Challenges for multimode transport in international logistics park: a case of Taiwanese ports

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Abstract

The derived demand of transport depends on the domestic and international trade. The growth of a region is directly dependent on the strength of its external exchanges with other regions. We could consider a bottom-down or a top-up scale of transport system in terms of integrated, co-ordinated, seamless, flexible, reliable and door-to-door service where fragmented transport at the very early stage. Since the revolution of containerisation has passed in the mean time four decades and during age of globalisation it is quite realistic to assume that the transport system of any country is not at the very primitive stage. The growing progression in the use of containers as standardized unit and the creation of joint venture in maritime industry and the trend to Post-Panamax container ships have put pressure on seaports to respond in such intermodality. The concept of hinterland is becoming obsolete because the use of containers provide the intermodality and so remove monopolistic position of ports in its next influence area. Efficient sea transportation is heavily dependent on the smooth operation of multimode transport. That means that intermodal transfer is a key point to successful shipping operations with their massive transhipment in major seaports. This study will focus on a short-term objective to approach the long-term vision by establishing the port logistics system and global logistics management mode. In this paper, we will discuss about the strategy for the intermodal freight transport system, comparing with the interior and exterior environmental situation for the intermodal development in international logistics park. Final paper will describe strategic planning methodology by adopting AHP (Analytic Hierarchy Process) method from the comparative point of view with container ports that use those maritime intermodal facilities.

1 Introduction

Containers as transport cargo unit improves the intermodality so that it becomes common that different ports shares the same hinterland, and there are resulted in port
The rise of intermodal transport has resulted in dramatic changes in the pattern of freight transport and port competition in the world-wide shipping [1]. The intermodal system afford exporters and importers impressive opportunities for saving money, expanding markets, and increasing the value added related to distribution, but by far the greatest benefit they afford is the minimisation of intermodal transfers. There will see a renewed focus on intermodal freight transportation driven by the changing requirement of global supply chains. Extension of the world-wide transportation has one fundamental flaw, the high cost of bringing goods to a halt, be it ever so briefly at the point of interchange between modes. Intermodal transport that combined transport by truck, rail, barge, sea vessel and air plane those will affect the spatial economic structure of the transport industry and the position of nodes in the world [2]. It is precisely this pause en-route that flouts that basic rule of transportation economics, the continuous flow theory, that to achieve optimum transportation equilibrium, goods in transit should move forward in a continuous manner. Industry and government are concerned about the capacity of ports to handle steadily increasing volumes of intermodal containerised traffic. They are concerned ports access to emerge the intermodal freight transport system. The objective of intermodalism is to maximise the service quality and minimise the cost of moving containers by integrating and making continuous flow. Even the containers move from vessel to shore-side and terminal to truck and rail.

Compared to the thousands years’ history during the last few decades, however, ocean transportation has experienced rapid changes. These changes can be classified into two broad categories: evolution in the growth of carrier and port infrastructures, and revolution in the system of linkages. The first revolution was in the ship-to-shore transfer, the invention of containers; the second was in the ship-to-rail transfer, the intermodal revolution; the third was in the ship-to-ship transfer, the transhipment revolution. The fourth revolution expected to be triggered by expansion of Panama Canal Locks. It will result in the emergence of Round-The-World (RTW) service [3]. Where as the developed countries are thinking of expansion of the Panama Canal’s locks to allow new generation ship operation, experts express opinion that the some developing countries have not yet achieved the goal of the revolution to intermodal transport.

The practice of using more than one mode of transport in a co-ordinated and seamless way is usually called intermodal transport and through-transport. Definitions of intermodalism usually concentrate on operational aspects and transport infrastructure. However, successful intermodal transport also requires an administrative and legal environment, and efficient interchange of information [4]. Muller prefers to use the term intermodal freight transportation instead of multimodal freight transportation, and defines it as co-ordinated, seamless, flexible, and continuous from door-to-door on two or more transportation modes. The movement of goods in multiple modes transportation was an important development in the transport industry and for all the elements involved in international/domestic trade. Indeed, containerisation and more recently, intermodality had caused a tremendous impact on every facet of the transport industry. Those definitions for intermodal have concentrated on the following aspects: (A) Intermodal transport is by more than one modes of carrier for an origin to destination transportation haulage.
(B) The goods can be for domestic or international trade that the goods remain in the same unit or container throughout the entire trip for easy and speedy transfer at modal interface. (C) The transport system can be termed as intermodal and the responsibility of the entire transportation haulage lies with one operator under a single contract.

The term intermodal is more used in the USA and in different academic journals and textbooks, whereas the term ‘multimodal’ is more used by United Nations Conference on Trade and Development (UNCTAD) and in Europe as well. All these definitions have put focus less on hardware, but more on the process by which a system approach can be developed. From the above discussion we can conclude that there are consensus over using at least two modes of transport for an origin to destination transportation haulage under a single contract and the goods can be for domestic or international. Although most definitions did not link movement of goods by container but it is implied that without containerised cargo co-ordinated, seamless, flexible and door-to-door transport service can not be achieved. So, we can define intermodal freight transport as an integrated system of transporting goods involving at least two different modes that can offer flexible, reliable, seamless and door-to-door service under a single contract. However, intermodalism is not only the movement of freight by at least two modes of transport, but also the interchange of information necessary to make the movement happened. As intermodalism has grown, electronic data interchange (EDI) has become essential to providing efficient, seamless service. Such a transport system is desirable everywhere but developing it a great task particularly, challenging in developing countries such as Taiwan. In the figure 1, we summarise the features of measurement how to develop an intermodal freight transport system to serve, from macro perspective, national economy, and, from micro perspective, domestic and international trade [5].

![Diagram](image)

Figure 1: The features of measurement to develop an intermodal transport system

2 New challenges for intermodal freight transport

As globalisation of the production process enhanced the established international exchange networks of finished goods and raw materials, so the focus shifted from the modes, which perform the bulk of international transport to the organisation of distribution. The importance of individual modes faded in favour of the management of the supply chain. In the globalisation, production, trade and distribution channels of today, managing the entire and increasingly complex process of movement of materials and goods has become more important than producing transport [6]. In very conventional terms, logistics is often defined as all the activities involved in providing a quantity of goods at the least cost where and when a demand exists. Logistics therefore concerns all the operations determining the movement of goods, such as warehouses, supplies, physical management of goods in process, packaging,
storage and inventory management and handling and preparation of orders, and transport and delivery rounds [7]. Industrial and commercial enterprises can modify their transport demand by establishing a logistics system, which ranges from a very conventional and generally modal demand, to a much more complex demand in table 1, transport is only one but the central unit.

Table 1: Transport and logistics service

<table>
<thead>
<tr>
<th>Shippers</th>
<th>Carriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expression of a new demand for complex logistics services (transport + range of services storage + handling + delivery)</td>
<td>Extension of the range of services offered to meet the shippers' demand</td>
</tr>
<tr>
<td>Small and medium sized shippers whose logistics are designed and operated by service suppliers</td>
<td>Modern service suppliers setting up a transport supply extended to the supply of logistics services</td>
</tr>
</tbody>
</table>

While productivity measures for manufacturing are widely understood and used, productivity measures specific for services have developed more slowly. The greatest gaps in the ability to measure service productivity come in the areas of desegregate customised service. Customer service quality refers to the measurement of the firm’s ability to meet specific needs of the customer firm [8]. Alike in the USA and Europe the service industry is also becoming increasingly important in the economic growth of developing regions like Asia and Latin America. In Mexico, the contribution of this sector to the GNP during 1997 was 66 per cent while employment level exceeded 50 per cent. Many other Latin American countries show similar trends [9]. The service industry in Korea contributed 41 per cent to the GDP in 1975, compared with 46 per cent in 1991. During the same period the labour force in the service industry increased from 34 per cent to 48 per cent of the total labour force. Consumption of service has also increased from 29 per cent in 1975 to 35 per cent in 1985. Compared with developed nations, the productivity of the Korean service industry is low and the growth in productivity remains slow. Productivity growth in the Korean service industry has increased only 2 per cent per year between 1971 and 1988. This is relatively low compared with the manufacturing industry, which gained 3 per cent per year in productivity during the same period [10]. The average contribution to GNP from the service sector in Latin American and Caribbean countries has increased from 50.7 per cent in 1980 to 56.2 per cent in 1996. More than half the economy of these countries is based on service activities and more than half of the registered population participates in service activities. However, the productivity of service industry in developing countries is constrained by a number of challenges.

2.1 Diversified logistics concept

Observing the economic achievement in some developing countries, multinational companies (MNCs) may rush to reshuffle their world market strategy but may face reality of the challenges. Each logistics concept such as Just-in-Time (JIT), Economic Order Quantity, has got its own peculiarities. So, adaptation of supply and distribution strategy to meet the particular set of business environment in own country or in foreign country is essential. On the other hand, in some newly
industrialised countries transitory JIT strategy has been adopted as 'intermediate technology'. For example, as a means of national strategy transitory JIT is working very well in Malaysia. Proton, an automobile manufacturing company in Malaysia, is clearly enjoying the benefits of the various JIT practices it uses. With the constraints imposed by the social policies of ethnic quotas in component suppliers, staff development and the multiple objectives of both increasing the proportion of indigenous suppliers whilst attempting to adopt JIT practices, full strategic JIT in the Japanese sense seems to be beyond Proton's reach in the foreseeable future [11].

2.2 Challenges from foreign logistics service providers

Although the interest of the top executives is considerable, they still do not realise that the function of logistics covers more than transportation and warehousing and the scope of logistics is not confined only to physical distribution but should be extended to include physical supply and manufacturing [12]. While the US and European companies are busy with developing and implementing quick response systems, efficient consumer response and supply chain management, these concept have not been yet well recognised by the executives of developing countries, for example S. Korea, in making a strategic difference in global competitiveness. If this is the case of leading developing countries, known as newly industrialised Country, then the situation in other developing countries in particular LDCs is probably more disappointing. However, market liberalisation in Korea has resulted in accelerated penetration of the Korean service markets by foreign firms. At the same time the cost of acquiring computer and telecommunications systems has been decreasing, resulting in accelerated use of information technology in the service industry. Considering such trends, it becomes apparent that the need for improving competitiveness is critical. To achieve this end, investment in advanced information technology, improvements in customer service, reducing costs, differentiating service offerings and expanding business territories are needed. It is crucial for service business leaders to listen, to understand and to interpret the needs of an increasingly demanding and dynamic environment of service economy. Another problem of logistics service is that the service providers are not always aware of the most important selection factors of shippers. Similarly, shippers are also not aware of the importance of the service providers. Carriers are not rewarded for performance, which they rank as important in carrier/modal selection. Shippers are not rewarded for performance, which will develop long-term relationship with carriers. Communication and reward gaps do exist within these industries, jeopardising both industries' ability to provide quality service. Two surveys, after the Railway Deregulation '80 in the USA, conducted by Purchasing World found some interesting similarities and differences in the outlook of carriers and shippers. According to these surveys among 15 logistics service factors. On time delivery and care in handling were ranked as first and second respectively whereas Intermodal capabilities was the lowest (15th) ranked by shippers. On the other hand, from carrier point of view, 'Rates', 'On time delivery' and 'Consolidating/Breaking capabilities' were first, second and 15th respectively. Foster and Strasser [13] reported that shippers were found to rank service factors such as schedule reliability and
willingness to negotiate services as being more important than cost factor. Differences were also found in selection criteria importance between rail and motor carrier with motor carriers ranking transit time as the most important criteria and rail carriers ranking schedule reliability as the most important criteria [14].

2.3 Change in technology for container ports

Change in technology is an ongoing process and whether this change is an opportunity or threat but is an unavoidable fact for container ports. For those who are competing and prospering in the global village, technology change will be a tool to achieve competitive advantage. Like other sector technology change affects freight transport system by changes in basic technology such as: ship form or port operation by using of gantry crane, flow of information technology by using of EDI, and other various interface technology by transhipment. New technology can be the result of internal development or transfer from related or unrelated field of activities [15]. So, the challenges for container ports for the change in technology can be taken into two broad categories as follows:

2.3.1 External change

The transferability of new technologies is an important element to be taken into account by technology transfer policy for container ports. Opinions differ regarding whether new technologies are becoming easier to appropriate or whether they are becoming a kind of ‘black box’, difficult to ‘reverse engineer’ and open. However, in the age of globalisation the tightening of intellectual property rights and control over technology will undoubtedly reduce possibilities for technology transfer for developing countries. Whether the effects of that in the long term will be positive through stimulation of innovations in developing countries themselves is very much industry specific and generally are not possible. ‘Technological change decisions are usually made on the basis of economic and performance advantage, but the choice, timing, scale of introduction, and utilisation of old as well as new technology is becoming more difficult now that new technologies become increasingly available long before the expiration of the economic life of existing technology. The problem of technological change is different for early or late adopters of existing technologies, as well as for large and financial powerful versus small and growing transport companies considering a new technology. Their perception of value and risk will be quite different, which in turn affects their technology decisions.

2.3.2 Internal change

The dream of paperless trade on documentation dates back long before the Internet surfaced a commercial entity some five years ago. A mercantile store of the USA placed an order for women’s knitwear with Peninsular Knitters of Hong Kong. ‘Global Cash & Trade’ completed the transaction, which involved 30 process steps over a three weeks period, beginning with purchase order. This is a significantly shorter time than using paper documents sent by post or courier. An electronic letter
of credit initiation was issued and Citibank was the advising and issuing bank for the credit transaction. APL was the carrier to achieve such a goal of paperless transactions, the exigent need for a common standard for recognising inter-flow information is encouraging. The document forms that trading partners send each other, such as purchase orders, order confirmations, bill of lading, invoices, advanced shipment notices and remittance advises, are formatted and converted to standard message in transaction process [16]. A recent study demonstrated a positive relationship between level of EDI implementation and customer’s perception of overall success of the EDI system, out of the four measures of EDI system success. The other success measures are user satisfaction, customer service quality and supplier’s perception of overall success. International harmonisation of EDI message is a problem and apprehended to remain as well. As the important aspects of international trade is in transition. First transition is seen from the development of regional EDI standards to the development and use of one global standard (excluding air transport) and related message thereto i.e. UN/EDIFACT (1997). Second, a common global standard will accelerate the transition to the use of electronic communication methods over the internationally recognised standard paper-based systems within the various functions in transport, customs, finance, and insurance [17].

3 Taiwanese intermodal transport system in international logistics park

Intermodal freight transportation is the movement of freight by the co-ordinated and sequential use of two or more modes of transportation. Intermodal freight moves from a shipper to a receiver by multiple modes through transfer points within a system. Taiwan offers great opportunities for applying intermodal concepts, particularly related to the movement of the country’s international trade. The system name that the inland movement of container between the international ports and inland container depots from Kaohsiung Port International Logistics Park to northern Taiwan, intra-port linkage between Kaohsiung, Taichung and Keelung. Shipping companies and port planning personnel’s reference are engaging in container loading, unloading and transport. Not only are these intermodal opportunities of great economic significance in themselves, but they also constitute a crucial expansion of the country’s competitiveness in handling East Asia’s transshipment trade. Taiwan has two key advantages in the intermodalism to be realised, First advantage relates to the logistics economy is unsurpassed in the region. In table 2 shows logistics costs as a percentage of GDP ranging 13% in Taiwan. Secondly, the potential volume between the strength of Taiwan’s domestic trade and its strength in the regional transshipment market including north and south Asia region. In table 3 indicates that Taiwan has the largest domestic export/import market of the above region’s ports, it theoretically provides the greatest total domestic and transshipment boxes. Unfortunately the collaboration between domestic and transshipment in Taiwan remains only theoretical because the high cost of delivering the island’s domestic trade. As the container box volume has increased up more than 40% over the past five years, and the traffic congestion on
the highways has become a problem. Driver productivity has declined, the average number to trips/truck has fallen and operating costs for the truckers have risen considerably. Moreover, the government has been forced to increase its expenditure on road building and repair programs in an attempt to prevent the current system grinding to a halt. Of course, on top of all this is the increasingly unmanageable environmental impact.

Table 2 Logistics costs as a percentage of GDP by country.

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP in US$ million</th>
<th>Logistics in US$ million</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>94,063</td>
<td>13,074</td>
<td>13.9</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>153,068</td>
<td>20,992</td>
<td>13.7</td>
</tr>
<tr>
<td>Taiwan</td>
<td>273,440</td>
<td>35,686</td>
<td>13.0</td>
</tr>
</tbody>
</table>

(Source: The Institute of Transportation, MOTC. 2000. Base on the data of 1998.)

Table 3: Major Asian Exporters/Importers of Commercial Services, 1999.

<table>
<thead>
<tr>
<th>Country</th>
<th>Exports</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value (US$ bn)</td>
<td>Rank</td>
</tr>
<tr>
<td>Japan</td>
<td>59.8</td>
<td>6</td>
</tr>
<tr>
<td>China</td>
<td>26.6</td>
<td>14</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>35.4</td>
<td>10</td>
</tr>
<tr>
<td>Taiwan</td>
<td>14.8</td>
<td>21</td>
</tr>
<tr>
<td>Singapore</td>
<td>22.9</td>
<td>16</td>
</tr>
<tr>
<td>South Korea</td>
<td>25.0</td>
<td>15</td>
</tr>
</tbody>
</table>

(Source: The Department of Statistics Ministry of Communications, Taiwan, R.O.C. 2000.)

3.1 The strategic planning process for intermodal transport system

Intermodalism has the potential to become the next governing transport element of strategy as an inventive way of creating value for customers, a source of savings, an important discipline on production flexibility. Value-added intermodality means that traditional services, products, and new capabilities are bundled into new configurations in order to offer greater value to decrease the need to compete on price alone. An intermodal transport system has two distribution strategies in a process during which strategic operating alternatives are evaluated to determine the most cost-effective way of providing the required service level. There are optimal size and the number of intermodal facilities.

This study applies the theory structure of Analytic Hierarchy Process (AHP) and the analysis is based on the characteristic of the multiple goals and the practicable issues of strategy analysis. With the hierarchy in figure 2, the corporate objectives are first compared in a pair-wise fashion in respect of the goal. Then the criteria, sub-criteria, alternative activity and strategies for the selection of an intermodal transport system are compared pair-wise in respect of each preceding level. In the classical weightings and scores approach, the ratings are determined by a questionnaire aimed at industrial, governmental and academic experts, and by applying AHP computer program software, and the final structural pair-wise comparison data is obtained as follows:
1. Goal: A. Selection of intermodal transport system (1.000)

2. Corporate objectives: B. Market share (0.286)
C. Logistics process (0.574)
D. Diversification (0.140)

3. Criteria: E. Reliability (0.286)
F. Flexibility (0.449)
G. Strategic compatibility (0.264)

4. Sub-criteria: H. Location convenience (0.313)
I. Access to infrastructure development (0.424)
J. Access to finance (0.185)
K. Integrated transportation (0.078)

5. Alternative activity: L. Port service (0.509)
M. Marketing (0.262)
N. Logistics (0.229)

6. Strategies:
   a. Improve quality of port management (0.145)
   b. Improve service of the people who assign in-port operations (0.083)
   c. Improve efficiency of loading and discharging (0.205)
   d. Establish service system of ship berthing (0.046)
   e. Increase management of berth scheduling (0.029)
   f. Industrialize port management (0.067)
   g. Establish national trade centre (0.018)
   h. Develop recreation area (0.029)
   i. Decrease port expense (0.126)
   j. Develop tourism (0.022)
   k. Simplify management of customs (0.101)
   l. Format intermodal links (0.050)
   m. Improve the system of transportation for exterior (0.030)
   n. Set up the port flow area (0.021)
   o. Establish check area for container depot (0.028).

Figure 2 Intermodal transport system planning hierarchical structure

4 Conclusion

The intermodal transport service proposed by this study has its objective context. It will include economies of scale, operational efficiencies, and financial arrangement. There is significant cost reduction as compared to the truck. If one looks at this reduction in terms of a shipping company's net income per container, it is indeed very significant. An important dimension of this service is that it will serve the industry as a whole. The rail infrastructure of Taiwan is not sufficient for
developed that system without compromising the economics of each other. And the rail has a duty to provide capacity for projected freight level increases, allowing the rail freight operating companies to take full advantage of the opportunities to transfer freight from road to rail. Therefore the currently consist of entities of context is expected to used by the majority for all shipping carrier.

The key aspect of intermodalism for international logistics park of Taiwanese container port will be focus on the operating system efficiency, especially for the intermodal service. It is crucial to continuously emphasise that the port operator proposes a continuous flow service, not a single modal. Just as Taiwanese container port represents a good opportunity for shipping lines, exporters and importers to reduce their operating expense by shifting from truck to intermodal service for movement of containers between the service areas. It is crucial to stress the macro-economic efficiency generated by intermodalism, from the standpoint of Taiwan’s GNP, it has a great impact on that. Intermodalism for Taiwanese container ports operation should encouraged from this overview; and for the economic issue will be enjoyed by all in the near term.

References:


