FUTURE PROSPECT OF SEA-AIR TRANSPORT LOGISTICS ACROSS THE TAIWAN STRAIT VIA THE KAOSHIUNG OFFSHORE SHIPPING CENTER

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Key words: sea-air transport, shipping, logistics, grey prediction model.

ABSTRACT

Sea-air transport across the Taiwan Strait has grown in the years since the Taiwan government amended the "Regulations for Establishment and Operation of Offshore Shipping Centers." The volume of cross-strait sea-air cargo was 8,950 tons in 2006, and monthly transit cargo volume averaged 746 tons. This figure failed to reach the anticipated target of 4,000 tons per month published by Ministry of Transportation and Communications, showing that the cross-strait sea-air transport route via Kaohsiung port’s Offshore Shipping Center (OSC) is still affected by many problems. The purpose of this paper is to describe the current state of development of sea-air transport via the OSC, analyze the main problems causing the gap between projected and actual cargo volume, estimate the future development of sea-air trade volume using the grey prediction model, and recommend some alternatives to sea-air transport across Taiwan Strait.

I. INTRODUCTION

"Regulations for Establishment and Operation of Offshore Shipping Centers,” enacted by the Ministry of Transportation and Communications (MOTC) in 1995, has clarified the definition of offshore shipping center as a special zone established in an international commercial port for the purpose of handling transshipment cargo shipped between Xiamen or Fuzhou (international commercial ports in China) and Kaohsiung (an international commercial port in Taiwan) under the principle of “no customs clearance and no entry to Taiwan.” In other words, the cargo delivered from the designated two ports in China by direct transport may not be imported into Taiwan.

Since 1997 the government of Taiwan has permitted legitimate vessels calling on the Offshore Shipping Center (referred to as the “OSC”) to extend their shipping routes to third areas, so that they were not limited exclusively to sailing between Xiamen or Fuzhou and Kaohsiung. The MOTC further proposed an amendment to the aforementioned regulations in order to include sea-air transport modal via OSC, for instance, any commodities exported from China are transported by sea from Xiamen or Fuzhou to Kaohsiung, and then shipped by air via Kaohsiung International Airport or Taiwan Taoyuan International Airport to another third area.

As formally revised by the Executive Yuan on August 3, 2001, the “Regulations for Establishment and Operation of Offshore Shipping Centers” enlarges OSC functions to include sea-air intermodal transport services, which is intended to enhance Taiwan’s industrial competitiveness in the China market. In practical terms, this revision expands the scope of transshipment between Xiamen/Fuzhou and Kaohsiung from only sea transport to both sea and air transport.

The first sea-air cargo was shipped from Xiamen to Kaohsiung by Yang Ming Line on August 8, 2002. This shipment was handled in the logistics center operated by the Yes Logistics Company via the procedures of unloading, repacking, labeling, palletizing, and loading; the cargo was ultimately shipped by air to Los Angeles Airport, launching a new era for the cross-strait shipping and logistics industry [1].

After literature review there is a few recent studies associated with sea-air transport issues. Hou proposed that the preconditions for an sea-air transit hub port include a central geographical location, frequent flights, a stable source of cargo, sufficient facility capacity, efficient cargo handling, simplified business procedures, inexpensive shipping rates, a qualified operating workforce, sufficient service time, safety, convenient inland access, automated and computerized operation, and sound management and legal regulations and policies [5]. Wu suggested that the assessment criteria for sea-air transit hub
ports should cover possession of sea-air transshipment functions [19].

The OSC sea-air transit model allows Taiwanese businesses to obtain the benefits of value-added service, less costly shipping rates, and shorter lead time. This model can not only strengthen the competitiveness of Taiwanese businesses in China, but also make Taiwan a global logistics hub in the Asia-Pacific region.

Grey forecasting refers to the forecasting of systems possessing grey characteristics. Grey forecasting is chiefly based on the GM (1, 1) grey system model, and encompasses the five categories of sequence prediction, disaster prediction, season prediction, topology prediction, and composite prediction. Sequence prediction consists of predicting the characteristic trend of a system based on the data in that system, for instance prediction of sales in the market or amounts of cargo, etc. The GM (1, 1) model employed by Deng in 1982 is the simplest grey forecasting model for uncertain systems with little information. Many researchers have studied this model and sought to improve prediction accuracy or reduce fitting and forecasting error [6].

Due to insufficient sea-air transport data available from the government authority, we used the sequence prediction method to forecast sea-air transport throughput volume based on volume for the period of 2003-2008.

The main goal of this paper is to: (1) highlight the advantages of sea-air transport via the Kaohsiung Offshore Shipping Center (KOSC), (2) express an integrated operating model for sea-air transport via the KOSC, (3) estimate sea-air transport cargo throughput volume using the grey prediction modal (GPM), (4) identify major issues affecting sea-air transport, and (5) propose sea-air transport alternatives.

II. INTEGRATED SEA-AIR TRANSPORT LOGISTICS MODELS

Intermodal transport consists of the combination of at least two modes of transport in a single transport chain, without a change of container for the goods, with most of the route traveled by rail, inland waterway or ocean-going vessel, and with the shortest possible initial and final journeys by road [8]. Intermodal freight transport has developed into a significant sector of the transport industry in its own right. Intermodal freight transport is a term describing the movement of goods in one and the same loading unit or vehicle, which uses successive, various modes of transport (road, rail, water, air) without any handling of the goods themselves during transfers between modes. Intermodalism is a shipment method that uses different and coordinated modes of transport [7]. Intermodal transport is the transport of unitized loads by the coordinated use of more than one transport mode so that the comparative advantages of the modes are maximized and the transport chain is unified [10]. Multimodal transport involves the movement of cargo from shipper to consignee using two or more different modes under a single rate, with through billing and through liability [4]. The objective is to transfer goods in a continuous flow through the entire transport chain, from original to final destination, in the most cost and time effective way [14].

The sea-air concept involves the movement of goods usually by sea on the first consolidated sector, and air on the latter, with the transfer between modes taking place at a hub [11]. Sea-air transportation reaps the benefit of both modes through savings in cost compared with airfreight, and savings in time as opposed to sea freight. This resultant service is commonly marketed by providers as about “half the cost of pure airfreight and taking only half the time of basic sea service” [2]. Intermodalism developed shortly after WWII to address one concern, security; however, there were some other benefits, particularly the safety of the cargo, the safety of workers, efficiency and speed [7]. Wu contended that the integrated development environment of sea-air intermodal transportation in Taiwan, which obtains an average score of 2.57, is characterized by the advantages of an appropriate geographic position for airline routes, abundant cargo sources for midway forwarding, transportation cost savings, a highly-educated, low-wage workforce, efficient uplifting facilities, and sophisticated distribution technology.

CAL and EVA have inaugurated sea-air transport service since the intermodal transport route between Taiwan and China was permitted by these areas’ respective governments in August 2001. The former carrier initiated a strategic alliance with Yang Ming Line and Wang Hai Line, establishing a new cooperative model of sea-air transport. The latter carrier selected Evergreen Marine as a trading partner since both are members of the Evergreen Group. Due to unfamiliarity with the regulations and practice of intermodal transport in China, CAL has had to rely on Yes Logistics to deal with some complex business issues in China, such as foreign currency restrictions, bills of lading, customs clearance, and shipment loading. CAL thus only performs forwarding and marketing tasks. Table 1 shows integrated OSC sea-air transport logistics models. Certain features of these models can be summarized as follows:

1. Both CAL and EVA hold a dominant position in overall transport activities as shipping companies playing supporting roles. In other words, these shipping companies are responsible for front-end operations, while the respective airlines deal with back-end logistics. 2. Both models perform quotations and account settlement based on air route; target markets consist of Taiwanese and foreign enterprises in China, but Chinese enterprises are potential future customers. Sea-air transport logistics maximizes benefit for global express, airline, and shipping companies. Airlines accept transfer cargo exported from China, and instruct shipping companies to deliver cargo to the OSC, from where it is transported to its destination by air. Since EVA has a partnership with fellow group member Evergreen Marine, it can avoid many of the costs arising from communications, technical, and cultural
Table 1. Comparison of the CAL and EVA sea-air transport logistics models.

<table>
<thead>
<tr>
<th></th>
<th>China Airlines</th>
<th>EVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinating companies</td>
<td>Yang Ming, Wan Hai, OOCL</td>
<td>Evergreen</td>
</tr>
<tr>
<td>Ports of call</td>
<td>Xiamen, Fuzhou</td>
<td>Xiamen, Fuzhou</td>
</tr>
<tr>
<td>Consolidation channel</td>
<td>Yes Logistics, Freight Forwarder</td>
<td>Evergreen, Freight Forwarder</td>
</tr>
<tr>
<td>Customer source</td>
<td>Taiwanese businesses, foreign businesses</td>
<td>Taiwanese businesses, foreign businesses</td>
</tr>
<tr>
<td>Quotation Method</td>
<td>Air freight quotation</td>
<td>Air freight quotation</td>
</tr>
<tr>
<td>Bill of Lading</td>
<td>Airway B/L</td>
<td>Airway B/L</td>
</tr>
<tr>
<td>Transshipment airport</td>
<td>Taoyuan International Airport, Kaohsiung International Airport</td>
<td>Taoyuan International Airport</td>
</tr>
<tr>
<td>Billing method</td>
<td>Settlement in Taiwan</td>
<td>Settlement in China or Taiwan</td>
</tr>
<tr>
<td>Number of aircraft</td>
<td>1. 8 B747-200 2. 8 B747-400</td>
<td>1. 9 MD11 2. 3 B747-400 3. 10 B747-400 (Combi)</td>
</tr>
</tbody>
</table>

Conflict problems in CAL’s integrated model.

In effect, the operating system for integrated sea-air transport can be divided into three segments. The first segment consists of sea shipments from Xiamen to Kaohsiung, and includes forwarding, booking, delivery, consolidating, customs clearance, shipment, sailing, and application for sea-air transport customs clearance. The second segment consists of the transit process via the OSC in the Port of Kaohsiung, and includes ship arrival at Kaohsiung, unloading, unpacking and repacking, airport warehouse entry, weighing and measuring, issue of master airway bill, palletizing or loading into a ULD (Unit Load Device), and aircraft take off. The third segment consists of arrival at the destination, unloading, warehouse entry, import customs clearance, cargo delivery, and other matters (refer to Fig. 1).

Table 2. Comparison of freight quotations between different transport models.

<table>
<thead>
<tr>
<th>Transport mode</th>
<th>Shipping Route</th>
<th>Freight (NTD/Kilogram)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Xiamen to H.K./L.A.</td>
<td>110</td>
</tr>
<tr>
<td>Sea-air</td>
<td>Xiamen/Kao/L.A.</td>
<td>85</td>
</tr>
<tr>
<td>Sea</td>
<td>Xiamen/Kao/L.A.</td>
<td>3</td>
</tr>
</tbody>
</table>

Fig. 1. Sea-air transport business flow.

Furthermore, to compare the operating days of the different transport models, the fact that the price difference reaches 25 dollars/kilogram indicates that sea-air transport holds a competitive advantage compared with air transport (see Table 2).

Moreover, compared with the Xiamen to H.K. sea-air transport model, the Xiamen to Kaohsiung sea-air transport model has the following advantages:
Table 3. Comparison of operating days between different shipping routes.

<table>
<thead>
<tr>
<th></th>
<th>Lead time</th>
<th>Sea transport</th>
<th>Inland transport</th>
<th>Air transport</th>
<th>Total days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xiamen to H.K. air-air</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>Xiamen to H.K. inland-air</td>
<td>0.5</td>
<td>0</td>
<td>1</td>
<td>1.35</td>
<td>3</td>
</tr>
<tr>
<td>Xiamen to Kaohsiung by sea-air</td>
<td>1.5</td>
<td>0.5</td>
<td>0.5</td>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>Xiamen to H.K. by sea-air</td>
<td>1.5</td>
<td>1</td>
<td>0.5</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Xiamen to L.A. by sea transport</td>
<td>1.5</td>
<td>14</td>
<td>0.5</td>
<td>0</td>
<td>16</td>
</tr>
</tbody>
</table>

1. Compared with outbound cargo from Xiamen to H.K. by sea and H.K. to L.A. by air transport, employing the same model from Xiamen to Kaohsiung can save half a day of transport time, and the sea transport freight or air transport freight is cheaper than delivery of cargo to Hong Kong for transshipment.

2. Warehouse storage expenses and handling costs at Hong Kong International Airport are HKD 2.1 per kilo, but the same costs at Taiwan Taoyuan International Airport are only TWD 1.7 per kilo (approximately HKD 0.0425); airport costs in Taiwan are thus only one-sixth those in Hong Kong.

3. The combination of an airline with a shipping company and logistics service provider can achieve integrated supply chain synergy and decrease the logistic expenses at every stage, including booking space, sea transportation, storage, stevedoring and inland transportation.

4. As air freight costs in Taiwan are 5%-8% less than those in Hong Kong, transshipment through Taiwan can reduce logistic costs in an integrated transport model.

In summary, the Xiamen to Kaohsiung sea-air transport model has a time savings advantage compared with sea transport and a cost advantage compared with air transport. The sea-air transport model is therefore very attractive for shippers in Taiwan and Mainland China in the meantime of selecting traffic means.

III. REVIEW OF GREY PREDICTION MODEL

1. GM (1, 1) Model

The grey model (GM) is the foundation of the grey system. Grey system theory views random variables as grey variables within a certain range and employs grey processes that are related to time. This theory attempts to uncover concealed features from a pile of chaotic raw data and reveal internal patterns. Processed sequences are converted to differential equations to establish a GM. The following explains the model-building method proposed by Deng [3] and employing dynamic GM (1, 1) in the paper: [16, 17, 18] \( x^{(0)}(1), x^{(0)}(2), \ldots, x^{(0)}(n) \) is the original data sequence.

Which is converted to a first order AGO (accumulated generating operation): \( x^{(1)} = AGO \cdot x^{(0)} = (x^{(1)}(1), x^{(1)}(2), \ldots, x^{(1)}(n)) \) (1)

Where:

\[
\begin{align*}
  x^{(1)}(1) &= x^{(0)}(1) \\
  x^{(1)}(2) &= x^{(1)}(1) + x^{(0)}(2) \\
  &\vdots \\
  x^{(1)}(n) &= x^{(1)}(n-1) + x^{(0)}(n)
\end{align*}
\]

Using the mean value generating operation, we define the background value as:

\[
z^{(1)}(k) = 0.5 \times \left[ x^{(1)}(k) + x^{(1)}(k-1) \right], \quad k = 2, 3, \ldots, n \quad (2)
\]

The grey difference equation of GM (1, 1) is then defined as:

\[
x^{(0)}(k) + a z^{(1)}(k) = b \quad (3)
\]

Here \( a \) is referred to as the developing coefficient, and \( b \) as the grey input.

\[
\frac{dx^{(1)}(t)}{dt} + ax^{(1)}(t) = b
\]

we deform \( \frac{dx^{(1)}(t)}{dt} \) into \( x^{(1)}(k) - x^{(1)}(k-1) \) (4)

Means, \( \frac{dx^{(1)}(t)}{dt} \rightarrow x^{(1)}(k) - x^{(1)}(k-1) \)

Applying the inverse accumulated generating operation, \( x^{(1)}(k) - x^{(1)}(k-1) = x^{(0)}(k) \).

Therefore, \( \frac{dx^{(1)}(t)}{dt} \rightarrow x^{(1)}(k) - x^{(1)}(k-1) = x^{(0)}(k) \) (5)

And according to the definition of \( x^{(1)}(t) \) and based on (2), we know that \( x^{(1)}(t) = z^{(1)}(k) \) yields solutions for the development coefficient \( a \) and the grey input \( b \) via the least squared method.

\[
a = \frac{\sum_{k=2}^{n} z^{(1)}(k) \sum_{t=2}^{n} x^{(0)}(k) - (n-1) \sum_{t=2}^{n} z^{(1)}(k) x^{(0)}(k)}{(n-1) \sum_{t=2}^{n} z^{(1)}(k)^2 - \left( \sum_{t=2}^{n} z^{(1)}(k) \right)^2} \quad (6)
\]
We substitute these in the shadow equation to get the following equation:

\[ d\left(\frac{C(t)}{A(t)} - \frac{b}{a}\right) = -a \left(\frac{C(t)}{A(t)} - \frac{b}{a}\right) \]  

(8)

The solution of the shadow equation is then:

\[ \frac{C(t)}{A(t)} = \left(\frac{b}{a}\right) e^{at} + \frac{b}{a} \]  

(9)

By (9), we can now obtain a prediction for \(x_{(k+1)}\) as follows:

\[ \hat{x}_{(k+1)} = \left[ \frac{C_{(1)}}{A_{(1)}} - \frac{b}{a} \right] e^{ak} + \frac{b}{a} \]  

(10)

The prediction in (10) results from the first order AGO sequence. We now need to convert this to a prediction for the original sequence via the inverse accumulated generating operation. The result is shown in (11):

\[ x_{(k+1)} = x_{(1)} + \hat{x}_{(k+1)} - x_{(k)} \]

\[ = (1-e^{a}) \left[ \frac{C_{(1)}}{A_{(1)}} - \frac{b}{a} \right] e^{ak} \]  

(11)

2. Error Analysis

Using (11), we can make predictions concerning the system’s future development. After applying the foregoing developing and construction models, we need to further examine the accuracy level in order to understand errors between the predicted value and the actual value \(e(k)\). This paper uses the residual test and performs residual comparisons based on the actual and predicted values. The formula used is as follows:

\[ e(k) = \left| \frac{x_{(k)} - \hat{x}_{(k)}}{x_{(k)}} \right| \times 100\%, k = 2, 3, \ldots n \]  

(12)

The accuracy level is defined as 1-\(e(k)\). If the average accuracy level is greater than 90%, this means the grey prediction model has good prediction results.

Table 4. Sea-air transport cargo throughput forecasts.

<table>
<thead>
<tr>
<th>Units: tons</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual value</td>
<td>7942</td>
<td>8950</td>
<td>8783</td>
<td>4631</td>
<td>4296</td>
</tr>
<tr>
<td>Predicted value</td>
<td>7942</td>
<td>9479</td>
<td>7281</td>
<td>5593</td>
<td>4296</td>
</tr>
<tr>
<td>(e(k))%</td>
<td>0%</td>
<td>-5.91%</td>
<td>17.10%</td>
<td>-20.77%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Fig. 2. Sea-air transport cargo throughput trends.

IV. FUTURE PROSPECTS OF SEA-AIR TRANSPORT VIA THE KOSC

According to MOTC statistics, sea-air transport cargo volume via the Kaohsiung OSC has increased rapidly from 861 tons in 2001 to 8,950 tons in 2006. If we compare the actual figures with projections published by the government, however we find that average monthly exiting cargo volume was only 746 tons in 2006, and this figure lagged far behind the government’s original projection of 4,000 tons per month. The achievement ratio is therefore only 18.65%. In other words, a serious gap exists between reality and the expected results, and appropriate improvement measures must be determined to resolve this situation and ensure that the competitiveness of intermodal transport via Taiwan’s OSC does not weaken relative to other Asian ports in Hong Kong, Korea, and Singapore, etc.

The GPM yields a forecast that sea-air transport via the KOSC will continue to decrease from 7,942 tons in 2005 to 4,296 tons in 2009, and the global financial crisis at the end of 2008 will seriously curb sea-air transport cargo volume growth. In addition, for decreasing the prediction error, we used GM (1,1) rolling check to predict sea-air cargo volume in 2009, had tried rolling check by 4 years, 5 years and 6 years, their average error value showed 14.59%, 19.82% and 18.71% respectively, it’s obvious that rolling check by 4 years is better choice. As the average error value from 2005 to 2008 is 14.59% and the average accuracy level \(1-e(k)\) is 85.41%, which represents that the average accuracy level has nearly approached 90%.

Figure 2 shows that the sea-air transport growth tendency appears to be dropping gradually, the influential factors of declining tendency could be illustrated as: (1) due to the effect of the global financial crisis and world economic turndown in
the recent years, it results in not only freight gap between Sea-Air Transport and Air Transport via Taiwan becoming narrow, but also make Sea-Air Cargo volume sharply diminishing. (2) the direct air and sea navigation across Taiwan Strait agreement signed by the Mainland China and Taiwan governments could weaken the transit role of OSC as a special zone attracting transit cargoes from China. (3) Some shipping companies including Yang Ming Line have decided to use direct sailing in place of indirect sailing channel and reduce sailing frequency on the direct route via the KOSC, only a few ships are available to carry sea-air cargo, thus this has resulted in sea transport schedule management conflicts between Yang Ming Line and China Airlines.

The inherent disadvantage of intermodalism is that goods must come to a halt during the interchange between modes, and additional handling and time costs are incurred at the transfer point [9]. Obstacles to multimodal transport and logistics services can be grouped among the categories of infrastructure and technologies, security and safety, facilitation, legal aspects, and market access [13].

Wu suggested that issues arising from the fact that some commodities cannot be shipped by sea-air transport via Taiwan may complicate the process of customs clearance, documentation, and communications; this will increase the loss of time and total operating costs during the transit process, which implies that Taiwanese industries will be at a disadvantage relative to competing industries in Singapore and Hong Kong, etc.

From April to June 2007 this study interviewed with eight business managers (from China Airlines, EVA, Yang Ming Line, Wan Hai Line, Evergreen, Yes Logistics and other forwarders) in charge of sea-air transport affairs. These interviews revealed the obstacles to sea-air transport development summarized as follows:

1. Marketing of sea-air transport is currently dominated by airlines. Taiwanese airlines have set up offices in Xiamen to handle business matters associated with forwarding, consolidation, data filing, document issuance, cargo tracking, and direct billing. However, compared with major forwarders’ consolidation ability, airline marketing is still insufficient to attract much cargo.

2. Technical problems hamper data interchange and connection between the marine transport and air transport customs clearance systems. Data entered in the marine transport customs clearance system cannot be transferred to the air transport customs clearance system, and must be manually re-entered. This entails higher labor costs and more operating time.

3. Air freight flights from Kaohsiung International Airport are very limited and only China Airlines, Dragonair, and Japan Asia Airway offer inter-Asia regional service from the airport. Transit cargo headed to the US or EU must be transported by truck to Taiwan Taoyuan International Airport (formerly CKS International Airport).

4. To prevent the smuggling of illegal goods into the country, Taiwanese customs clearance regulations formerly required that transit cargo be delivered by bonded truck or transported under customs officer custody. This increased transport costs and consumed more time during the transit process.

5. Custom offices do not provide 24-hour service. Clearance work will be postponed to the next day if the offices have closed for the day. If leasing information can be transmitted by the custom authorities, export cargos may be palletizing or loaded on ULDs in preparation for loading on aircraft.

6. Truck transport of cargo from Kaohsiung to Taipei International Airport takes an average of five to six hours, and traffic jams, accidents, and vehicle breakdowns can result in serious time delays and missed flights. This is an especially serious problem for logistics service providers specializing in “just in time” deliveries.

7. Since sea-air shipping rates are cheaper than pure air freight or value-added freight rates, sea-air service is often sacrificed by being dropped from airline boarding lists. Sea-air cargo is sometimes kept waiting for aircraft space and may be stored for more than one week.

8. Direct shipping across the Taiwan Strait has been permitted for Taiwanese-flag and Chinese-flag ships to navigate since a direct sea-transport agreement came to effect at the end of 2008; direct shipping modal seems to replace an indirect transport model on the perspective of logistic time saving and cost down for intermodal service providers or carriers, and the specific functions of KOSC could be disappeared in the near future.

V. CONCLUSIONS

Many problems concerning the offshore shipping center sea-air transport model remain to be resolved. These include antagonism between the governments of Taiwan and China, need to liberalize OSC regulations, imperfect links between sea and air customs clearance systems, complex transit procedures, soaring logistics costs, need to diversify sale and marketing channels, and uncertain transit time, etc.

The greater the degree of integration across a supply chain, the better a shipping firm performs [15]. Integrated functions play an important role in global supply chains, especially since inter-organizational business processes and information technology has become more complicated, and transaction costs have increased due to different corporate cultures and the computerization of heterogeneous operations. Although transit time through Taiwan’s OSC should ideally be only one or two days, there are currently many sources of delay, such as vehicle breakdown on the road, ship schedule delays due to severe weather, and incomplete customs clearance data and document applications, etc.

Airlines play a pre-eminent role in organizing overall transfer procedures, which include shipment forwarding, consolidation, booking space, packing, loading on board, seaway
bill issuance, unloading, unpacking, inspection, sorting, distribution, customs clearance, road transport, palletizing, loading on an aircraft, and so on. Since there are many parties involved in transshipment, including forwarders, third party logistics firms, shipping companies, warehouse operators, logistics center operators, customs brokers, and airlines, inter-organizational communications have become more complex and transaction costs have increased, but marginal revenue is squeezed due to intense competition. Shortages of resources have encouraged carriers to form partnerships in order to meet minimum customer expectations and maintain a competitive edge in intermodal services [12]. If the concept is properly marketed and transshipment hubs continue improve their operational and port/airport customs interfaces [11], sea-air intermodal transport should continue to thrive in the future.

The government of Taiwan should consult with the logistics industry in formulating appropriate improvement measures to resolve these issues, develop state-of-the-art multimodal transportation facilities, and provide seamless integration of various modes of transport and supply chains. Especially in the case of international trade and logistics activities across the Taiwan Strait, if the governments of both Taiwan and China can hold formal meetings in order to eliminate obstacles and further open markets, this will help Taiwan become an important global supply chain hub and a gateway for foreign companies seeking to do business in the Greater Chinese Economic Zone.

REFERENCES