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Logistics in Yemen: Optimal Intermodal Frieght Transportation

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Abstract

Major roads in Yemen are not paved and its population density is high in coastal areas, implementing the idea of intermodal transportation method all over the coastline will give the product industries a huge advantages, due to its attractive solutions to the poor transportation infrastructure and its extremely limited road transportation system. The transport of goods in Yemen depends heavily on road transport in the absence of rail transport and limited movement by air transport and its high cost, the private sector provides the bulk of land transport services (goods) and has accompanied the performance of road transport activities in the absence of regulation and supervision. In this research paper the author intends to analyse and develop optimal intermodal freight transportation plans for product shipping in Yemen by using two modes of transport (truck, ship) without any handling of the freight itself when changing modes. Using intermodal transportation is vital for the product movement and supplies when single mode alternative becomes unusable or infeasible. The author intends to use quantitative research method, plan and execute fieldwork, collecting data form freight companies (truck, ship), local factories, Ministry of Transportation, etc. Compile preliminary maps of roads condition and population density. First the author intends to visit the Ministry of Transport to closely monitor the program and objectives of the Ministry and the secret of work and projects in which it is implemented and meet with its representative for the purpose of collecting data and evidence of the difficulties it faces in order to become familiar with it Comprehensively and directly on its problems and study the possible solutions. , the author will intend to visit Aden and Hodeida ports to view the service and facilities for a better understanding of the processes and to examine the availabilities of intermodal transportation freight and collect data of sea freight costs. The author also intends to visit a local factory (Shamlan Industry Ltd) to explore difficulties of products movement on road, costs, etc. the author attempts to provide an in depth examination of two major tasks, single mode and multimodal. Finally the Author intends to visit Ministry of public works and roads to compile preliminary maps of roads condition and population density. As a result Intermodal transportation can be a solution when transportation resources are scarce, bad road infrastructure and mountainous terrain. The quantity of demand is usually high and required an instant solution to meet the demand of the transportation resources. After analysing data and identifying findings of two modes of transportation, the author found multimodal fright transportation cost is comparatively advantage over single transportation mode.

Keyword: **Logistics, Transportation, Optimization, Multimodal Freight.**

Introduction

The transport sector plays an important and fundamental role in the renaissance of the peoples. It is the basis of economic and social development and the pillar of economic growth. Transport services are the most important requirements for the different stages of development in countries. An efficient transport sector is a prerequisite for ensuring economic development in each country or that the development of the transport sector.

At the same time, the transportation is an economic activity in itself, as it provides many investment opportunities, as well as provides employment opportunities linked to the private business. Transport is also the main artery of economic and social activity and a political component in investment decisions in the development of many economic sectors (trade, industry, agriculture, exploitation of mineral resources, etc.) Through the role of transport represented in securing the transport and movement of goods and individuals, it links between the centres of production, consumption, import and export.

The occupation of the transport sector of the first centres in terms of the size of its contribution to the GDP of many countries to reflect the nature of this vital role and important for transport in advancing the pace of development and contribute to the economic growth of any country.
Dry land port: The dry port is sometimes called the inland port, which is a storage station for goods directly connected with the roads or railway connecting to the sea port. The dry port is used as a centre for the collection of goods coming from the sea in preparation for distribution to the suppliers.

The dry port also has storage and unloading centres, maintenance centres for trailers, trucks, customs clearance services and customs inspection. This is aimed at relieving the pressure on storage capacity and the customs area which is crowded with seaports.
The port is located near the international shipping route and serves the location of the port a number of provinces with densely populated population and economic activities.
The port of Hodeida is the main port in the South of the Red Sea for the handling of imports, which represents 70% of the imports to Yemen. The port is located near the most densely populated city in Yemen.

Sea ports: The port of Aden and Hodeida are located near the international shipping route and serves the location of the port a number of provinces with densely populated population and economic activities. The port of Hodeida is the main port in the South of the Red Sea for the handling of imports, which represents than half of the imports to Yemen. The port is located near the most densely populated city in Yemen.

It is clear that rail transport is superior to other means of transport, especially in the field of transport of goods and is the best in terms of safety and cheaper in terms of transport costs for long distances and medium, not to mention the low consumption of fuel.

The first railway project in Yemen was launched a hundred years ago to connect the area of Tihama with Taiz to Sana'a, from which at that time it operated seven kilometres and stopped with the outbreak of the First World War. In addition, there was a railway line connecting Lahj and Aden. Unfortunately all government attempts failed to establish a railway project.
Multimodal transport is the latest mode of transport (container transport), with low transport cost while reducing transportation time and maintaining goods during its journey from origin to consumer, known as the door-to-door service.
The role of multimodal transport in the service of international trade increased, which is based on the transport of goods by container and through the use of more than one mode of transport (at least two modes) (land, sea, air) and through a single transport contract covers all stages of transport.

This system requires the availability of many requirements and the necessary elements to activate it, the most important of which are:
- Provision of suitable infrastructure (ground road networks, conforming to international standards, rail networks, and developed seaports, airports equipped to service cargo, assembly areas and links between transport patterns).
- Providing advanced mechanisms and equipment for dealing with containers (in airports, ports and connecting stations), as well as means of transport (special vehicles for transporting containers) and private aircraft equipped for the transport of goods.
- Dealing with information technology and providing advanced automated systems that simplify and facilitate customs procedures and shipping documents.
- Revisiting a lot of existing legislation to keep up with this system.

Major roads in Yemen are not paved and its population density is high in coastal areas, implementing the idea of intermodal transportation method all over the coastline will give the product industries a huge advantages, due to its attractive solutions to the poor transportation infrastructure and its extremely limited road transportation system, including the bad level of road security. As a frequent and regular service, offering a door-to-door solution to customers, it may substantially contribute to bypass road congestion. This mode isn't land consuming and is environmentally friendly. For the carrier, it can guarantee transit time and avoid delays due to traffic congestion; it is reliable and enables door-to-door solutions.

Intermodal transportation can be a solution when transportation resources are scarce, bad road infrastructure and mountainous terrain. The quantity of demand is usually high and required an instant solution to meet the demand of the transportation resources. Alternative transportation modes such as coaster (sea) can carry goods supplies in higher amounts on a single trip as a cure for fleet size constraints of road transportation in the short term. Coaster ship (sea) can cover the longer distance and final miles can be covered using tours with trucks on road.

Sea transport can be cheaper than road transport, due to Low infrastructure costs, Alternative varieties of service (route), environmentally friendly low energy consumption. , Unlimited

capacity usage , Being much more secure in comparison to the other modes of transportation , Fair pricing, Lower jam rate, Optimum duration in navigation, convenient transit duration.

Literature review

The optimization of supply chain structures considering both economic and environmental performances is nowadays an important research topic. However, enterprises are commonly faced with the competing issues of reduced cost, improved customer service and increased environmental factors as a multi-faceted trade-off problem when designing supply chains. (T PaksoyE Özceylan, June 2014)

Effective design and management of supply chain networks traditionally assists in transportation and delivery of a variety of products at low cost, high quality and short lead times. The dominant paradigm for supply chain networks is considering the organization in a way that maximizes profitability. The calculation of profitability, however, has included only the economic costs that companies directly incur. The distribution of goods through supply chains impairs local air quality (greenhouse gas emissions), generates noise and vibration, consumes fuel and makes a significant contribution to global warming. It is impossible to eliminate these factors while goods are moving. But it is possible to minimize the factors, providing for a perfect trade-off management. (T PaksoyE Özceylan, June 2014)

As presenting products with lower prices are getting more important in nowadays competitive environment, companies not only try to reduce their own cost but also corporate with their supply chain (SC) to reduce total system cost. In this regard, decisions in SCs can be made into two categories, i.e. centralized and decentralized. In centralized supply chains (CSC), decisions are made according to the benefits of whole SC and the members have complete access to the whole information of each other. However, in the decentralized supply chains (DSC), each member has only access to its own information and tries to maximize its own profit regardless of other members. Joint Economic Lot Sizing (JELS) problems known as integrated vendor-buyer problems try to optimize joint total cost/profit of all members, simultaneously. (Navid Dehghanbaghi, Mohsen S. Sajadieh, May 2017)

With the growing importance of transportation, logistics, and supply chain economics to support industrial activities, specific supply chain asset investments can significantly impact national, local, and regional economies. At the same time, the relative availability, quality, and cost of a range of transportation services, particularly those relevant to essential intermodal activities and infrastructure, influence firms' location decisions. (David J. Closs and Yemisi A. Bolumole, Winter 2015)

The history of transportation and logistics is as long as the history of mankind, but has been marked by recent milestones. The railroad was discovered at the beginning of the nineteenth century, the airplane in 1903. In maritime transportation, the invention of the sea container is dated 1956 and has impacted sea transport dramatically. Nowadays logistics, and the broader

concept of supply chain management, is mainly intended as a business function that has the scope to make goods available where and when needed and in the needed quantities. Transportation management can be seen as part of logistics, when referred to the business processes. (M. Grazia Speranza, August 2016)
In the last few decades, the building evidence that CO2e emissions lead to climate change has pointed to a need to reduce CO2e emissions. (V. Sanchez Rodrigues, 2015) uses five scenarios in the context of UK import trade to assess total CO2e emissions and costs of import re-routing containers. The overall objective is to assess possible carbon mitigation strategies for UK supply chains by using a combination of alternative ports and revised multimodal strategies. The model adopted includes three elements: port expansion, container handling and freight transport. The alternative scenarios explore different settings modal shift and short sea shipping. . (V. Sanchez Rodrigues, 2015)

Road freight transport typically dominates in urban delivery operations. However, an increasing number of trials and commercial operations have started in the past 10 years attempting to use rail transport in a range of cities. At the EU level attention on the possibility to shift at least some traffic from road to rail (or perhaps to use rail in combination with clean vehicles making the last mile delivery) has been increased by the EU White Paper on Transport (European Commission, 2011). A number of challenging goals were set, including the aim of achieving essentially CO2-free city logistics in major urban centres by 2030. The White Paper makes the point that achieving essentially CO2-free city logistics would also substantially reduce other harmful emissions. (Michael Browne et al, 2014)

Three main types of transportation systems are defined in the utilization of multiple transportation modes. Multimodal transportation refers to passenger or freight transportation from an origin to a destination using two or more transportation modes. Intermodal transportation is a type of multimodal freight transportation that uses an intermodal transport unit (ITU) (e.g. container) with no handling of the goods themselves between mode changes. Combined transportation is a type of multimodal freight transportation that excludes air transport and where most the trip occurs by rail or on waterways with only the initial and final legs of the trip occurring on road. (Ertem, M.A., İşbilir, M. & Şahin Arslan, 2017)

Methodology

The road network is one of the most important pillars of development in Yemen, especially since the terrain in the Republic of Yemen is mostly mountainous and requires the implementation of a network of roads to enable the state to connect the rest of the other services.
In this research paper the author like to use quantitative research method, plan and execute fieldwork, collecting data form freight companies (truck, ship), local factories, Ministry of Transportation, etc. Compile preliminary maps of roads condition and population density.
Given the importance of the role played by the Ministry of Transport from the impact on the economic sectors such as the industrial sector and the trade sector, and represent a modern and integrated transport infrastructure Land, sea and air

The first step to start the fieldwork program, the author intends to visit the Ministry of Transport to closely monitor the program and objectives of the Ministry and the secret of work and projects in which it is implemented and meet with its representative for the purpose of collecting data and evidence of the difficulties it faces in order to become familiar with it Comprehensively and directly on its problems and study the possible solutions.
Second step, the author will intend to visit Aden and Hodeida ports to view the service and facilities for a better understanding of the processes and to examine the availabilities of intermodal transportation freight and collect data of sea freight costs.
The author also intends to visit a local factory (Shamlan Industry Ltd) to explore difficulties of products movement on road, costs, etc. Next the author attempts to provide an in depth examination of two major tasks, single mode and multimodal.
Finally the Author intends to visit Ministry of public works and roads to compile preliminary maps of roads condition and population density.

Recommendations based on preliminary research

Intermodal transportation can be a solution when transportation resources are scarce, bad road infrastructure and mountainous terrain. The quantity of demand is usually high and required an instant solution to meet the demand of the transportation resources. Alternative transportation modes such as coaster (sea) can carry goods supplies in higher amounts on a single trip as a cure for fleet size constraints of road transportation in the short term. Coaster ship (sea) can cover the longer distance and final miles can be covered using tours with trucks on road.

This section will demonstrate multimodal method to find the optimum transportation cost. The first step is to explain the targeted sea ports from the point of origin to point of destination to represent the model. Then analysed all collected data and identifying findings of multi modes transportation method (truck, ship) over single mode transportation method (truck), compare road condition and difficulties over sea shipping. Investigate the use of intermodal freight transportation in Yemen.

Targeted sea ports

Hodeida is the industrial and agricultural capital of Yemen. Its ports are one of the most important import and export entrances. With its strategic location in the Red Sea, it manages the unloading of more than half of the dry cargo in Al Yamouhi, the headquarters of the largest fleet of trucks. Al Hodeida is located on the traffic of commercial goods from its port and is home to 20 large companies. Aden port's Core strengths: Strategic geographical location, connected to populated major cities, Design of a unique business area, Natural port with simple drill channel. Modern Container Terminal Services, Good storage facilities

Citation: Yemen General investment authorities

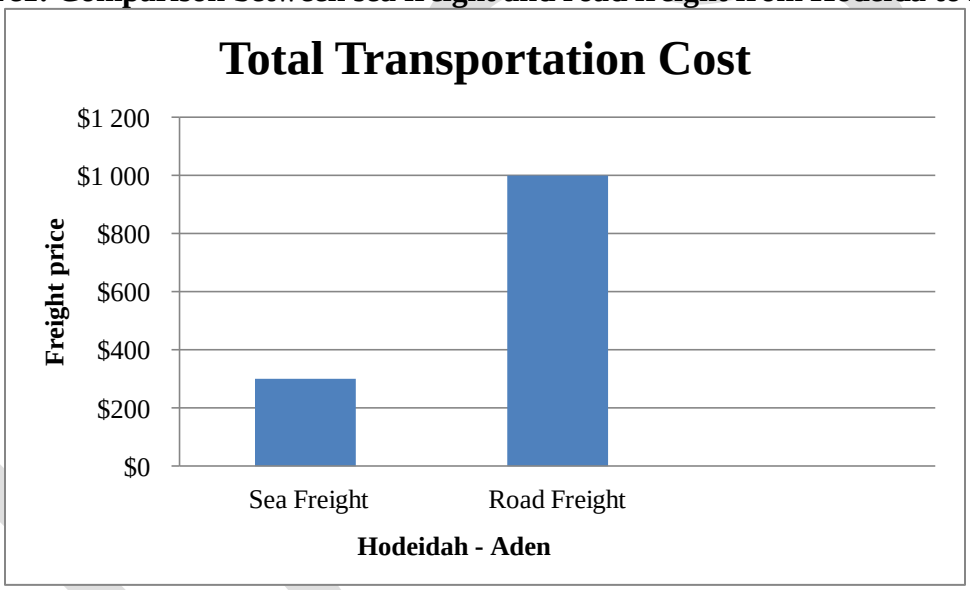
Table 1: Sea and Road freight cost from port of Hodeida to port of Aden

	Origin	Destination	Cost	Cost Optimization
sea(coaster)	Hodeida	Aden	$300	+$700
Road (Truck)	Hodeida	Aden	$1,000	-$700

Source: United Arab Shipping Company, Yemen

In this table, we compared two modes of transportation according to freight cost, first sea mode freight cost from port of Hodeida to port of Aden full load container $300, then road mode freight cost from port of Hodeida to port of Aden full truck load $1000, we found that sea mode has more comparative advantage over road mode from point of origin to point of destination.

Figure1: Comparison between sea freight and road freight from Hodeida to Aden



Source: United Arab Shipping Company, Yemen

The figure demonstrates the comparative advantage of sea mode over land mode from port of Hodeida to port of Aden.

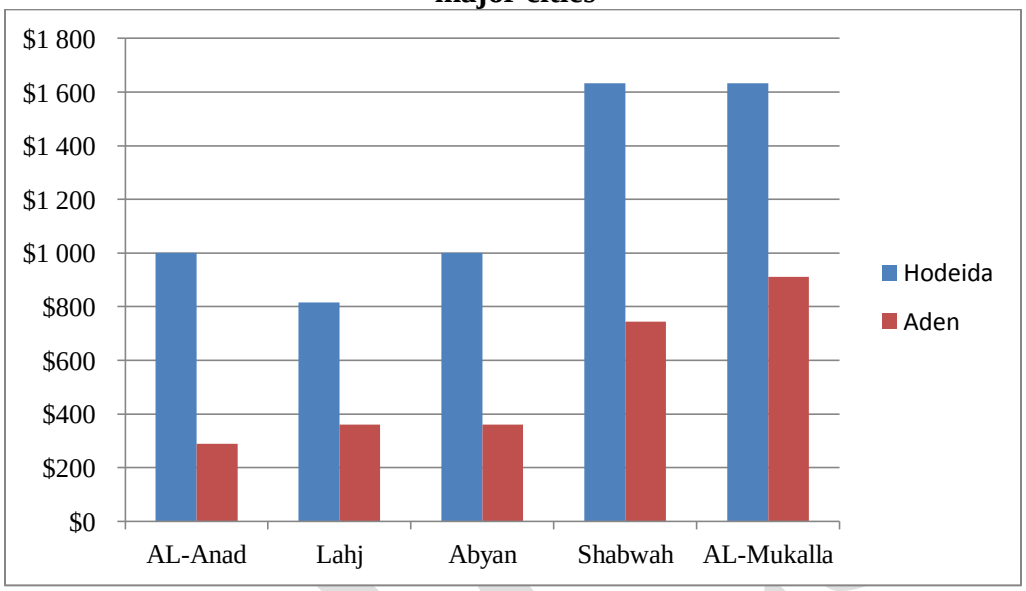
Table 2: Road freight cost from port of Hodeida and port of Aden to targeted major cities

	AL-Anad	Lahj	Abyan	Shabwah	AL-Mukall
Hodeida	$1,000	$816	$1,000	$1,632	$1,632
Aden	$288	$360	$360	$744	$912

Source: Yemen Land transport Affairs Authority, Yemen

In this table, we will compare direct road "full truck load" freight cost from port of Hodeida to Aden's nearest major cities, then from port of Aden to the nearest major cities, later at the table below, we will add multimodal transport (sea, land) to find the comparative advantage of multimodal over single mode of transport.

Figure 2: Comparison of Road freight from port of Hodeida and port of Aden to targeted major cities



Source: Yemen Land transport Affairs Authority, Yemen

In this figure, demonstrate direct road "full truck load" freight cost from port of Hodeida to Aden's nearest major cities, then from port of Aden to nearest major cities.

Analysing data and identifying findings of two modes of transportation

After collecting all data, finally we will analyze and identify the multimodal (sea, land) transportation freight cost over single mode (land) transportation mode then we will find the comparative advantage of multimodal over single transportation mode.

Table 3: Multimodal and single mode comparative advantage

	AL-Anad	Lahj	Abyan	Shabwah	AL-Mukalla
multimodal	**$588**	**$660**	**$660**	**$1,044**	**$1,212**
Single mode	**$1,000**	**$816**	**$1,000**	**$1,632**	**$1,632**

Finally, this table demonstrates the comparative advantage of multimodal fright transportation cost over single transportation mode.

Figure 3: Multimodal and single mode comparative advantage

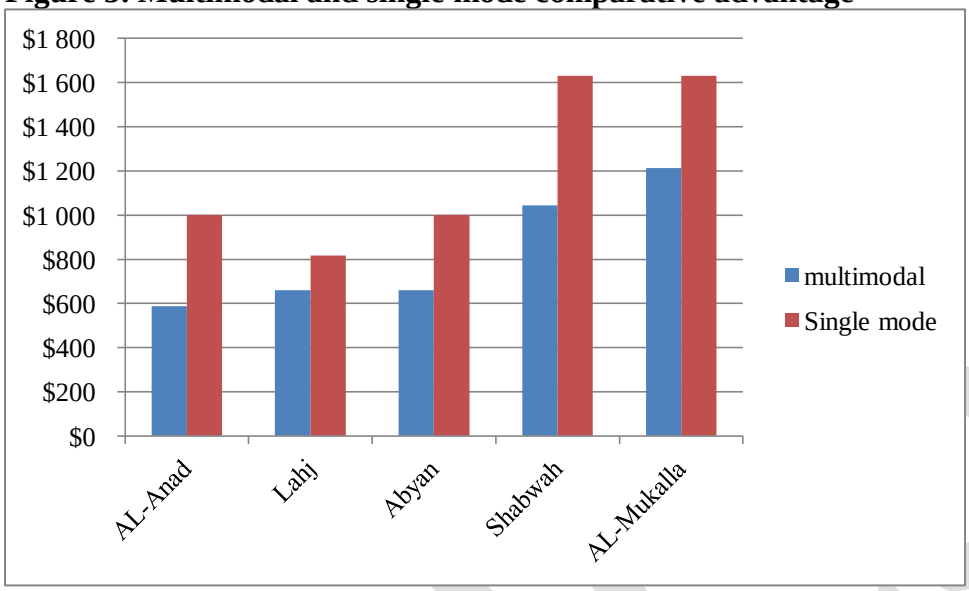


Figure demonstrates multimodal fright transportation cost is comparatively advantage over single transportation mode.

Conclusion

In conclusion, the road network is one of the most important pillars of development in Yemen, especially since the terrain in the Republic of Yemen is mostly mountainous and requires the implementation of a network of roads to enable the state to connect the rest of the other services. Major roads in Yemen are not paved and its population density are mainly populated in the coastal areas, implementing the idea of intermodal transportation method all over the coastline will give the product industries a huge advantages, due to its attractive solutions to the poor transportation infrastructure and its extremely limited road transportation system, including the bad level of road security. As a frequent and regular service, offering a door-to-door solution to customers, it may substantially contribute to bypass road congestion. This mode isn't land consuming and is environmentally friendly. For the carrier, it can guarantee transit time and avoid delays due to traffic congestion; it is reliable and enables door-to-door solutions.

Intermodal transportation can be a solution when transportation resources are scarce, bad road infrastructure and mountainous terrain. The quantity of demand is usually high and required an instant solution to meet the demand of the transportation resources. Finally after analysing data and identifying findings of two modes of transportation, the author found multimodal fright transportation cost is comparatively advantage over single transportation mode.

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