger growth for the period 1995-2020 would be 7.1% per annum and for the period of 2010-2020, the annual growth estimated was 6.7% per year. The outbound passenger transport forecasted to be 50% of the inbound rate of transport, which might reach 3.25 million of passengers traveling from Iraq per year in 2015.
Regardless of the accuracy of the percentage of the inbound and outbound rate of growth as well as the domestic transport rate, the current transport system is insufficient to be customer-focused services to mobilize the increasing demand for passenger transport.

Table 5.6 Distribution of forecasted inbound passenger flows in 2015

<table>
<thead>
<tr>
<th>Macro Area</th>
<th>Total</th>
<th>Religious</th>
<th>Tourism</th>
<th>Business</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>929,340</td>
<td>14.3</td>
<td>47,938</td>
<td>5.0</td>
</tr>
<tr>
<td>Europe</td>
<td>2,134,610</td>
<td>32.8</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>Rest of Africa</td>
<td>34,980</td>
<td>0.5</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>America</td>
<td>564,202</td>
<td>8.7</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>Iran</td>
<td>1,027,657</td>
<td>15.8</td>
<td>910,813</td>
<td>95.0</td>
</tr>
<tr>
<td>Asia &amp; Pacific</td>
<td>1,809,211</td>
<td>27.8</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>6,500,000</td>
<td>100.0</td>
<td>958,750</td>
<td>100</td>
</tr>
</tbody>
</table>


Obviously, the outcome of the improvement of the country's economy would affect the freight transport sector. Such development increases the import and export of goods due to the recovery of financial ability of the citizens, increasing the purchasing power of consumer goods. Therefore, it is expected that the export of goods and crude oil would intensify in the forthcoming years if the security situation improves as shown in Table 5.7, which shows the estimated growth for export of goods and crude oil within 30 years.
Table 5.7 Estimated Growth of cargo export from Iraq to different regions (ton/year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Middle East, Iran, Libya and Egypt</th>
<th>Rest of Africa</th>
<th>Europe</th>
<th>Rest of Asia</th>
<th>America</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1,470,375</td>
<td>550,052</td>
<td>2,872,862</td>
<td>4,549,253</td>
<td>6,376,692</td>
<td>15,819,234</td>
</tr>
<tr>
<td>2010</td>
<td>835,556</td>
<td>675,035</td>
<td>3,248,989</td>
<td>4,966,307</td>
<td>7,024,750</td>
<td>16,750,636</td>
</tr>
<tr>
<td>2015</td>
<td>638,627</td>
<td>832,883</td>
<td>3,886,109</td>
<td>5,917,840</td>
<td>8,022,482</td>
<td>19,297,941</td>
</tr>
<tr>
<td>2020</td>
<td>474,243</td>
<td>969,712</td>
<td>4,465,431</td>
<td>6,773,772</td>
<td>8,930,113</td>
<td>21,163,270</td>
</tr>
<tr>
<td>2025</td>
<td>545,381</td>
<td>1,116,815</td>
<td>5,222,140</td>
<td>7,801,204</td>
<td>10,031,583</td>
<td>24,717,123</td>
</tr>
<tr>
<td>2030</td>
<td>637,559</td>
<td>1,301,521</td>
<td>6,222,775</td>
<td>9,075,384</td>
<td>11,771,219</td>
<td>29,008,458</td>
</tr>
<tr>
<td>2035</td>
<td>738,501</td>
<td>1,503,060</td>
<td>7,331,456</td>
<td>10,467,787</td>
<td>13,674,428</td>
<td>33,715,231</td>
</tr>
</tbody>
</table>


The forecast of imports and exports shown in tables 5.7 and 5.8 was very optimistic, which can be inferred from the performance of the total volume of cargo imported and exported to Iraq during the last five years, which shows only a slight increase. Moreover, the downturn of markets in general due to the global financial crisis was unexpected and not taken into consideration when anticipating the import and export volume. The introduction of a proper infrastructure and MT facilities into the Iraqi transport system is an urgent demand in view of the fact that they symbolize the country's backbone in the future.

Despite concerns over continued involvement of foreign private companies in developing oil and other natural resources, the security instability has scared away most foreign investors from participating in developing the country and bringing in new technology for other sectors such as transport. The oil fields are mostly far away from the cities in the desert, and there is not much interaction between inhabitants and investors, which are secure from danger. Further, the oil market is considered as beneficent for investors due to the high and consistent demand for oil generating more profit.
The transport sector is a service-based activity directly connected to the daily life of its customers. Therefore, the investors ought to be engaged in developing the transport sector implementing the advanced technology for operating an efficient transport system by direct control. The biggest foreign investors in the transport sector are aware of this fact of uncertain and unsecured business, which has impeded them from being highly involved. The continued process of normalizing the country may provide extensive means of persuasion to investors in order to promote their participation in the development process and introducing new efficient MT systems in the country and probably expanded to cover the entire region.

Similarly, the growth of the economy in the country would lead to increasing the GDP. Consequently, the GDP growth per capita will increase leading to raising the demand for importing more cargo. Therefore, the expected growth for trade is interrelated with import growth as shown in Table 5.8.

Again, it can be said that the estimate was very optimistic for the reasons mentioned before. In addition, the preoccupation about the country's security and the stability of the current situation take precedence for the decision makers over all sectors, which

### Table 5.8 Estimated growth of cargo import to Iraq from different regions (ton/year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Middle East, Iran, Libya and Egypt</th>
<th>Rest of Africa</th>
<th>Europe</th>
<th>Rest of Asia</th>
<th>America</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>9,008</td>
<td>1,184</td>
<td>3,032</td>
<td>2,403</td>
<td>496</td>
<td>16,123</td>
</tr>
<tr>
<td>2010</td>
<td>1,633m322</td>
<td>441,133</td>
<td>692,897</td>
<td>690,924</td>
<td>164,530</td>
<td>3,622,806</td>
</tr>
<tr>
<td>2015</td>
<td>2,813,189</td>
<td>1,012,264</td>
<td>1,368,092</td>
<td>1,481,690</td>
<td>340,103</td>
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has led to delayed development of the infrastructure of the country, and this in turn affected the provision of additional capacity to accommodate the increase in imported cargo.

The location of Iraq in a highly populated region might play a notable role in logistics and trade globalization. The low labor cost might attract global producers to establish regional production and distribution centers for manufactured goods, which probably would be relatively cheaper compared with manufactured goods in the country of origin due to the transport cost involvement, low labor cost and low cost of ground rent. Such industrial activities require a reliable MT network, like the one in Europe, to serve the movement of raw materials as well as finished production.
Chapter 6

Conclusions and Recommendations

6.1 Conclusions

This dissertation attempted to analyze the possibility of introducing a new corridor in order to adduce more options for the competitive shipping market. Basically, it has to take into account several factors other than the transport bottlenecks that have a significant impact on trade direction. The transport cost, time of transport, the reliability of the mode of transport and the service level are the most decisive factors influencing the selection of routes by carriers and shippers. However, the market concentration and the demand for transport also contribute to attracting more traffic. Moreover, the connectivity between different modes and nodes of transport supplement the backbone for a number of developed countries like the US, the EU countries and Japan. The removal of constraints for the evolvement of transport systems enabled these countries to best utilize the available resources and implement the latest transport technology. Considering transport costs only, sea transport is more desirable compared with air, rail and road transport, but the efficiency and reliability of other modes of transport for the mentioned countries have given competitive advantages to be prosperous in different regions.

The multimodal transport concept has become the setting up of door-to-door transport of goods by combining different means of transport. This dissertation has been analyzing the combination of sea transport with rail and road transport as an alternative multimodal transport system for the Suez Canal route. Several criteria have been used to assess the competitiveness of such multimodal transport system since it is possible to be a rival for maritime transport. Regarding the distance comparison, the new route has the advantage of being shorter than the Suez Canal route in the case of European trade with Asian countries and Arabian Gulf countries. However, the time of transporting goods would be longer due to the cargo handling operations in two ports for loading and unloading. Further, crossing the borders may create delays due to documentation processes and customs clearance. The savings in
distance is not significant compared with the transport costs because the distance of the new route represents 96.5% of the Suez Canal route, whilst the cost is 179% for transporting one TEU from Shanghai to Rotterdam.

Due to the economic crisis, most shipping lines are applying slow steaming to minimize the operating costs by reducing the fuel consumption and deploying more vessels since the demand was decreased. Therefore, the time factor for cargo delivery might be flexible in a number of cases and for some types of commodities. Thus, the cost of transport is the most influential factor for the competitiveness between the two routes. The determination of transport cost per unit proved that the existing route is the most desirable one in terms of cost effectiveness and time saving. The high cost of the proposed integrated transport system resulting from the current incompetence and old transport network caused a higher set of prices.

Sea transport is getting benefits from the size of vessels, which has a direct impact on transport cost per unit due to the economies of scale. Hence, the suggested corridor does not have the ability to be the exclusive alternative for cargo transit unless a reliable multimodal transport system is developed in order to be cost effective like the MT systems in developed countries. Actually, the present Iraqi and Syrian transport systems would be a relevant bottleneck for cargo transshipment for hinterland connections. Because of the higher transport costs, the new multimodal transport is deemed to be unqualified to compete with full maritime routes circumnavigating Africa or using the Suez Canal. Considering a unique base condition can be misleading because of the particular situation. The transport system can be renewed or reconstructed since the budgetary allocation is available to invest in such a modern network. The regional countries should make strong modifications of the transport system. However, with high transport cost and low customer service level it is hard to convince the carriers and shippers to use the suggested route.
The existing route has a limitation for the number of vessels that can transit through the Suez Canal as convoys. This may be used as an opportunity for developing a regional transport system between Iraq and Syria from one side and Iraq with Turkey on the other side if the traffic is increasing and market starts booming again. The market share of the new route can be increased by sufficient regional cooperation and investing huge amounts of money to rebuild the connected transport network and reducing bureaucratic routine. Pirate attacks on ships transiting the Suez Canal are another challenge to the traffic, which is an opportunity for the new corridor to increase its market share.

Obviously, the current situation in Iraq is also threatened by terrorism attacks, which have led to instability of the region's security, but it can be said that the situation will probably improve. Likewise, the pirate attacks can be considered as temporary conditions, which make the comparison difficult in terms of security for both routes. Nevertheless, the Suez Canal has been closed twice for security and political reasons, which enraged the shipping companies since they had to cover longer distances. However, Iraq has suffered three wars within 30 years, which affected the entire transport system, particularly the sea transport and port approaches. Again the security situation for both options is unpredictable and can be aggravated anytime due to piracy and political instability of the region. Relatively, the existing route is more desirable despite the high insurance and the ransoms to be paid for pirates as well as the danger to the lives of seafarers.

An assessment of the environmental impact and gas emissions has been carried out in this dissertation by calculating the CO$_2$ emission from ships, rails and trucks. The outcome of these calculations demonstrated the preference of using the existing route in terms of CO$_2$ emissions, but the new route has a potential to perform greener transport services through modernizing rails, trucks and cargo handling equipment. Further, applying strict rules and regulations can assist in reducing GHG emissions from ships, but it can affect the competition level between the two routes. Another
technique would be possible to protect the environment by using a green pricing system and giving incentives to shipping companies if they make an effort to reduce GHG emissions. Iraqi ports and Syrian ports can provide ships with purified bunker to reduce the GHG emissions and also offer port reception facilities in order to be attractive for shipping lines by reducing their costs and being environmentally friendly.

The competitiveness credibility of the new routes can be given to crude oil transport by pipelines from the Gulf countries to Europe and the US. This dissertation has found that exporting crude oil through a dedicated oil terminal in the Mediterranean can potentially interest oil exporters in the region. The time saving, cost effectiveness and environmental friendliness of a new transport system via Syria would solve piracy problems for oil tankers and reduce the total transport cost.

At present, the growth of Iraq's GDP and economy due to the contribution of a gradual increase of crude oil exports caused the urgent need to improve all areas related to services. Special attention ought to be given to transport systems to serve the movement of raw materials needed for such development and to provide significant logistics as part of the total supply chain. The demand for transport and ship calls have been increasing in the previous five years and also cargo volumes have increased. However, the transport network is insufficient to cope with such increasing demand due to the limited capacity of ports, which created bottlenecks for smooth flows of cargo. As a matter of fact, this dissertation has highlighted, among the areas for which a more thorough analysis was needed, both a study of a new configuration of the multimodal transport system as a consequence of the introduction of a new deep sea port and for international connections.

The establishment of a new deep-sea port connected with efficient hinterland connections requires a reorganized multimodal transport system with specific objectives for better function of the country. A continuous sediment problem
affecting the depth of ports and their approaches is requiring a continuous maintenance dredging in order to sustain appropriate depth for safe ships' sailing. The maintenance dredging requires an allocation and disbursement of huge amounts of money leading to increasing the port tariffs and entire transport cost. The construction of a new deep-sea port implies rail and road connections with the domestic network. This network can be linked to regional transport systems in order to gain mutual benefits for all countries participating in the project. European countries and the American countries are trade partners to Iraq because most of the crude oil is exported to these countries and a big part of the imported materials and goods come from them. However, the transport costs make up a considerable part of the total cost of goods due to lack of efficiency in the transport system. In spite of that, transporting goods from Europe and the US to Iraq via Syria and Turkey is cheaper compared with using the Suez Canal route. Similarly, shipment of goods to Turkey, Syria, Lebanon and Jordan from Asian countries is price effective through the suggested route. The cost comparison illustrated that the new route is more expensive for international flow of goods than the Suez Canal whereas it is cheaper for goods transport to remain in the Middle East.

As a result of the critical analysis undertaken by the author, the development of the regional transport system can be initiated with reasonable capacity to serve the movement of goods within the region since the economy is growing. Further, the final destinations for goods imported and exported have not changed for shippers and carriers. Therefore, the new integrated transport system would improve the service level to satisfy the clients and reduce the costs, which would attract more traffic. Once the suggested transport system has illustrated its reliability and cost effectiveness in the region, the competition level with the Suez Canal route will be affected and the carriers may be convinced to redirect their routes.

Obviously, more choices for shipping lines will eliminate the monopolistic status of the Suez Canal to have exclusive control on the price of transit through the Canal. In
the long term, the competition between the two routes may lead to transport cost reduction and provide an alternative in case of the Canal closure. The success of the new route depends on its ability to provide certain services to a high standard with smooth process of formalities and high efficiency.

6.2 Recommendations

• Since the current transport system has not reached its designed capacity, special attention should be paid to enhancing the capability of the present network in order to accommodate increasing traffic as medium term planning. This will improve the overall system of transport as well as the country's economy and social benefits. Without having developed an internal network of transport, the introduction of a new MT system as an alternative for the existing Suez Canal route will be impossible.

• The arrangement of regional cooperation is required to be investigated before investing in this regional multimodal transport system in addition to the cooperation between governmental authorities involved. A legal framework has to be agreed upon in order to facilitate cargo transit through different countries. Moreover, decisions need to be taken regarding the investment contributions by the regional countries. Private sector involvement would lead to improvement of the commercial outcomes of the new route similar to those existing in the US and Europe.

• The pricing system for transport by railway and roads needs to be reassessed for transited cargo and port tariffs can be reduced in order to attract more traffic. However, there is a need for an agreement between the regional countries about free customs dues for transited cargo similar to the system that applies in the EU countries. Further, the risk analysis system at the borders can be applied by Customs instead of inspecting all containers and trucks.
A special initiative for oil transport is required by Iraq and Syria to build a pipeline from the oil fields to the Mediterranean in order to encourage oil tankers to change their routes. This will contribute towards transport cost reduction and will be profitable for both countries.

A practical cost determination and analysis of other transport factors can be performed by the Iraqi and Syrian authorities concerned since there is a railway connection between the two countries similar to the attempt that was carried out by TSR between Duisburg in Germany and Moscow. By doing so, the exact situation will be clearly addressed and real figures of transport cost will be provided, which is the main concern for carriers and shippers. Likewise, it can be done for the transport connection with Turkey to evaluate the feasibility of investing in a multimodal transport infrastructure. Passenger transport may also be evaluated by similar methodology because of the special feature of transporting people, who are mostly concerned about the service level, time and transport cost.

Due to unavailability of sufficient data related to the transport system and transport cost in Syria, further research is recommended for estimating the real transport cost in order to present comprehensive data for the new route users as well as the decision makers in both countries.
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