Studying Seaport’s Hinterland-Foreland Concepts and the Effective Factors on Their Development

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ABSTRACT: The areas which enjoy the comparative advantage, the main hinterland shall be considered a port and generally, this port to handle the majority of entry and exit cargos. The comparative hinterland consisting of areas that have no ports with special advantage exists. Consequently, other ports, have a share in the local market. For many ports, the captive hinterland has been destructed or reduced to a smaller size. This lead to increasing attention by ports authorities in boosting the capacity of the comparative hinterlands. The current research was implemented in three phases aiming at studying hinterland-foreland concepts and the relative effective factors in developing them. At the 1st phase, the concept of ports’ hinterland-foreland and the effective elements on them were investigated and at the 2nd phase, using Delphi method, the effective factors in non-development and inefficient access to the ports’ hinterlands were determined and with respect to experts’ opinions were prioritized.

Key words: Hinterland, foreland, main hinterland, comparative hinterland, transportation, ports.

INTRODUCTION

Today ports turned to a global logistic chain circle, in a way that the port competitiveness has changed from ports’ competitiveness to competition among transportation chains. In fact at many of transportation chains that include both origin and destination, transportation cost from the hinterlands is higher than ports and maritime transportation cost (McCalla, 1999). The majority of ports at the competitive hinterlands are working, consequently; their share from the competitive market essentially depends on the quality of transportation services of the so called hinterlands (Notteboom, 1997). Thus, the ports to continue their activities at the competitive markets and also to protect and increase their traffic, they are forced to follow the hinterlands’ policies (Notteboom and Winkelmans, 2001; Notteboom, 2002). The areas the port enjoying a permanent competitive position, shall be considered the main hinterland (Notteboom and Rodrigue, 2004). Generally speaking, the so called port does the maximum work of handling entry and exit cargos to those areas (Notteboom and Rodrigue, 2005). The competitive hinterlands consisting of areas in which no port with absolute advantage exists. Thus, different ports and with respect to the made advantages, has some shares in the market (Robinson, 1998). For many ports, the main hinterland has been destructed or diminished and therefore nowadays, ports around the world are not able to only depend on the hinterland markets which geographically speaking, has been under the captivity of the so called ports. Given the changes that have taken place in the maritime transportation so far, the increasing size of ships and ports’ shifting roles at the supplying chain, and deliberating hinterlands’ development, gained an increasing significance (Wang, 1998). The current research was implemented aiming at deliberating ports’ hinterland and foreland in the country along with the effective factors on their development in 3 phases, at the 1st phase ports’ hinterland and foreland concept with the effective factors to be studied and at the 2nd phase using Delphi’s method, the elements which influence non-progression and inefficient access to ports’ hinterlands to be determined and regarding the experts opinions, shall be prioritized. At the final phase/stage, the procedures in developing the countries’ hinterlands to be presented and with respect to experts opinions to be prioritized.
Research Methodology

The present research's purpose, regarding the results that can be beneficial for ports' hinterlands, is assumed to be a practical research and with respect to the problems' essence, type, goals, they used the descriptive method and for gathering information they benefited from the field procedure.

Community and Statistical Sample

In this research the statistical community encompasses all ports and maritime experts and the university's specialists. Due to lack of exact information of the statistical population of the statistical sample, the estimation of the preliminary variance at the confidence level is 95% out of a number of 80 people.

DELPHI METHOD

Delphi method, collecting data and attendance and experts' viewpoints to facilitate problem solving process, decision making and programming. This task needless of people's physical attendance altogether is to be implemented. Instead, they make use of mailing, faxing and/ or emailing services. The mentioned plan was design for more benefits from the experts and attendees' points of views. This technique is based on strengthening the group in solving problems and decreasing group's weak points. Thus, by the most appropriate techniques of collecting experts' ideas shall be used at this phase of the technique to determine and prioritize the determinants in lack of development and inefficient access to the ports' hinterlands and also to identify and prioritize the executive strategies in developing the ports' hinterlands of the country.

Also to prioritize the proposed procedures and the determinants in lack of development and inefficient access to ports' hinterlands in accordance with experts' opinions we used Likert five-option questionnaire. With respect to the type of the proposed questionnaire, according to table 1, a score to each strategy to be awarded. After receiving people interviewed ideas and with the help of final weight relation 1 and 2 and average weight, each procedure shall be calculated and the best procedure to be elected.

<table>
<thead>
<tr>
<th>Options</th>
<th>Very important</th>
<th>Important</th>
<th>Average</th>
<th>Non-significant</th>
<th>Quite insignificant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerogative</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Relevancy 1

\[+[(\text{no. of the important responses}) \times (7)]+(\text{no. of the very important responses}) \times (9)]= \text{Final prerogative of each procedure}\]
\[+(\text{no. of the non-significant responses}) \times (5)]\]
\[[(\text{no. of the quite unimportant responses}) \times (1)]\]

Relevancy 2

\[\text{Average prerogative} = \frac{\text{final prerogative of each response}}{\text{no. of the interviewed people}}\]

Each procedure

Validity and Perpetuity

Justifiability of the questionnaire from several experts and instructors' point of view is approved and to check its perpetuity we used the Kruskal Alpha, in which the amount for the research questionnaire was implemented through the software 19% SPSS 19.

1st Phase

Ports

Ports are intermediate in the maritime and terrestrial transportation process. The previous descriptions, introduces ports as places for cargos' loading and discharging, but today it seems that this definition is far from complete (Theys et al., 2008). At the recent decades, ports have evolved from a label of mere maritime and terrestrial intermediate of transportation (1st generation ports) to places which provide special services (3rd generation ports). In fact, this issue has presented value added support theory(Van Klink, 1995). In other words, ports other than the loading and discharging task will increase cargos’ value, too. Nowadays, in the international product - distribute based transportation, implement a special role.
**Hinterland**

Hinterlands are places in which a transport terminal and/or one port, exchanges its services and deals with its customers (Waals and Wijnolst, 1998). To put it another way, hinterlands are lands located at the back of the ports that have an important role of supporting and delivering export cargos to ports and distributing and attracting import cargoes from the port (Weigend, 1958). Each port attempts to increase its share in the local market in comparison to the other ports at action.

**Foreland**

Forelands are like mirrors of the hinterlands at the sea side. Ports and markets at the other side of the sea which are linked to port through shipping services are called forelands. In other words, the concept of foreland is subject to port and foreign markets that by shipping lines are linked to market sources (Zohil and Prijon, 1999). To put it well, foreland is an area that handles port of delivery of goods from across the borders.

![Figure 1. Captive and contestable hinterland's position along with hinterland A of the port(Van Klink, 1995)](image)

**Evolution in Hinterlands’ concept**

Until the early forties the geographers didn’t have a unified definition for the concept of hinterlands (Waals and Wijnolst, 1998). Although this was not a new term and long ago it was used in maritime transportation literature, no definition was able to persuade all opinions. Not until early 1941, Van Cleef, argued that the common element in all the prevalent hinterlands definitions was concentrating on the spatial dimension and accordingly presented a widely accepted definition (Wiegmans et al., 2008). He defined hinterland in the following way:

An area contains major activities of one port. At the end of 1980s the passion to study hinterland faded away. This change was due to several factors. First of all, to create a match between the static concepts of hinterland was made more difficult due to the dynamic nature of transportation esp (Theys et al., 2008). At the advent of containerization. Secondly and most importantly logistic markets’ changes and the inconsistent nature of complex logistics network which allowed the emergence of the clustered hinterlands. The prevalent standpoint in defining hinterland based on distance has almost lost its meaning, with respect to the occurred changes in the maritime transportation. Thus, the necessity for a practical method to unify it with the logistics supporting chain was felt (Wang, 1998).

At the recent years, the validity of hinterlands’ concept especially at the time of the contemporary containerization was questioned. The occurred ease of movement by containers, has facilitated market penetration to a lot of extent, in such a way that in many far away ports, there exists a sense of competition for trading and increasing market share. This change eventuated in hinterlands’ intervention. The concept of an individual hinterland with determined and specified borders, in many cases, was questionable. Several hinterlands have changed to discontinuous ones (Notteboom, 1997).
The significance and Exigency of Studying and Developing Ports’ Hinterlands

Global trading growth and subsequently maritime transportation shall lead ports to development and prosperity. Political incidences and also technical developments, has exposed the global economy structure and the community through a lot of changes. The gained evolution had a direct impact on transportation and ports’ works (Notteboom, 2002). Among the caused changes in the growing attention of hinterland’s concept we can mention the followings:

Increasing geographical dispersion of international commerce centers
Development of international commerce
Globalization of production and consumption patterns
New demands of global commerce in transportation and distribution

On the other hand, size increase and vessels’ specialization had inevitably influenced port operations, in the past. Nowadays, production, commerce and transportation are not investigated as an individual task. But all the elements in one united and integrated system are bound to each other and confirm the fact that modern port’s task exceeds the old fashion operation of loading and discharging ships and that their operations’ are not independent of world’s transportation operations. To prepare for such activities, should turn from mere logistics transportation to a full logistics center that is in coordination with latest and international maritime transportation. This indicates that ports should have a dynamic role in enhancing the international business. In fact, ports should be considered as catalysts which accelerate a wide range of trading activities for economy and business growth. To reach this end, developing the hinterlands and increasing cargos transportation quality at the foreland, has an undeniable impact. Also, the existence of strong ties among the port and its forelands to protect its situation in the world trade that the main character of which is the international contest enjoys a tremendous importance.

Containerization

With respect to the increasing use of containers for cargo transportation affairs, the need of special outlook for ports’ creation based on container and the relative equipment was identified. More than 60% of sea freight is done through containers and in the business among the developed countries this number exceeds 80%. According to the Latin American Economic Commission and Caribbean coverage, the major world welcome factors of containerization is speed acceleration, of loading and discharging operations which enables ship’s reloading and provides focused productivity. Therefore, global approach increased vessels’ size and volume and consequently, culminated in transformation of ports’ fundamental equipment to provide the required conditions for accepting and loading large vessels. Obviously, the entry of larger vessels with more containers requires increasing traffic of a large volume of rail-road fleet to ports’ operational areas to complete container logistics distribution chain. This highlights the significance of paying attention to ports’ hinterlands and developing strategies. Without increase in performance of transportation at hinterlands, ports are not able to handle the volume of containers influenced constantly by world trade and vessels increasing volume. Non consideration to this issue shall culminate in several problems including cargo sedimentation in ports (Robinson, 1998).

Weakening of the Captive Hinterland

Areas in which a port has noticeable contestable advantages is said to be the “captive hinterland”. Generally speaking, the so called port handles the main cargo entry/exit of the areas. The contestable hinterland consisting of areas in which no port with a special advantage exists. Thus, different ports have a part in the local market of those areas. For many ports, the captive hinterland has vanished or diminished and consequently today’s port can’t compete by only depending on cargos and the hinterland’s traffic toward other ports (Notteboom, 1997).

Hinterlands’ Taxonomy

Captive hinterlands

A part of the market which is closer to the terminal and assumingly the main traffic of the so called area passes through that terminal indicate that the so called port has the bigger share and impact on the flow of cargos. Nevertheless, in case the level of the services provided by the port was extremely weak, even in the aforementioned hinterland that its indisputable area is only the port, the possibility of competition shall exists. With respect to the latest developments in the port industry and access development, the concept of hinterland has weekend drastically (Van Klink, 1995).
The competitive hinterland reflects a place in which a port competes with other ports. Obviously, the quality of services provided and imposed charges to port beneficial, are the main success factors in this hinterland. In the other word, competitive hinterland is an area of a market in which a port is forced to compete with other competitors in order to attract traffic and its market share (Notteboom, 2002).

Nature and various types of hinterlands

Hinterlands are mostly commercial and their importance depends on level of economic activity and present competition in the region. As well as passenger terminals, airport hinterlands has definite limit which is equal to traffic area in which Clients can access to the terminal within a few hours. Also the level of activity in hinterlands is proportional to population density and traveler income. But like other freight terminal, port activity depends on the dynamic level of the region to which they are connected. Any changes in the nature of these activities and level of access, hinterlands are subjected to changes. Any changes means creating new opportunities to increase port traffic or threats to reduce traffic, or changes in the nature and composition of the traffic. Inbound hinterland traffic is a consumption oriented one, unless the goods and components are used in the manufacture of another product; while outbound hinterland traffic is generally from extraction or production. Based on the type of goods which makes a specific part of the supply chain, hinterlands can be separated as follow:

Bulk products

Distance is one of the most important factors shaping hinterland in this group of products. Such as minerals, chemicals, raw materials, wood, seeds, etc. Due to the nature of the goods, transportation cost is expensive. So hinterlands tend to get smaller and terminals are directly connected to the Extraction or production site of materials through high capacity corridors.

Parts and Manufactured Goods

They often lead to container traffic. Improvements in intermodal transport and economic globalization significantly improve hinterlands of this kind of traffic. In many cases, especially if there is transport corridors, hinterlands can be of major economic areas.

Factors affecting hinterlands and foreland

The three components including geographic location, accessibility and Infrastructure are the main parameters affecting on importance of a commercial port.

Geographic location

A large hinterland in a developing environment, being close to centers of production and consumption, benefiting from populated hinterland, high income, being located on the main maritime routes play an important role on port hinterland expansion.

Accessibility
Local access market and relation with regional transportation systems are of utmost importance. Despite the efficiency of ships loading and unloading, total operation of a commercial port can be strongly affected by poor access.

**Infrastructures**

First of all, a key function of a port depends on services provided to ships and goods. Port infrastructure shall meet port traffic. As development and modern technology transformation which will affect port operations, are predicted in operational environments. Port consists of a multiple combination including intermodal transportation infrastructure and ensuring a high level of access for hinterland and foreland communication. Each port has its own specific hinterland including the area surrounding the port and the local radius is for port services and interacts with customers. Hinterland also indicates market environment of a port in which port services take place. Demand for cargo handling also comes from Port Hinterland. Hinterland is important as determines the level of competition between ports. Indeed, port operational throughput directly affects hinterland coverage. Marine infrastructures such as access channels also affect in determining the volume of hinterland. On the other hand, Development of Multimodal Transport and Containerization phenomenon And standardization for port activities Play a significant role in the development of port hinterland. Since the situation is the same for port competitors, port competitiveness is developing and exposes the real meaning of hinterland.

**Hinterland development strategy**

Globalization and The growing complexity of supply chain made port authorities to adopt strategies aimed at creating a greater level of hinterland coordination.

**The Use of incentives**

Encouraging transportation activists, makes use of transport cycle and infrastructural Facilities closer to a desired one. From among intensive strategies, is lower tariff for customers who have a minimum volume of cargo which eventually encourage others to get the same reward.

**Inter-firm alliances**

There are two coalitions in this field. First, vertical integration (along the transport chain) in which for example a marine transport company and a terminal operator make agreement for better coordination of services. The second is horizontal integration (between competitors) in which for example Coalition of equipment or container occurs In order to improve the use of assets between the two rivals (port and shipping companies). Vertical and horizontal development strategies are adopted in order to collaborate other actors of market shipping industry and also Development of port operators’ hinterland. Vertical strategies include Integration of operations with maritime transport operators and other onshore Transport operators. Horizontal strategies were further supported by the executive directors in recent years. Anyway Port operators follow the politics of economic integration through horizontally strategies for example, alignment with port terminal competitors outside main port or vertical strategy like further logistical services to Regular customers of the port aiming to develop hinterland and foreland.

**Social programs**

A series of strategies which gather port and maritime organizations aimed at regulating public-private partnership that will ultimately lead to the establishment of a regional logistics. Due to its expertise and experience, each of these social actors participates in this program.

**The effect of intermodal transportation on hinterland development**

With the advent of intermodal transport and Origin - destination transportation services, hinterland and foreland have been increasingly integrated. As an important link that connects Transport chain, ports play an important role. Through development of a logistics module for marine transportation, Modern ports can compete with long- distance goods and competitors. On the other hand, the bargaining power of marine transport operators in the international transport indicates that modern ports have improved to the degree of competition in which changing sea and transit routes or customer attraction, raise the risk of being or not for competing ports. It seems Development of inland dry ports And logistic zones is a growing Model. However, the Port officials are hesitant to collaborate with them; the major concern is that it can cause a loss of value-added activities and employment for ports. Dry ports also May promote seaport competition or transportation corridors, so can be a major challenge for port hinterland and is related cargo. However there is actual Coordination and cooperation between ports and...
terrestrial logistical zones especially in the world’s largest ports. For example, Dominant strategy in Europe is a dedicated rail or the marine service toward domestic ports while the ports of North America tend to set up logistics zones in adjacent areas to keep traffic.

**The second stage**

Due to various reasons, domestic ports have not yet necessary conditions to compete with regional ports such as Jebel Ali, Dubai and southern margin ports of the Persian Gulf. These factors were described using Delphi method Table 2 and were prioritized according to experts.

<table>
<thead>
<tr>
<th>Table 2. Causes and effective factors for lack of development and inefficient access to hinterlands</th>
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</thead>
<tbody>
<tr>
<td>causes and effective factors for lack of development and inefficient access to hinterlands</td>
</tr>
<tr>
<td>Lack of rail transport access in ports ,small and meaningless share of rail transport in cargo Input and output handling</td>
</tr>
<tr>
<td>Lack of infrastructure and superstructure needed to implement a compound transportation system</td>
</tr>
<tr>
<td>Lack of coordination between policymakers of different parts in transportation system</td>
</tr>
<tr>
<td>Weaknesses in the development of dry ports in the country.</td>
</tr>
<tr>
<td>Lack of coordination between rail , road and port transport operators</td>
</tr>
<tr>
<td>Disadvantages of private sector on investment in ports</td>
</tr>
<tr>
<td>Inefficient road transport, high traffic and old fleet</td>
</tr>
</tbody>
</table>

**The third stage**

By using Delphi Model in this point some strategies for development of domestic port hinterland were describes as table 3 and prioritized according to experts.

<table>
<thead>
<tr>
<th>Table 3. Strategies for efficient access to the ports hinterland</th>
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</thead>
<tbody>
<tr>
<td>causes and effective factors for lack of development and inefficient access to hinterlands</td>
</tr>
<tr>
<td>Development of sustainable transport systems in the hinterland</td>
</tr>
<tr>
<td>Creating the necessary infrastructure Including hardware and software For implementation of Combined and integrated transport</td>
</tr>
<tr>
<td>Efficient use of transportation infrastructure</td>
</tr>
<tr>
<td>Law enforcement for open access to Islamic Republic of Iran Railways</td>
</tr>
<tr>
<td>Proper and sufficient Development of transport infrastructure</td>
</tr>
<tr>
<td>Organizational coordination in the transport chain</td>
</tr>
<tr>
<td>Creating attractiveness for private companies, such as Terminal and Marine Services</td>
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</table>

**CONCLUSION**

The present study aims to investigate the country’s ports hinterland and foreland in three steps. Definition of hinterland and foreland and related affective factors are checked in the first stage. At the second stage, 7 factors in an inefficient development and access to all ports hinterland were identified by Delphi Method, and prioritized according to experts. The result of this stage indicates that Lack of coordination between different sector’s policymakers in Transportation system is the most important factor for inefficient access and development of ports hinterland. Poor development of dry ports determined as the least important factor.

By using Delphi method in this point 7 strategies for development of domestic port hinterland were describes and prioritized according to experts. According to the results, top priority was given to development strategy for Sustainable transport system in hinterlands and the last priority was for creating attractiveness for private companies such as terminal and marine services.

**REFERENCE**