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Evaluation of shipping finished automotive in multimodal containers : a marketing plan for shipping company

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EVALUATION OF SHIPPING FINISHED AUTOMOTIVE IN MULTIMODAL CONTAINERS

A Marketing Plan for Shipping Company

By

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

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DECLARATION

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

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

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(* Insert names only here)

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ABSTRACT

Title of Dissertation: **Evaluation of Shipping Finished Automotive in Multimodal Containers – A Marketing Plan for Shipping Company**

Degree: **MSc**

Shipping finished automotive by container is a relatively new way compared with the traditional RORO modal of car shipping. However this sector has been growing fast in recent years. The dissertation is a study of the container modal of automobile shipping, aiming at finding out the reason behind such a trend and evaluating its competitiveness as a niche method to the dominant RORO modal of car shipping.

The existing research in the field of containerized car shipping is limited. In order to find out the supportive factors to the growth of container car shipping, the trend in global seaborne car trade, which is the driving force of auto shipping, is investigated. Additionally, a comparative analysis of the two shipping modals is carried out from various aspects, aiming at identifying the strengths of the container modal.

Most importantly, a cost-benefit analysis is made from the perspectives of both carmaker and container line through case studies on the Asia-Europe trade. One the one hand, the competitiveness of container modal to RORO modal in terms of total logistic cost is examined, by converting both the explicit and intangible costs into monetary units for comparison. On the other hand, the benefit from investing in container car shipping service is also evaluated in order to examine the feasibility of launching the service from the view point of a shipping line. Based on the results, it is anticipated that the container modal is more competitive among emerging markets than traditional East-West trade lanes.

In the final part of the research, a marketing plan with selected target market and marketing strategy is suggested to the China Shipping Group to launch the container car shipping service. Furthermore, the concluding chapter looks into the future car shipping market and anticipates the role container shipping may play, recommending a time table with action plan to the China Shipping Group.

KEYWORDS: Automotive, Container, RORO, Seaborne Car Trade, Total Logistic Cost

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List of Abbreviations

BTO	Build to Order
BTS	Build to Stock
CEEMEA	Central/Eastern Europe, Middle East and Africa
CEU	Car Equivalent Unit
CKD	Completely Knock-Down
CMP	Copenhagen Malmo Port
CSCL	China Shipping Container Lines Co., Ltd
CSL	China Shipping Logistics Co., Ltd
EB	East Bound
FEFC	Far East Freight Conference
IMF	International Monetary Fund
IRR	Internal Rate of Return
LOLO	Lift-on Lift-off
NOR	Non-Operational Refrigerated container
NPV	Net Present Value
OEM	Original Equipment Manufacturer
OTD	Order to Delivery
PCC	Pure Car Carrier
PCTC	Pure Car and Truck Carrier
PDI	Pre-Delivery Inspection
POD	Port of Discharging
POL	Port of Loading
RORO	Roll-on Roll-off
TEU	Twenty-Foot Equivalent Unit
THC	Terminal Handling Charge
VDC	Vehicle Distribution Center
VSC	Vehicle Storage Center
WB	West Bound

1. Introduction

1.1 Background

The global seaborne automotive trade is generally served by a specialized fleet of Pure Car Carriers (PCCs). These ships are designed to carry vehicles such as cars, trucks and trailers, with in-built ramps enabling vehicles to drive on and off the ships with their own powers. The Pure Car Carrier category also includes PCTCs (Pure Car and Truck Carriers), which are typically characterized by higher and strengthened decks to enable the transportation of high and heavy vehicle cargo.

The PCC was originated from the RORO (Roll-on and Roll-off) vessel, which came into existence before the 2nd World War for sending war machines. Until the 1950s it was adopted for commercial purposes for short sea car shipping between European countries. Due to its efficiency in cargo operations and economy in port expenses, it was quickly deployed on deep sea routes by ocean carriers. Soon the Scandinavian shipping companies took the lead and built the first PCC to carry commodity cars exclusively for car makers (Bohme, 1989). Later Japanese car manufacturers massively introduced them to ship their fast growing car exports to the western markets. Today the RORO is the dominant way of finished automotive shipping, especially in new car transport, where it shares almost nothing with other modes of shipping.

Containers were invented by McLean in the 1950s. Since then the new modal of shipping started to change the world. It replaced the traditional way of handling break bulk cargo by securing the barrels and cases into standardized metal containers. For the last half of the century, container shipping altered the landscape of the global economy and the way people live. According to Bohlman (2001), container shipping reduced the transit time by 84% and the costs by 35%. Goods are increasingly containerized for international transport. Apart from manufactured goods, more and more commodities (such as coffee) as well as refrigerated cargo (fruit, meat, fish) are today largely transported in standardized sea containers. Take refrigerated cargo as an example, there used to be hot debates on whether it would be massively converted to containerization in the 1980s, when a specialized reefer fleet was carrying 70% of its total volume. However, today the share of containers is 70% instead (Mohlin, 2014). By 2001, more than 90% of world trade in non-bulk goods was transported in ISO containers. Today the figure must be even bigger.

However, in finished automobile shipping, container shipping only plays a minor role. Despite carrying a huge volume of car parts and CKDs (Completely Knock-Downs), normally containers are only used to ship secondhand cars and a negligible share of new cars. Today more than 8 million secondhand cars are shipped in containers every year, plus 0.15 million classic racing cars, some of which are the most expensive vehicles in the world. New cars from OEMs (Original Equipment Manufacturers) shipped by containers only total up to 0.7 million per annum, but the volume is growing fast (Donaldson, 2014).

The highlights of containerized car shipping can be summarized as fast, flexible and secured, sending vehicles from door to door. It is obviously attractive to those expensive and low volume outliers. Tesla, for instance, moves all vehicles in containers from its US factory to global destinations (Donaldson, 2014). Lotus was an early converter to Trans-Rak's racking system for container shipping (Min & Jianhua, 2007). Premium carmaker Bentley Motors, too, makes use of containers to reach particular markets from the UK. During 2009 the company shipped around 20% of its output by container (Malcolm, 2010). BMW uses containers to specific markets where RORO services are not competitive because of the small volumes involved. The company's usage of containers is stable and they are currently shipping less than 1% of their total outbound volumes via containers. Jaguar Land Rover (JLR) is also a small user of containers to ship vehicles, dispatching 1.1% of its total production by this method to 19 markets (Cross, 2012). Volvo Cars, too, has used containers to ship to small and emerging markets. Even some low-end car producers like Chinese BYD, which has exported vehicles since 2006, also relies on containerization via CMA CGM to reach markets such as Africa, South America and the Middle East.

1.2 Objectives and Structure of the Research

Today shipping finished new vehicles by multimodal containers, though still marginal, is more common than before, and tends to be accepted by more carmakers in particular trades. Under such circumstances, this research is aiming to find out the reasons behind the growing trend of containerized car shipping, evaluate the attractiveness of container modal in certain trade and suggest a marketing plan to a shipping company to launch container car shipping services.

This paper is composed of seven chapters. Chapter 1 is the introduction of current finished vehicle shipping market, pointing out the growing trend in container shipping out of the traditional RORO shipping. Existing studies and literatures relative to the topic are reviewed in Chapter 2, and their contributions and limitations are summarized for the sake of supporting and differentiating this research. Chapter 3 is dedicated in finding out the driving force behind the increase in container car shipping from its determining level - global car trade pattern. It also helps demonstrate the positive trend in container modal from the aspect of market demand. In Chapter 4 the strengths of container shipping are analyzed in contrast with RORO shipping. In Chapter 5 two case studies are launched from the perspectives of both service user and provider, to discuss the competitiveness of container modal to a carmaker in terms of total logistic cost in a particular trade lane, and to evaluate the investment in container car shipping services for a shipping line. Then a marketing plan is suggested in Chapter 6 to the China Shipping Group. Finally the conclusion and recommendation is made in Chapter 7.

2. Literature Review

2.1 Review of Existing Research

Finished automotive shipping, which belongs to the outbound part of automotive logistics, has been studied by many scholars and experts. However the research related to container modal is limited.

Some Japanese researchers have studied the feasibility of shipping cars in containers, based on the purpose of carrying these containers still on PCCs, naming such kind of automotive shipping as LOLO(lift on lift off)-PCC. The study compared the cost of transporting a car in RORO and LOLO-PCC methods, from the period it leaves the factory to being loaded onto the vessel. It also examined the technical feasibility in terms of displacement, stability and resistance of the ship when loaded with car containers. One of the important conclusions of this study is in proving the economy of scale of stuffing several cars into one container (Tsutomu Momoki, 2011). However, the feasibility of loading a PCC with a big volume of containers is fairly low. PCC is originally designed for loading vehicles rolling on and off under their own power. In order to carry more vehicles, the height of each deck story is tailored to be just enough for a worker to drive a vehicle in and out of the vessel. If carrying containers on board massively, there probably needs to be a large number of forklifts to load and discharge the containers. Obviously its productivity and efficiency in cargo handling is not comparable with container ships. As to the cost comparison between RORO and LOLO-PCC, it focused on labor cost, covering only the period from leaving the factory to loading on board, while the costs such as ocean freight rate, storage, inland carriage were not discussed. Therefore, the study was insufficient. Furthermore, the study is based on the suggested 45-foot aluminum containers that can carry 4 to 6 cars inside, which is a kind of special equipment when compared with the ISO ones. So there will be extra costs for shipping lines or car makers to build this type of special container. As the utilization may be limited to car shipping only, it is far less economical than using general purpose containers. If its benefits cannot offset the costs, it is difficult for either party to invest in the new equipment.

Others contributed their knowledge in the part of inland car transport by using containers. For example, Tan Miller launched a case study on the best way to transport finished cars within North America. The study implemented a mixed integer programming type model to determine the best mix of truck, conventional rail and containerized intermodal rail in vehicle distribution. At the same time, it evaluated both short-term and long-term improvement by shifting the mode from conventional rail to containerized intermodal transport. In certain lanes, the whole system cost could be saved by 1% immediately, and transit time reduced by 0.5 day. In the long run, the container intermodal transport indicated a reduction in total operating costs by up to 6% and total transit time by about 15% (TAN, 1996). However, the study only focused on the inland part of automobile distribution. When it comes to ocean transport, there is no investigation done to discuss the possibility in cost and time saving by using intermodal containers. According to Tan Miller (1996), car manufacturers have great interest in potential transit time saving in order to reduce OTD (Order to Delivery) time, and they are also looking forward to some improvement in achieving damage free transport. Therefore, further study on ocean shipping is necessary in order to find out if the container mode can meet the carmakers' need to reduce lead time and damage rate in a cost efficient way.

Tao Zeng (2013) established a model and a genetic algorithm to help decision making in allocating commodity cars among various modes of transportation. The study has some practical significance in reality. Given a certain transportation requirement with route and volume, the model can calculate according to the transport cost, transit time and capacity constraints under different modes of transport. As a result, it provides an optimal volume allocation among road, railway and waterway transport, aiming at minimizing the total logistic cost (ZENG, HU, & HUANG, 2013). The study illustrates a clear picture of automotive logistics procedure – how the new cars are moved from the plant to the dealer. It also emphasizes the important role shipping plays in the automotive outbound logistics. However, this paper is merely based on the conventional RORO modal, and there is no specific study the on container side. The result of this study can be used as benchmarks to examine the efficiency and competitiveness of container shipping.

Matthias Holweg and Joe Miemczyk (2003), based on findings of the 3DayCar research program, launched a case study of inbound, outbound auto logistics and sea transport operations in the UK market. It provided an in-depth knowledge of current auto logistics processes and problems. The paper not only analyzed the motivation of the transition of vehicle supply from forecast driven to customer driven, but also discussed the new requirements and challenges facing the logistic service providers (Matthias & Joe, 2003). The study called for a rethinking of automotive logistic operation towards BTO (Build to Order), which is believed to be the way of car production in the future. According to some insiders, sooner or later, automotive production will definitely go onto the track of BTO, as it is just a matter of time (Junsong, 2009). Thus, with the understanding of the role shipping plays in automotive outbound logistics and what the industry expects from shipping service providers, we can better evaluate the characteristics of container shipping and its potential benefits to the auto industry.

2.2 Methodology Used in This Dissertation

The evaluation of shipping finished vehicles in containers includes both qualitative and quantitative parts. The qualitative part is mainly in analyzing the strengths of the container modal over the RORO modal, using the comparative analytical method

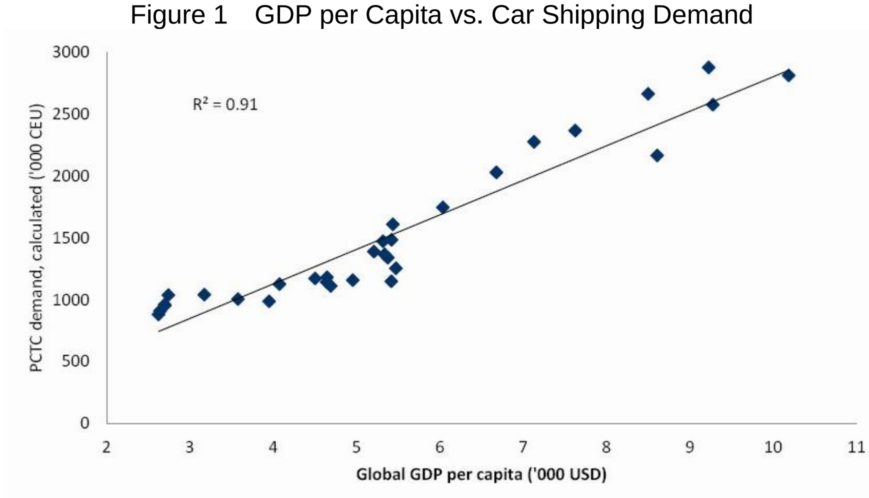
(Collier, 1993), and with the support of industrial data. The quantitative part mainly lies in the cost-benefit analysis (Cellini & Kee, 2010) and comparison of the two transport modes. In order to better find out the difference in total cost, case studies are launched on the Asia-Europe trade lane from the perspectives of both logistic service user and provider. The cases are supported by empirical studies and real data from the practical business world.

3. Global Seaborne Automotive Trade

3.1 World Economy

The world economy has a significant impact on the automotive industry. It is proved that GDP per capita has a positive correlation with car seaborne transport demand (Figure 1). The global financial crisis directly led to the collapse in demand in late 2008. After 5 years of slow recovery, a cautious optimistic outlook towards the world economy in the coming years is generally expressed by those international economic institutions. According to the World Bank (2014), an actual annual world GDP growth of 3.2% can be witnessed in 2014, increased by 0.8% on top of the figure in 2013. IMF (2014) also forecasts that the world economy will further strengthen in 2014 and 2015, following the trend of late 2013.

Figure 1 GDP per Capita vs. Car Shipping Demand



Source: RS Platou Economic Research

These forecasts are mainly based on the sign of the strengthening of the US economy and the gradual recovery in Europe. Moreover, the stable development of emerging economies, such as China, India and Brazil, also contribute to confidence in the future (Table 1). However, they also point out that the prospect of growth still remains fragile, due to the uncertainty of keeping up the economy stimulus in major countries, and the volatility in world financial and capital markets.

Table 1 Real GDP Growths in Major Economies
(% change previous period)

		2012	2013	2014(f)	2015(f)
Global Economy		3.2	3.0	3.4	3.7
USA		2.8	1.9	2.8	2.7
EURO Area		-0.6	-0.5	0.5	1.1
UK		0.3	1.9	2.5	2.2
Japan		1.9	1.8	1.3	1.1
Emerging Markets		4.9	4.8	5.0	5.3
Asia ex Japan		6.2	6.1	6.0	6.4
	China	7.7	7.7	7.2	7.4
	India	5.1	4.7	5.1	6.0
Latin America		2.9	2.7	2.9	3.0
	Brazil	1.0	2.3	1.9	1.5
	Mexico	3.8	1.3	3.3	4.0
CEEMEA		2.7	2.2	3.2	3.6
	Russia	3.4	1.5	2.6	2.6
	S.Africa	2.5	1.8	2.8	3.5
	Nigeria	6.5	6.8	7.8	7.5

CEEMEA = Central/Eastern Europe, Middle East and Africa

Source: Morgan Stanley (2014)

3.2 Global Automotive Industry

The global automotive industry on the contrary is also a leading driver of global economic growth. The industry's yearly growth rate is expected to exceed 5.5% from 2010 to 2015, reaching a value of more than $5.1 trillion by 2015 (MarketLine, 2012). It is also a leading employer throughout the world. According to the International Organization of Motor Vehicle Manufacturers, the industry provides 9 million jobs in direct vehicle production, representing 5% of the world manufacturing jobs, and another 50 million jobs in the area indirectly related to the auto industry. To the individual country, it is a key sector of the economy in terms of revenue. For example, in the United States, the automotive market contributed to approximately 4% of the country's GDP in 2010 (FranchiseHelp, 2014). It is also estimated that the manufacture of vehicles contributes more than $430 billion to the governments of 26 countries combined.

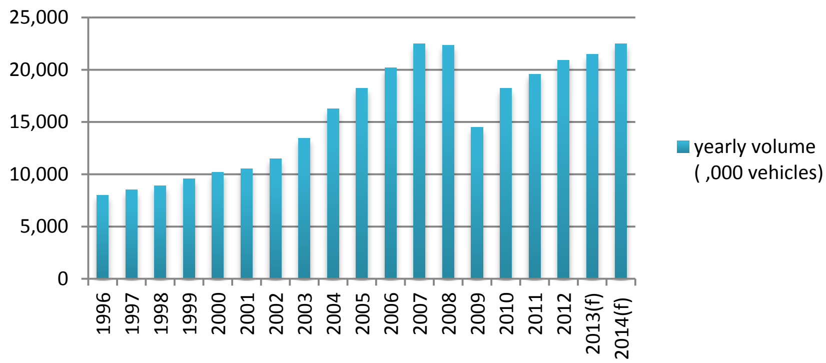
3.3 Overview of Global Seaborne Automotive Trade

The world economy growth has been dragging the development of the global automotive industry for the last decades, continuously driving the demand for seaborne transport of vehicles from the manufacturing centers to the final consuming markets.

3.3.1 Trade volume evolution

Global seaborne car trade volume grew by 179% from 1996 to 2007, at an average pace of 9.8% per year. It peaked at 22.4 million vehicles in 2007, and then was hit severely by the economic crisis in 2009, dropping by 35%. A gradual recovery has been witnessed since 2010. However, until last year, the volume, expecting to rise to 21.5 million, was still below the record of 2007 (Clarkson Research Services, 2013). Fortunately, there is huge probability that the global car trade in 2014 is projected to increase by 5%, which is likely to reach another historical high (Figure 2).

Figure 2 Global Automotive Seaborne Trade



Source: Customs Data, Industry Sources, November 2013.

3.3.2 Global seaborne automotive exports

The Far East to North America and Europe are the largest two routes of the seaborne car trade. The biggest exporters on these routes, Japan and South Korea, have been keeping their leading position for decades. In 2012 their export together accounted for 40% of the global seaborne car trade, although it had already been reduced from a 53% share in 2003 (Coia, 2013).

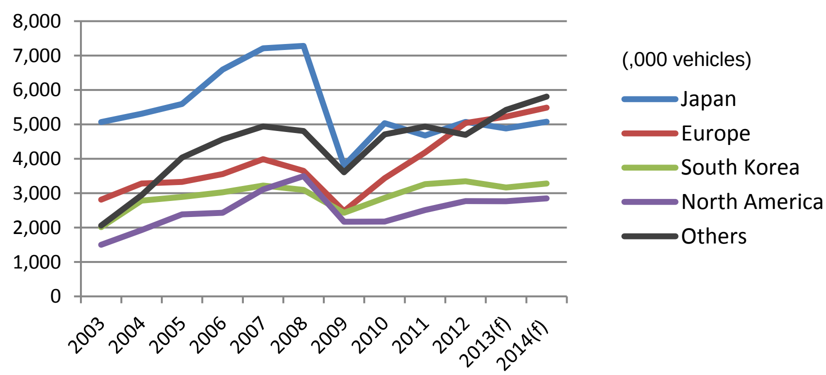
Japan is historically a key player in the seaborne car trade. Before the crisis, it exported nearly 7.3 million cars in 2008, accounting for 1/3 of the global volume. However, in 2009 its export volume shrank dramatically by nearly 50%, mainly due to the weak demand from major importing countries. Since then Japan's seaborne car export remained at relatively suppressed levels.

Unlike Japan, South Korea's export increased steadily in the recent 10 years. Despite the shock from global recession, its seaborne car export volume already surpassed the level before 2008, to 3.3 million cars in 2012. Among its export destinations, US is the biggest overseas market, and about 25% of the total seaborne car exports are shipped to North

America (Clarkson Research Services, 2013).

The European export performance in the most recent 5 years was quite outstanding compared with other major exporters. It recovered from 2.5 million cars in 2009 to 5.2 million cars in 2013, at an average growth rate of 20% per year. This is mainly attributed to the increasing demand from China, as well as the strengthening of the US market. Also the US itself is a significant auto exporter representing 9% of the global seaborne car trade, but its trade flows are much more diversified and in smaller quantity (Figure 3).

Figure 3 Global Seaborne Car Exports



Source: Customs Data, Industry Sources, November 2013.

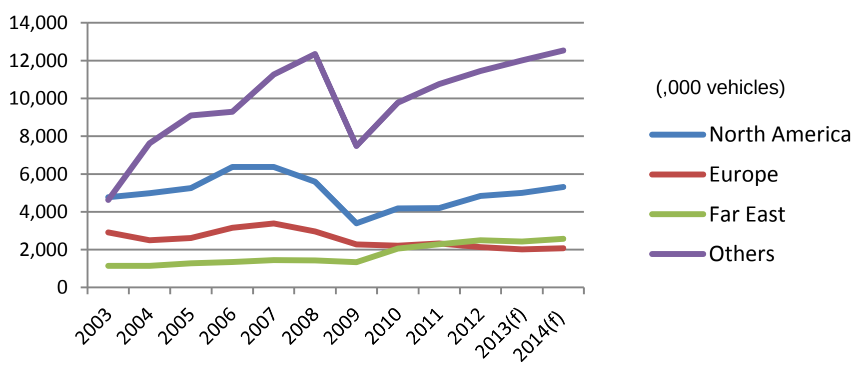
3.3.3 Global seaborne automotive imports

Likewise, North America and Europe are the two major auto import regions in the world. The US alone imported totally around 20% of the world car trade by sea in the last decade. While Europe's import volume (European internal trade excluded) is significantly lower than that of the US, and it is recently surpassed by the Far East. So far the import volume into both North America and Europe still remains below their levels before the crisis.

Due to the huge share of the US in the global seaborne car trade, the change of demand in the US market had a significant impact on the total trade volumes. The US auto import peaked at 4.5 million cars in 2006, and stayed more or less stable before the collapse to 2.5 million in 2009. After that it picked up gradually, but at a relatively slow speed. Japan is the largest supplier of US auto import, accounting for around 50% of the whole US import by sea. The US's slow recovery in demand is also one of the main factors that results in the suppressed exports from Japan.

The European seaborne car import was surpassed by that to the Far East for the first time in 2012. In that year, the Far East imported 2.5 million cars while the volume to Europe dropped by 9% to 2.1 million. According to Clarkson's research, the share of Japanese and Korean cars in European imports was decreasing in these years, from 48% in 2007 to 38% in 2012, while countries in the Far East, as well as other emerging regions, are importing more than ever before (Figure 4).

Figure 4 Global Seaborne Car Imports



Source: Customs Data, Industry Sources, November 2013.

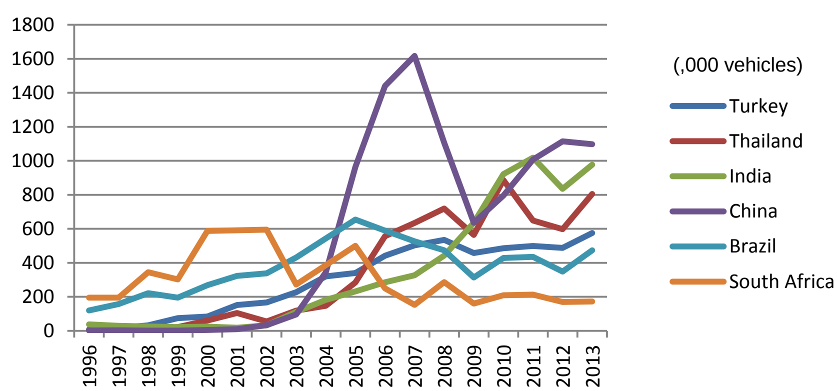
3.4 Trend in Global Seaborne Automotive Trade

Generally there is a positive trend in the growth of the global seaborne automotive trade. However, the trade flow and structure has begun to change in recent years.

3.4.1 Increasing share of emerging countries

As the shares of most traditional trading countries are shrinking, the roles played by other countries, especially by emerging economies, are becoming increasingly important. Countries like China, India, Thailand and Turkey have experienced strong growth in car export in the last decade (Figure 5). For example, China's export volume has grown by 1044% to 1.1 million since 2003, now representing 5% of global seaborne car exports. During the same period, exports from India and Thailand have also increased dramatically by 772% and 576% respectively.

Figure 5 Seaborne Car Exports from Emerging Countries

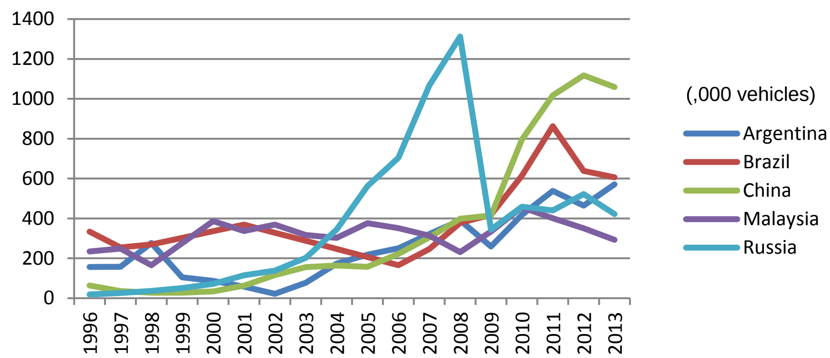


Source: Clarkson Research Services.

On the import side, shares of countries other than North America and Europe rose from 43% in 2003 to 67% in 2013, in which China's share increased from 1.2% to 4.9%, and

Brazil and Argentina together achieved 5.5% from 2.7% (Figure 6). Despite the recession starting from 2008, shipments to developing countries in Asia have increased by 70%, and to Brazil and Argentina combined have grown by 53% (Crowe, 2013).

Figure 6 Seaborne Car Import to Emerging Countries



Source: Clarkson Research Services

3.4.2 Local production and local consumption

Besides the booming demand in developing countries, their increase in the share of global seaborne car trade is actually one of the results from the application of local production and local consumption strategy by major auto producers.

Production will be further broadly scattered in emerging countries out of traditional auto manufacturing centers such as Japan and South Korea. For example, Japanese auto manufacturers are pushing aggressively to localize their productions in overseas markets, such as Mexico, US and Southeast Asia, in order to overcome the disadvantages such as natural disasters in Japan, volatility in currency exchange rate, long OTD time and slow response to the change in the local market.

To be more specific, Nissan opened its third plant in Mexico at the end of 2013.Toyota also planned to expand its capacity in the US and Canada. Further, both Honda and Mazda are scheduled to open new factories in Q1 2014 (Coia, 2013). The movement of assembly factories from South Korea to Eastern Europe and North America has been witnessed as well. More European productions are also expected to shift from the Euro zone or South Africa to their final overseas markets (Ludwig, Williams, & Apostolides, 2013).

3.4.3 Influence in automotive shipping

According to the trend of global seaborne vehicle trade, traditional long leg trade from Japan, South Korea to North America and Europe is expected to be slightly reduced. However, it is projected that a significant increase in the number of new routes into and out of emerging economies will occur, as well as a boom in volume generated by intra-regional trades.

In such circumstances, more diversified and frequent shipping services will be called for in order to satisfy the needs of the seaborne car trade between more fragmented markets. Therefore, these changes may distract the volume of current deep sea shipping. Meanwhile, short sea and regional shipping could gain benefits and new deep sea routes may even be created.

In the near future, higher frequency of shipment, smaller volume each time and more diversified port pairs will probably be the new characteristics of automotive shipping.

3.5 Opportunity Identification for Container Shipping

Traditionally finished automotive is shipped by Pure Car Carriers. As the trend of the global automotive trade alters, this conventional way of shipping may face some challenges, but it could be an opportunity for container shipping.

Those emerging car markets will lessen the traffic of traditional East/West deep sea routes, which the huge PCC was originally invented for. They are in the regions where PCC services may not have been well covered. While for container shipping lines, especially those leading companies in the world, they have already established much more comprehensive service networks, covering diversified markets worldwide. The larger number of service and higher sailing frequency of container shipping can be both attractive and available to meet the demand of these emerging markets.

Besides the merits that match the trend of automotive shipping, the container mode now also appears to be a good alternative solution for car shipping in terms of cost efficiency. With the rapid development of containerization in past decades, the cost to transport a container now is much lower than before. The economies of scale of mega container ships, ever increasing numbers of large and specialized terminals and widely adopted handling facilities, all enable the decrease in transport costs of container shipping more than ever before.

4. Comparative Analysis on RORO and Container Shipping

4.1 Competition Environment

Unlike the perfect competition in tramp shipping, the competition in both the car carrier and container shipping market are incomplete. The difference is that the car carrier shipping market supply is even more consolidated and monopolized by fewer but bigger players than in container shipping.

Access to the market of seaborne car transport is subject to economic and political obstacles. As a result, only relatively few companies are engaged in this operation. Leading operators of specialized auto carriers can be divided into three groups. The first group is Scandinavian carriers, including Wallenius Wilhelmsen Logistics and Höegh Autoliners. The second is the Japanese group, including Mitsui-O.S.K. Lines, Nippon Yusen Kaisha, and Kawasaki Kisen Kaisha. The third is South Korean Hyundai Glovis and Eukor (Clarkson Research Services, 2013). As of January 2014, the top five operators combined (including sister companies and subsidiaries) deployed a fleet of 501 vessels, with a total capacity of 2,693,000 CEU, accounting for 73% of the global fleet (Table 2). Usually the shipping companies are closely tied up with car producers, because the vast majority of the seaborne car traffic is shipped against annual agreement, and the high degree of specialization of the ships requires long term contracts to guarantee utilization. Moreover, the ships are often financed by major carmakers, by which method the carmakers can have better long-term control of their shipment. The most distinct example of such close ties is Japan, in which way its car carrier fleet grew rapidly in recent decades. To the shipping companies, space utilization is locked at high levels and they can sell the rest allocation for better profit. To the carmakers, their interests are protected and they can stay more competitive than their rivals in the shipping section by guaranteed service at low costs.

Table 2 Market Share of Top 5 Car Carrier Operators

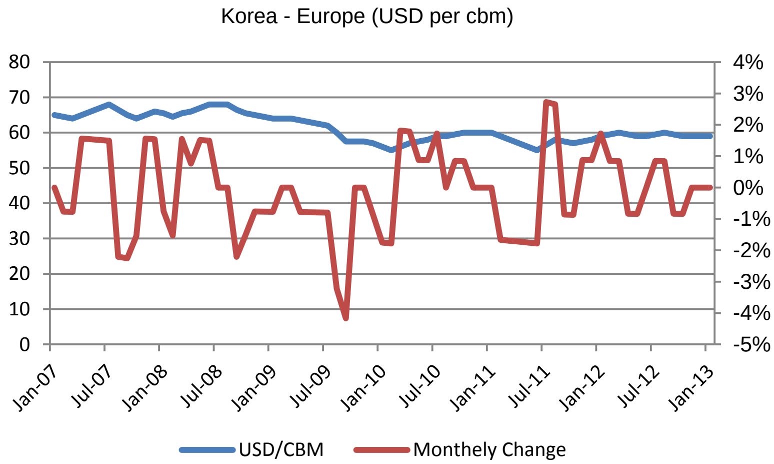
No	Carrier	Operated Fleet		Order Book	
		Number of Ship	Capacity (1,000 CEU)	Number of Ship	Capacity (1,000 CEU)
1	WWL	126	820	10	76
2	MOL	124	625	1	6
3	NYK	121	591	4	28
4	K Line	85	391	10	74
5	Hoegh Auto	45	264	10	77
Total Top 5		501	2691	35	261
World Fleet		776	3679	67	469
Share Top 5		65%	73%	52%	56%

Note: Data of Jan 2014

Source: Dynamar

Since the new entrants are kept out of the market by close partnerships and long term contracts, the dominant players enjoy a monopolized market. One piece of evidence was that the freight rate of car carrier shipping market did not plunge as other shipping sectors in recent years. Take the Korea-Europe route as an example; despite the slump in car sales in 2009, the ocean freight rate has been keeping stable around USD60/cubic meter since the beginning of 2007 (Figure 7) (Dixon, 2013). This means for a middle sized car like the Sonata the freight rate is about USD750/car. Interestingly, in 2000 the car carrier freight rate of the similar route from Japan to the UK was around USD700 as well (Matthias & Joe, 2003). The stable rate was not a coincidence, but likely to be the result of oligopoly. That is why a number of big car carrier operators were involved in an antitrust probe in late 2012. They were inspected by authorities such as Japan Fair Trade Commission, European Commission and Federal Maritime Commission. Some of the carriers confirmed that they have received preliminary rulings that suggested they were involved in unfair trade practices.

Figure 7 Car Carrier Freight Rate



Source: Drewry Supply Chain Advisors

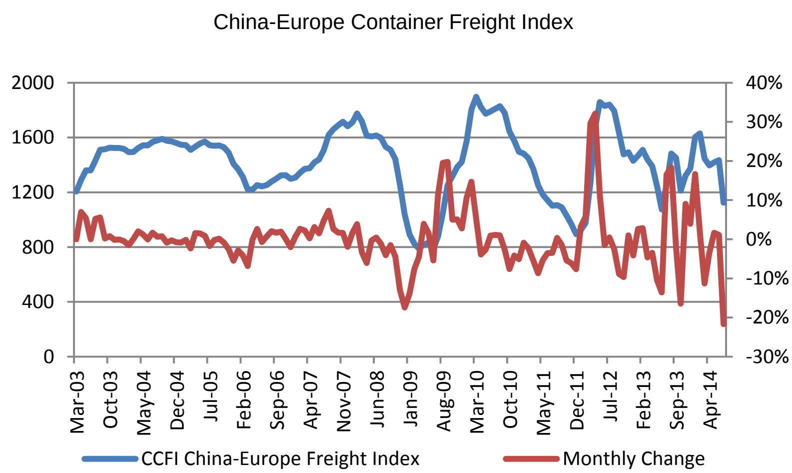
By contrast, the market consolidation in container shipping is less significant and the competition is much fiercer. First of all, the number of the container shipping lines is much bigger and the fleet under their control is less concentrated. The combined fleet of the largest 10 shipping lines in the world only accounts for 64% of the global total (Table 3), and nearly all the top 20 shipping lines can provide global services. Secondly, the container shipping market is highly volatile and the average freight rate was struggling around breakeven level even after the crisis. One of the reasons was the weak demand and over supply that pushed the carriers to fight for every single box to fill their empty slots. Other factors such as the termination of FEFC (Far East Freight Conference) also caused the volatility of the freight market in Far East-Europe trade (Figure 8). According to Dynamar's study, in the past five years, shipping lines lost an average 16 US dollars per TEU carried (Hailey, 2014).

Table 3 Market Share of Top 10 Container Shipping Lines

No	Carrier	Operated Fleet		Order Book	
		Number of Ship	Capacity (1,000 TEU)	Number of Ship	Capacity (1,000 TEU)
1	Maersk	574	2717	13	219
2	MSC	498	2482	37	429
3	CMA CGM	430	1583	39	371
4	Evergreen	191	887	20	246
5	COSCON	96	785	7	74
6	Hapag-Lloyd	65	765	0	0
7	CSCL	75	649	8	125
8	Hanjin	35	603	8	70
9	APL	49	568	1	9
10	MOL	33	567	14	115
Total Top 10		2046	11606	147	1658
World Fleet		4976	18220	489	3601
Share Top 10		41%	64%	30%	46%

Note: Data of Jul 2014
Source: Alphaliner

Figure 8 Volatility of Container Freight Market



Source: Shanghai Shipping Exchange

As a result of the continuous sluggishness, shipping lines are speeding up their paces to form alliances in order to improve the utilization and lower the cost. Although P3 was banned, Maersk and MSC formed 2M just weeks after the unexpected decision from the Chinese authorities; The CKYH alliance was strengthened by absorbing Evergreen; G6 will expand their cooperation to the US trade. Other top single players are also expected to team up in certain form to cope with the uncertainty in the future market.

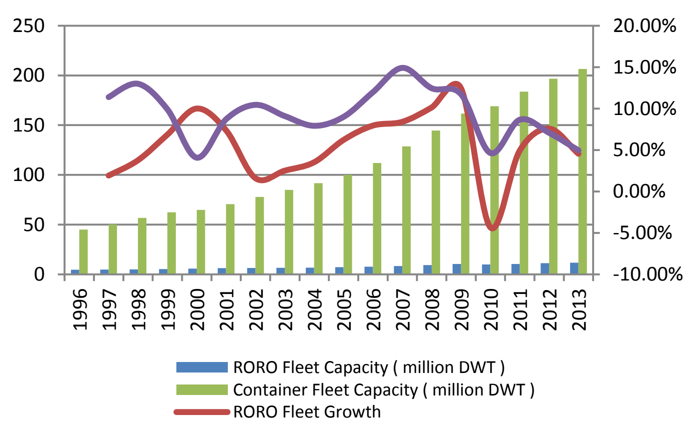
Therefore, in the competitive container shipping market, especially when it is over supplied, the shipping lines are trying by all means to lower the running costs and increase the service quality in order to stay competitive. Car makers may take the advantage to start or increase the share of container shipping for their outbound distribution, as they can enjoy better service at cheaper prices.

4.2 Fleet Development

4.2.1 Current fleet

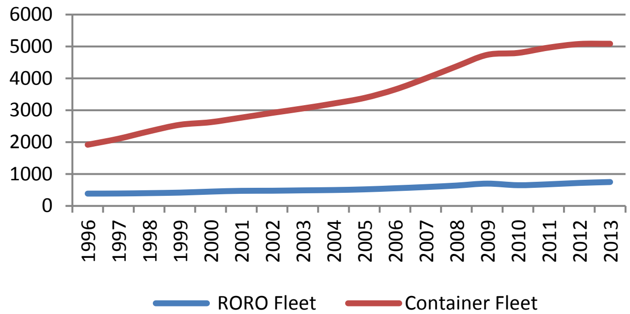
Both PCC and the container fleet experienced fast expansion together with the boom in trade volume in recent decades, but the container fleet is growing at an even faster pace. In addition, due to the difference in target market and service function, the scale of the container fleet is incomparable with the PCC fleet in terms of both capacity (Figure 9) and number of ships (Figure 10).

Figure 9 Fleet Capacity Comparison



Source: Clarkson Research Services.

Figure 10 Vessel Number Comparison



Source: Clarkson Research Services.

By the end of 2013, the global PCC fleet, including ROROs, totaled 756 vessels with a combined capacity of 3.7 million CEUs (Car Equivalent Units), increasing by 180% compared with the figure in 1996. Since 2003, the global PCC fleet has been growing in line with the development rate of the global seaborne vehicle trade, at an average pace of 7% per year (Clarkson Research Services, 2013).

The global container fleet numbered 5082 ships with a nominal capacity of 17.1 million TEUs (Twenty-Foot Equivalent Units) at the beginning of 2014, expanding by 480% on top of the capacity in 1996. During the last decade, the container fleet capacity increased averagely 10% every year, while the yearly growth of the global container trade was only 7% (Drewry Maritime Research, 2014 Q1). Especially since the crisis, the over-supply in the container shipping market has resulted in low ocean freight rate and fierce competition.

4.2.2 Fleet forecast

The growth rate of the PCC fleet slowed down again in 2013 after climbing out from the recession in 2009. The shrinking order book, postpoment in deliveries and scrapping of the old small-sized tonnage contributed to the slowdown, and it is expected to remain soft in the short-term before 2016 (Table 4). However, the global seaborne car trade is projected to increase by 5% in 2014 (Clarkson Research Services, 2013). Therefore, some imbalance in supply and demand in the PCC shipping market can be experienced in the coming years.

Table 4 Fleet Capacity Forecast

	PCC Fleet		Container Fleet	
	(,000 CEU)	Growth	(,000 TEU)	Growth
2014	3671	1.6%	18103	5.7%
2015	3753	2.2%	19310	6.7%
2016	3917	4.4%	20222	4.7%

Source: Drewry Maritime Research

Unlike the PCC fleet, the container fleet capacity will keep increasing steadily in the foreseeable future. Although the growth rate cooled down after the crisis to a historically low level, new order books now, especially for ultra large vessels, have been keeping placed for the sake of a potential recovery of the market. Hence, the annual growth rate still remains at around 6%. However, demand has not picked up as expected. According to Drewry (2014), the world container traffic is estimated to grow by 4.2% and 5.0% in 2014 and 2015 respectively. Thus, the over-supply situation in the container shipping market is not likely to be improved completely in the near future.

4.3 Economy of Scale

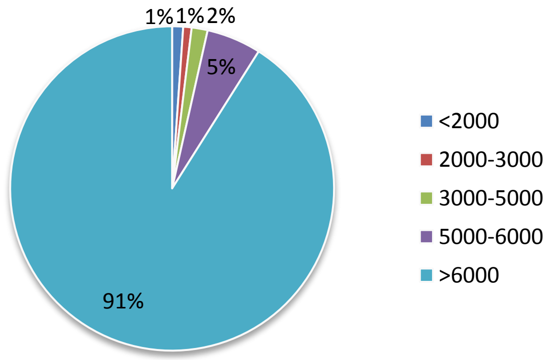
4.3.1 Ship size upgrade

There is the same trend in both the PCC and container fleet where the capacity development is highly focused on ships of large sizes to achieve the economies of scale.

PCCs with capacity over 6000CEU account for nearly 60% of the current fleet, and 91% of the capacity in the order book (Figure 11). Almost all the new deliveries in the coming years are large vessels to be deployed on deep sea routes. Despite the motivation to achieve further economies of scale, another reason can be the widening of the Panama Canal that will allow large-sized PCCs up to 8500CEU to pass in 2016.

Figure 11 PCC Order Book by Size

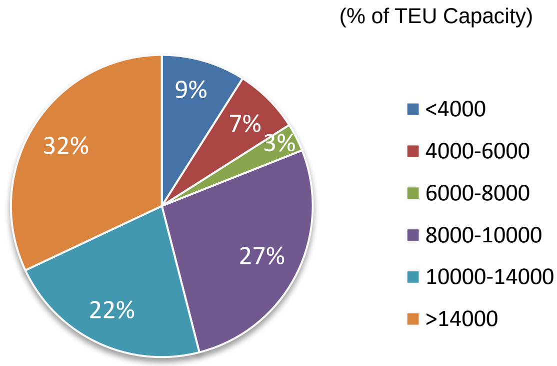
(% of CEU Capacity)



Source: Clarkson Research Services.

As to the container fleet, the concentration on mega ships is not as significant as the PCC fleet, but it is still remarkable. According to Drewry, in January 2014, the total capacity of ships over 12,000TEU accounted for 12% of the global container fleet, while they only stood for 3% of the total ship number. In the last five years, the ultra large vessel sector witnessed the highest growth by 42.5% in capacity, while the sector of vessels below 4000TEU has continued to shrink. Moreover, 54% of the capacity on the order book attributes to ships over 10000TEU, in which ships over 14000TEU account for 32% (Figure 12).

Figure 12 Container Ship Order Book by Size



Source: Drewry Maritime Research

4.3.2 Ship unit running cost

Although mega vessels can only be deployed on limited main routes, they are replacing the smaller vessels and pushing them on to other routes. Therefore, the average vessel size on all routes will increase as a result of this cascading effect, and the average unit cost is expected to be further reduced. Nowadays, in terms of car equivalent unit, the running cost, including capital cost, operating cost and voyage cost (Malcom Willingale V.Group, 2014) of a mega container ship tends to be lower than that of a large PCTC.

Firstly, the large container ship is more competitive in unit capital cost. Assuming 60% of the car traffic fits for the 'two cars into one TEU' style, each TEU can load averagely 1.4 cars (Chen, 2014). In such circumstances the unit new building price of the current largest 18000TEU container ship is 30% lower than that of the biggest 8500CEU car carrier (Table 5). Taking into account the repayment of loan principal, interest and depreciation, the capital cost of one car carrying unit is still expected to be lower in the container mode.

Table 5 Unit New Building Price Comparison

Vessel Type	Capacity	New Building Price/Ship (Million USD)	New Building Price/Unit (Thousand USD)	New Building Price/Car unit (Thousand USD)
PCTC	6500 CEU	60	9.23	9.23
PCTC	8500 CEU	70	8.24	8.24
Container	13000 TEU	110	8.64	6.04
Container	18000 TEU	140	7.78	5.56

Note: *1. Assumption: 60% of the vehicle can fit into 1TEU with 2 cars*
2. New building price of Sep 2013

Source: *Clarkson Research Services*

Secondly, a container ship has no disadvantage in unit operating cost and voyage cost (bunker cost usually accounts for 60% of the voyage cost). Taking the bunker price as USD630/ton, the cost of a car carrying unit per day of different vessel size can be estimated as below (Table 6). For a 4000CEU PCTC or an 8000TEU container ship, the difference in cost is very slim. For an 8500CEU PCTC, the cost is estimated to be similar to a 14000TEU container ship. Therefore container ships of capacity over 14000TEU benefit from the economy of scale more than even the largest PCTC in the world.

Table 6 Vessel Unit Operating and Voyage Cost Comparison

Vessel Type	Capacity	Operating Cost (USD/day)	Bunker Consumption (ton/day)	Bunker Price (USD/ton)	Cost (USD/Unit/day)	Cost (USD/CarUnit/day)
PCTC	2000CEU	5000	30	630	5.98	5.98
PCTC	4000CEU	6000	40	630	3.90	3.90
PCTC	6500 CEU	8000	48	630	2.94	2.94
PCTC	8500 CEU	9500	54	630	2.56	2.56
Container	4500TEU	10000	100	630	7.30	5.21
Container	8000TEU	13000	120	630	5.54	3.96
Container	13000 TEU	14500	133	630	3.78	2.70
Container	18000 TEU	18000	121	630	2.62	1.87

Note: *1. Ship operating costs include manning, insurance, stores/lubes, R&M, and admin*
2. Capital cost, diesel cost, port cost, canal passage excluded
3. Assumption: 60% of the vehicle can fit into 1TEU with 2 cars

Source: *Based on Drewry Maritime Research / Clarkson Research Services / Lloyds list*

In the meantime, the bunker price turns out to be crucial to the advantage in the unit running cost of container ships. As the PCC consumes much less fuel than a container counter party, if the bunker price decreases, the advantage of a container ship will diminish quickly. However, the time of high fuel cost is still expected to continue in the foreseeable future. Moreover, on routes where there is more limitation on the vessel size, the advantage of a mega container ship is quite slim (Drewry, 2013-35). For example, in transpacific and transatlantic trade, where a 9000TEU ship is the maximum to be accepted by some of the US ports while a 8500CEU PCTC can be served there without much difficulty, a conventional car carrier is still efficient in terms of the unit running cost.

4.4 Service Coverage and Frequency

Generally car carriers are also operated in the manner of liner shipping, with fixed ports of call, transit time and sailing frequency. However, the intensiveness of sailing frequency, the length of transit time and the range of service coverage of RORO shipping is far less comprehensive than container shipping.

For example, it is common in the market that car carrier lines operate fortnightly services even in major deep-sea routes. Weekly sailing is considered to be high frequency. The frequency of selected services of the top 6 car carrier companies is relatively low (Table 7), while they represent nearly all deep sea capacity supply and more than 75% of the total market share. Transpacific has the highest number of sailings where every week there are around 5 to 6 sailings from the Far East to North America. The Far East-Europe and Transatlantic is less frequently served, with about 4 sailings per week respectively in the market. However in the container shipping market, the number of sailings per week on these major deep sea routes is up to 7 times of that of the car carrier market (Table 8).

Container shipping also proves to be faster than car carrier service. Generally the longer the sailing distance, the more time saving can be achieved by container shipping. For instance, transit time from the last POL (Port of Loading) in Far East to the first POD (Port of Discharging) in Europe is about 21 days via Maersk AE10 service (Table 8), while it takes 26 days via NYK car carrier service (Table 7). The saving is also evident in transpacific trade, but in transatlantic trade is difference is only 1 day.

Table 7 Frequency & Transit Time of Major East-West Car Carrier Services

	Far East/Europe		Transpacific		Transatlantic	
Carrier	No.of Service / Month	Transit Time (Days)	No.of Service / Month	Transit Time (Days)	No.of Service / Month	Transit Time (Days)
WWL(incl.Eukor)	8~10		12~12		4	
MOL	2				4	
NYK	2~3	26			4~6	10
K Line			4	28	4	10
Höegh	3	36	2	25	2	11
Hyundai Glovis	2		5~8			

Note: Slot chartering services could be included in the number of services
Source: Carriers' official websites

Table 8 Frequency & Transit Time of Major East-West Container Services

	Number of Weekly Services	Average Vessel Size (TEU)	Transit Time (Days)
Far East/Europe			
Far East/North Europe	22	11,229	21 (AE10)
Far East/Mediterranean	15	8,156	
Total	37	10,024	
Transpacific			
Far East/USWC	42	6,726	11 (TP5)
Far East/USEC - Panama	13	4,554	
Far East/USEC - Suez	6	7,067	22 (TP3)
Total	61	6,218	
Transatlantic			
Europe/North Atlantic	7	4,547	10 (TA2)
Europe/US Gulf & Mex	6	4,068	
Europe/Montreal(Canada)	3	3,570	
Total	16	4,254	

Note: Transit time is based on Maersk Services
Source: Drewry Maritime Research / Maersk

Moreover, container shipping is more extensive in service coverage than RORO shipping, providing a wider range of destination possibilities for the seaborne car trade. The high Liner Shipping Connectivity Index (the index captures how well countries are connected to global shipping networks) of traditional car trade ports in developed countries enables the shift of auto shipping to the container mode (The World Bank, 2014). In emerging countries container service accessibility is also increasing fast. It provides the opportunity for container lines to share the pie of the fast growing car trade into and out of these new markets (Table 9). By contrast, car carrier services do not cover those secondary ports as well as container services. Since the total number of PCCs in the world is only 15% of that of the container fleet, it is impossible to deploy as many car carrier loops as container ones. Even if there is a RORO service connection in some smaller ports, the schedule tends to be more flexible than the container service, because the car carrier company may sometimes skip calling due to the limited cargo volume.

Table 9 Liner Shipping Connectivity of Major Car Trade Countries

Index (Maximum 2004=100)

Traditional Origins and Destinations	2004	2009	2014
Korea, Republic of	69	87	108
United States	83	82	95
Netherlands	79	89	94
Germany	77	84	94
United Kingdom	82	85	88
Belgium	73	83	81
Japan	69	66	62
Emerging Origins and Destinations			
China	100	132	165
Malaysia	63	81	104
Turkey	26	32	52
India	34	41	46
Thailand	31	37	45
Brazil	26	31	42
Mexico	25	32	40
South Africa	23	32	38
Argentina	20	26	38

Russian Federation	12	21	38

Source: UNCTAD STAT

4.5 Cargo Handling Technology

The cargo handling technology in the two logistic systems is totally different. In the RORO system, vehicles depend on their own power to drive on and off any kind of transport carriers, while in the container mode cars are loaded and sealed into sea containers and moved as any other ordinary multimodal ones.

Usually when the new cars come off from the production line, they are loaded on to the specialized truck trailer to a VDC/VSC (Vehicle Distribution/Storage Center). These are usually near the plants, because the factory often has limited space to store a huge volume of new cars. These trailers' capacity varies from 6 to 18 cars. The gang of the loading and unloading operation is composed of 2 or 3 workers, including 1 new car driver, 1 lasher and 1 truck driver. The average time to load a trailer of 11 cars is 113 minutes (Matthias Holweg; Joe Miemczyk; Geoff Williams , 2001), about 10 minutes for each car, and the unloading is usually faster. When it comes to loading a PCTC, usually a gang of 20 to 30 stevedores, according to the capacity of the ship, is sent by shuttle van to the yard, from where they drive the new cars one by one onto the ship via its self-equipped ramp. After parking the cars at the assigned positions, they are sent back by the van to the yard to pick up another lot. At the same time the other gang of lashers will fasten the cars tight down on the ground in the vessel. After the new cars are discharged at the destination port, they are will be either stored in the terminal parking lot or transferred by truck or train to another distribution center or directly to the dealers.

As to using containers to ship automobiles, the number of cars to be accommodated into a box is the basic factor deciding if the solution is economically feasible or not. In order to load more vehicles in one container, in the past a common way is to build up wooden racks inside the container to separate the inner space and support several cars at the same time. The problem is the fairly low reliability of the wood and high cost of building such disposable racks. Now there is some revolutionary equipment in the industry, such as the collapsible or removable car racks systems that can accommodate up to 6 cars in one 40 foot high cube container.

According to the practice of CSCL (China Shipping Container Line), which has been using a special collapsible car rack system to ship new cars for some car makers in the China domestic trade (Figure 13), the loading process requires 4 to 5 workers, including 1 container tractor driver,1 new car driver, 1 forklift driver and 1 or 2 lashers. The test in the initial stage shows that it took about 40 minutes to load four cars into a 40-foot high cube box, and 35 minutes for unloading, which was not much slower than loading the truck trailer in the RORO manner. Another type of removable car rack designed by Trans-Rak takes only 35 minutes to load 5 small cars in one 40 footer and 20 minutes to unload (Min & Jianhua, 2007), and it needs no machinery to help with the cargo handling. This type of car rack can be installed manually into a container of any size (Figure 14). Comparatively it saves one forklift driver, spares more space for vehicles of bigger dimension and increases the efficiency in operation. By raising and securing the vehicles up to the roof space, the system maximizes the number of cars to be loaded into one container. The distance between poles and the angle of rising can be flexibly adjusted according to specific dimension of the vehicles. The racks can also be packed up into small pods for repositioning, and a 40-foot container can load up to 65 pods of these racks (TRANS-RAK International).

Figure 13 Revolutionary Car Rack System 1

Source: China Shipping Container Line

Figure 14 Revolutionary Car Rack System 2

Source: Trans-Rak International

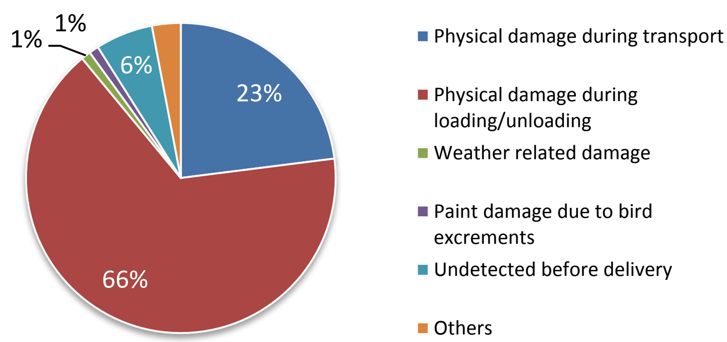
4.6 Safety and Security

Safety and security is another important aspect concerned in finished automotive logistics. The industry aims at delivering the right car, damage-free to the right place, at the right time. However, in the conventional RORO system, new cars are not protected as other packed products during transportation. The open carriage can result in damage or even theft due to weak operation awareness and poor risk management standards.

Damage to the new vehicles happens for many reasons, but one of the main areas that damage occurs is when the vehicle is being handled, driven on and off the various modes of transport, or into and out of storage compounds (Figure 15). For example, a new Volvo car is driven by at least 17 persons from it getting off the production line in

Gothenburg until delivery to an overseas dealer (Mao S. , 2003). The risk of damage is high due to the high frequency of handling. When the buyer eventually receives the vehicle, the new car is no longer new. Other causes include adverse weather, e.g., hail; airborne contamination from industrial fallout; salt water from the sea; small stones carried by strong winds; excrements and scratches from birds (Larsson, 2014).

Figure 15 Causes of Damage during Transportation



Source: 3DayCar Logistics Study

The damage and theft rate varies among territories. Sevatas (2013), the leader in the provision of risk management, claims and damage reduction solutions in Europe, points out that although logistics service providers have been training their staff to raise the awareness of damage prevention, the average level of damage in Europe is still nearly 3%. It costs up to 200 million euros every year, including insurance and administration to reduce such incidents (Sevatas, 2013). In the UK, the damage rate is around 2.5% per year, and the average repair cost is about GBP 180 per car damaged (Matthias & Joe, 2003). Moreover, in a UK dealer with an annual sales volume of 400 cars, the insurance cost for its stock is GBP 125 per new car sale (Holweg, Matthias; Jones, Professor Daniel T., 2001). In the US the ratio is claimed to be lower. While in the emerging countries, safety and security is a big issue. For example, Mexico railways spend about $2.5 million per month on security (Ludwig, Williams, & Apostolides, 2013); Theft rate remains at a high level on the northbound from South Africa; In India damage has been a problem difficult to reduce (Malcolm, 2010).

During the period of ocean shipping, the damage levels vary between 0.2% and 3.5%, mainly due to vehicle movement on rough seas, and during loading and unloading (Matthias Holweg; Joe Miemczyk; Geoff Williams , 2001). Sometimes not all the damage is transport related, since they might also refer to damage not detected before loading on board the ship. Actually the financial cost of the damage itself is not a big deal, but the time wasted in damage inspection between transport modal conversion (a standard PDI for one car takes about 4.6 minutes) (Rahman, T.C.Melewar, & Sharif, 2014), and the extra time it takes for maintenance and repair will lead to failure in on-time delivery, harming the reputation of the car producer.

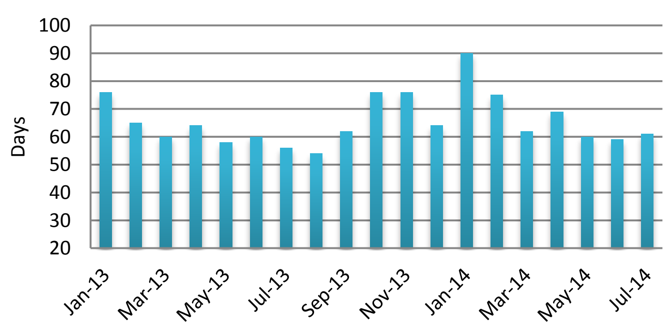
If using containers to ship new cars, the problem of safety and security can be solved to a great extent. The container not only provides the shelter for new cars, but also eliminates the movement of them throughout the period of transport. It enables the logistic service providers to achieve quality handling and damage-free delivery. According to the statistics from CSCL, the damage rate of its containerized car shipping service in the China domestic market is only 0.01%. Richard Cox, CEO of KTI (Kar Tainer International), a company supplying cassette-based systems, also says that one of their car manufacturer customers reported a damage rate reduction from 5% in the RORO system to 0.02% in their KTI system over a three-year period (Cross, 2012). Therefore, containerization provides a safe and secure way of car shipping that can deliver the new cars in their factory conditions to the customer.

5.1 BTS and BTO

BTS (Build to Stock) and BTO (Build to Order) are the two common production approaches in the automotive industry. However they leads to different structures and levels of cost in the completed automotive logistics.

BTS originated from mass production after the industrial revolution. Generally it is still the dominant way of auto production in the world. Products are built according to the sales forecast and historical demand. In such a manner, carmakers can achieve economies of scale through mass production. As long as there is stock in the compounds, new cars can be delivered to the receivers as fast as transport be can achieved. However, this is accomplished at the expense of a high inventory level and huge amount of capital tied up. Take the US as an example, at the end of January 2014, the US light vehicle inventory totaled 3.61 million units, 90 days' supply, which amounted to about 50 billion USD being tied up (Stoddard, 2014). On average, the inventory level of light vehicles in the US has been maintained at 65 days in last two years (Figure 16). Besides the high inventory holding cost, usually the stock will also end up being sold at massive discounts.

Figure 16 U.S. Light Vehicle Days' Supply



Source: WardsAuto

On the contrary, BTO is the approach to produce according to customers' specific requirements. In other words, there is no action until an order comes in and triggers the production process for one specific product assigned to the customer. Actually it is the oldest way of order fulfillment, but for a long time it has been employed mainly for high end, low volume products. For example, it is unlikely to find a Lamborghini built according to a sales forecast.

The fact is that the industry is moving more towards the BTO approach even for common models. A dozen years ago, the BTO level in major markets was relatively low (Table 10), but today some major carmakers' BTO volume has climbed up to 60% (Wheatley, 2013). However, the strategy adopted varies among different carmakers. Take Japanese producers for example. Toyota and Nissan are the piorneers in BTO strategy, already starting the transition decades ago, while Honda and Subaru produce all their vehicles to forecast. The transformation to BTO can improve efficiency and performance especially in areas where build to forecast has its major deficiencies, such as high inventory carrying cost and the slow response to volatile demand from the market.

Table 10 Sales Sourcing in Major Markets 2000

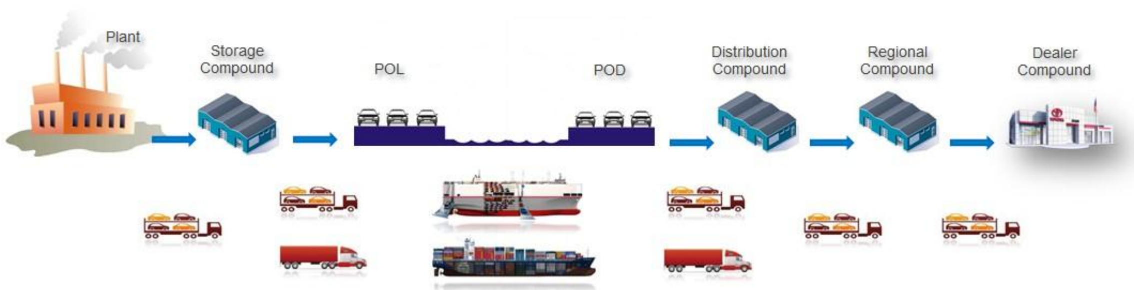
Sales source	Europe	UK	Germany	US	Japan (Toyota)
Cars built to customer order (BTO) (%)	48	32	62	6	60
Sales from central stock (distribution centers) or transfer between dealers (BTS) (%)	14	51	8	5	6
Sales from dealer stock (BTS) (%)	38	17	30	89	34

Source: (Holweg, 2008)

A different production and sales approach will lead to a different outbound logistic process (Figure 17 and Figure18). In the conventional BTS system, after new cars leave the plant, they tend to be stored in the compounds up to months waiting for the buyer. Up to 20% of vehicles have to be transferred between distribution centers (Matthias Holweg; Joe Miemczyk; Geoff Williams , 2001), and around 15% of the stock in VDC will be further shipped to regional compounds (Matthias & Joe, 2003). In the BTO system, the new cars tend to reach the receivers as soon as possible after leaving the plant. Nowadays, most carmakers apply a hybrid production mode, consisting of both BTS for quick delivery of basic models and BTO for customizing for more sophisticated demand.

Figure 17 Finished Automotive Logistics Flow Chart under BTS

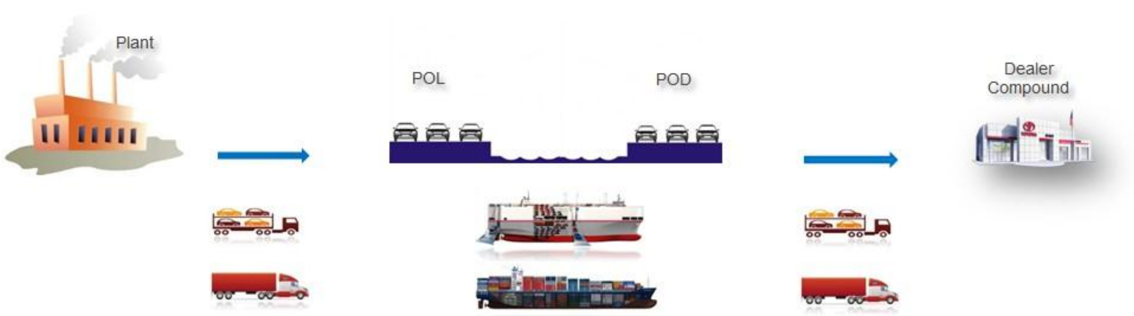
(when there is sea leg)



Source: based on information from APL logistics and CSCL

Figure 18 Finished Automotive Logistics Flow Chart under BTO

(when there is sea leg)



Source: APL logistics

5.2 Cost Analysis from Car Maker's Perspective

5.2.1 Objectives

In this section, a case study is made for Hyundai Motor on the Korea-Belgium trade lane, focusing on the cost comparison of RORO and container modal under both BTS and BTO production approaches. The cost breakdowns are examined and the factors affecting the total logistic cost, such as car value and export volume, are discussed.

Hyundai Motor Group is the 5th largest car manufacturers in the world. Despite the shrinking of the total world sales during the recession, it has been growing steadily in terms of global new car sales market share, rising from 6% in 2007 to 9% projected in 2014 (Seung-heon, 2014).

Hyundai Motors' main production facility is located in Ulsan Korea, 50km north of Pusan. It is the largest single automobile plant in the world with a daily production capacity of 6000 vehicles for both domestic and overseas markets. Belgium is the gateway of the continent for new car trade. The traffic was traditionally via Antwerp and now more and more through Zeebrugge, together making Belgium a distribution hub of European market. Another reason to choose this route is that both Korea and Belgium enjoy a high level of liner shipping connectivity, making the opting from RORO to container logistics more realistically feasible. Although today the Ulsan plant only contributes partly to Hyundai's total exports to Europe, as a typical Asia–Europe route, it is worth studying and the result can be instructive to other routes as well.

5.2.2 Evaluation premises

- Total Logistics Cost = Order Cost + Inventory Carrying Cost (Ma, 2014)
  Order Cost mainly refers to Transportation Cost.

Inventory Carrying Cost includes Capital Cost, Warehousing Cost (Storage), Inventory Service Cost (Insurance) and Inventory Risk Cost (Security).

This case study will convert the above costs into monetary units and sum up under both RORO and Container modal for comparison (Table 11).

- PCTC transit time: 42 days, based on Eukor schedule. There is only one sailing from Ulsan to Belgium per week in the market.

  Container ship transit time: 33 days, based on Hanjin schedule. There is service once every two days from Pusan to Belgium in the market.
- Car trailer average speed: 30km/h; Container truck average speed: 40km/h
- Distance between Ulsan plant and Ulsan car terminal: 10km

  Distance between Ulsan plant and Pusan container terminal: 50km

  Distance between port of Antwerp/Zeebrugge and final dealer compound: 200km
- Average storage time in Belgium under BTS: 3 weeks
- Annual export volume: 100,000 cars
- In the BTS approach, the container modal only applies during the ocean shipping period. Since new cars tend to be stocked for months waiting for firm orders, it is not feasible to store with the containers and car racks tied up. They need to be transferred to the RORO modal. Otherwise the cost tends to be very high.
- In the BTO approach, the container modal provides a door-to-door service from the plant to the dealer's compound.

Table 11 Cost Items in Automotive Outbound Logistics

Cost Items			Rate (in USD)	
			Korea	Belgium
Order Cost	Transportation Cost	Trucking rate /car/km (12 cars trailer)	0.8	1
		Trucking rate /car/km (40'HC with 4 cars)	1.5	1.8
		Trailer loading or unloading rate per car	3	4
		Container loading or unloading rate per car	10	12
		Car terminal handling charge per car	10	14
		Container terminal handling charge per 40'HC	140	215
		PCTC Ocean Freight Rate per Car	700	
		Container Ocean Freight Rate per 40'HC	2000	
Inventory Carrying Cost	Warehousing Cost	Compound storage cost per car	1	1
		Car terminal storage rate after 7 days free / car	1.5	1.5
		Container terminal storage rate after 7 days free / 40'HC	10	10
	Capital Cost	Capital Cost	0.1	
	Inventory Risk Cost	RORO Security Cost /car/day	0.8	
		Container Security Cost /40'HC/day	2	
	Inventory Service Cost	RORO Insurance Cost /car/day	1.8	
		Container Insurance Cost /40'HC/day	4	

Source: based on statistics from Anji, CSCL, Hyundai,3DayCar Study, (Zhang, 2005), (Jovanovic, 2014), (Chen, 2014)

5.2.3 Evaluation results

- The total transportation cost in RORO system is lower than container system.
  Though the ocean freight rates of both modes are supposed to be the same, the container THC (Terminal Handling Charge) is higher than RORO HTC. Also inland transport by means of container is more costly than the RORO modal. The result shows that the trucking cost, including loading and unloading cost, RORO is USD 103 cheaper than container under BTS, and USD 224 cheaper under BTO. The main reason is that the car trailer, usually carrying 12 cars, achieves a better scale economy than a container truck. Especially in BTO, it can still benefit from the current RORO inland transport system, while to container modal, the longer distance a container truck travels, the more expensive it is than a car trailer.

- Capital cost in the container system is lower.

Due to the shorter transit time and higher sailing frequency of container line services, the total lead time is shorter when there is a container leg involved; so it helps lower the capital cost.

- Storage cost is the same

  As it is always converted to the form of RORO when it comes to storage in the compounds, and with the same assumed storage time, the cost is the same under both transport styles.

- Inventory risk cost and inventory service cost are lower in the container mode.

  The cost mainly includes security and insurance expenses. The container provides the shelter for new cars loaded inside and eliminates their move during transportation, so that there requires less investment in risk prevention and insurance.

- Car Value vs. Total Logistic Cost

  In the BTS approach, it is cheaper to ship cars of value higher than USD 25,000 by RORO+Container style (Figure 19). While in the BTO approach, it is cheaper to ship cars of value no lower than USD 54,000 by containers (Figure 20). However, Hyundai cars global average selling price is only USD 15,000 (Hyundai Motor, 2012), which means the major market of Hyundai is mid/low end market. Therefore, under the above premises, when considering the minimum total logistic cost, there is not much traffic economically suitable for container shipping.

Figure 19 Car Value vs. Total Logistic Cost under BTS (USD/car)

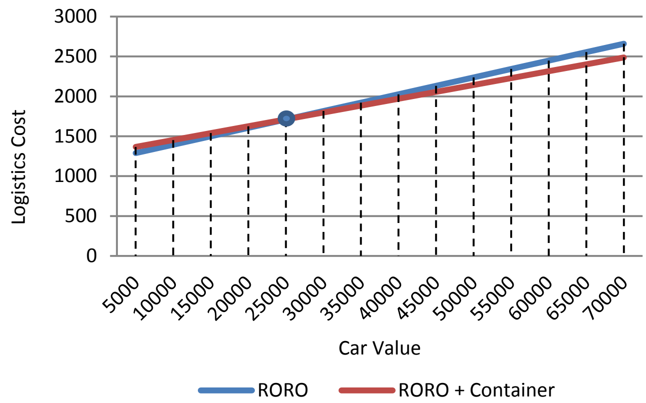
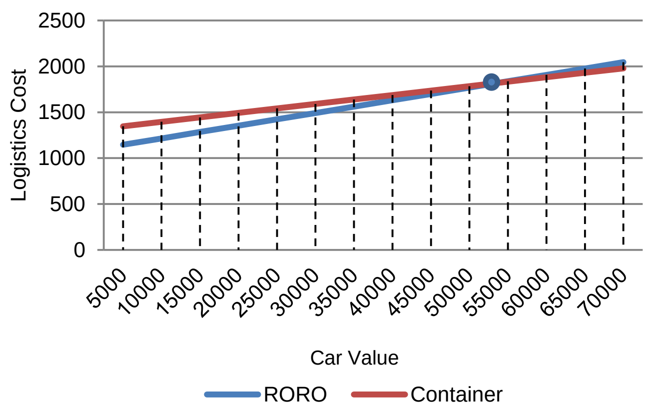


Figure 20 Car Value vs. Total Logistic Cost under BTO (USD/car)



- Export Volume vs. Total Logistic Cost

Bigger shipping volume lowers the total logistic cost per car. As bigger volume means stronger negotiation power, for example if the annual export increases to 200,000 cars, the car maker tends to obtain discounted rates in almost every aspect of the logistic chain, including ocean shipping, trucking and storage, regardless of shipping mode. Therefore the unit cost decreases against bigger volume, but the turning point of transport mode opting will not be affected significantly. However, it is not easy for container lines to accommodate huge volumes in one lot, e.g., a 1,000 cars shipment in a volume of more than 500TEU from one single POL. It will cause huge pressure on space allocation especially during peak seasons, as the space might have to be reserved for other shippers.

5.2.4 Summary

From the perspective of Hyundai Motor, although the container mode shortens the lead time, considering the total logistics cost it is less competitive than the RORO modal in either BTS or BTO. This is mainly due to the high inland trucking cost resulting from the lower scale economy level. If the container trucking cost is difficult to reduce, the container ocean freight rate pricing could be vital to its competitiveness in total cost. On the other hand, there is no doubt that cars of high value and strict lead time requirements are more suitable for container shipping, because the inventory holding cost of those cars are so high that they are extremely sensitive to the length of transit time. Moreover, if taking the customer waiting cost into account, yet difficult to quantify, the result of the container modal is believed to be improved.

5.3 Cost Analysis from the Container Line's Perspective

5.3.1 Objectives

In this section, based on above Hyundai Motor case study, the range of competitive ocean freight rate for container shipping is determined. Then another case study is launched from the perspective of CSCL to analyze the feasibility of investing in the car rack system and starting the containerized car shipping service on the Asia-Europe trade. The conclusion will be drawn from the evaluation of the NPV, IRR and pack-back period of the investment against the estimated range of the ocean freight rate.

The reason why choosing CSCL is because the company is the 7th largest container shipping line in the world by fleet capacity (Alphaliner, 2014), operating nearly 80 service loops covering more than 180 ports in over 60 countries and regions around the globe (CSCL, 2014). CSCL has been the innovator in containerized car shipping business in China domestic trade since 2010. By the end of 2013 it has successfully carried 43,400 cars for manufacturers as General Motor, Volkswagen, BMW, Nissan and Haima (Mao Z. , 2014). However, the service has not been extended to the overseas markets yet.

5.3.2 Evaluation premises

- Ocean Freight Rate Estimate

  The adoption of ocean freight rate (estimated income of the project), is crucial to the evaluation results. Based on the Hyundai Motor case study, we assume that there are only three variables: Container Ocean Freight Rate per car (C), PCTC Ocean Freight Rate per car (P) and Car Value (V), influencing the total cost, while other costs are all fixed. When the total logistics cost of container modal equals that of RORO modal, we can obtain below two equations under BTS and BTO respectively.

Equation 1 $C=P+1.4V/365-96.826$ (BTS)

Equation 2 $C=P+1.5V/365-222.25$ (BTO)

If the PCTC ocean freight rate keeps stable at USD700/car for WB (West Bound), and the car value equals Hyundai's average selling price USD15,000 per piece, the container ocean freight rate will be USD660/car (USD2640/40'HC) in BTS and USD539/car (USD2156/40'hc) in BTO. Assuming Hyundai's BTO portion only accounts for 10% of total deep sea traffic from Asia to Europe, then the weighted container ocean freight rate will be USD648/car (USD2592/40’HC). Therefore, USD648/car is the inflection point to judge the competitiveness of the container modal. Similarly, the inflection point of EB (East Bound) container freight rate can be determined as well. However due to the low container freight rate in EB market, around merely USD700 per 40 foot box, if charging more than USD300/car (USD1200/40’HC), the shipper will not use car rack system, but simply pay USD700 to load 2 cars into one 40 footer. Therefore for EB rate, we fix it at USD300/car (40% lower than PCTC market rate). In this case, USD648/car for WB and USD300/car for EB can be considered as the maximum or ideal ocean freight rates to charge for the new service.

However considering the potential price competition from car carriers, the container ocean freight rate is not expected to stand still. In order to stay competitive in certain target market, container rate is projected to be highly correlated with the PCTC rate. Therefore theoretically the identification of the cost of running a PCTC is crucial to determine the bottom level of price competition.

A PCTC Asia-Europe round trip takes about 90 days. Last year the fleet utilization averaged 84% and time-charter rates for 6,500CEU capacity vessels averaged USD25,000 per day (TradeWinds, 2013). Heavy fuel consumption for such vessel is about 48 tons per day. Taking bunker price as USD630 per ton, Suez cannel transit fee as USD120,000, all port disbursements and agency fee as USD300,000, the round trip average unit running cost of a 6500CEU PCTC is estimated to be USD433/CEU (Table 12). While for a typical 14000TEU container ship on this route, the average unit cost is about USD700/TEU (USD350/car) for both WB and EB.

Table 12 6500CEU PCTC Unit Running Cost

Asia-Europe Round Trip

Item	Amount
Vessel Capacity (CEU)	6,500
Round Voyage Time (days)	90
Time Charter Rate (USD)	25,000
Bunker Price (USD/ton)	630
Bunker Consumption (ton/day)	48
WB Space Utilization	85%
EB Space Utilization	80%
Short Leg Volume (CEU)	2,000
Suez Cannel Transit Fee (USD)	120,000
Port Disbursements (USD)	280,000
Agency Fee (USD)	20,000
Average Cost per CEU (USD)	433

Note: Diesel cost, variable cost not included.
Source: data from CSCC, (TradeWinds, 2013), (Suez Cannel Authority)

Assuming that a car carrier will not operate under this break-even level, the bottom freight rate of container service can be drawn a bit lower than that in order to compensate the deficiency in inland trucking, at averagely USD400/car (USD1600/40'HC) for both WB and EB.

- Total Investment

  Assuming at the first stage CSCL is going to purchase 1000 sets of car racks to launch Asia-Europe containerized car shipping service, with an average weekly capacity of 100 sets (200 cars). Each set of the rack costs about USD1200 (Donaldson, 2014). It will also cost totally USD200,000 for the training to use the new equipment. So the total investment is USD2,600,000, with no loan from the bank.

- Car Rack Residual Value

The car rack has a life of 8 years based on 6-7 rotations per year, and the residual value is about USD 100 after 8 years' service (Donaldson, 2014).

- Car Rack Rotation

  The evaluation will be based on the concept of round trip, which means the car racks need to be re-utilized as much as possible on both directions of Asia-Europe trade, e.g., on the west bound for Korea export, and on the east bound for Germany export. As an Asia-Europe round trip container service usually takes about 80 days, we assume that in the beginning 2 years each rack can be used for 2 round trips every year, and from year 3 to year 8 each can be used for 3 round trips.

  See complete Premises and Assumptions (Table 13)

Table 13 Car Rack System Investment Premises and Assumptions

Items	Amount (in USD)
Car Rack volume (sets)	1,000
Car Rack Price / set	2,400
Total Car Rack Investment	2,400,000
Training Fee	200,000
Total Investment	2,600,000
Debt Capital	0
Discount Rate	10%
Residual / set	100
Corporate Income Tax	25%
Car Rack Life	8 years
Max WB Ocean Freight Rate / car	648
Max EB Ocean Freight Rate / car	300
Min Round Trip Ocean Freight Rate / car	400

5.3.3 Evaluation results

- Project Acceptable against Ideal Freight Rate

  Applying the ideal container freight rate drawn from Hyundai's case, and all the costs estimated from the empirical study of CSCL, the result of the evaluation turns out to be in decent return. Till the end of the 8th year, the NPV from investing per set of car rack is USD1370. The IRR is 19%, and it takes 5.32 years to recover the cost (Appendix A).

- Project Unacceptable against Bottom Freight Rate

  Applying the estimated bottom ocean freight rate, the result is unacceptable, because the NPV and IRR turn out to be negative (Appendix B).

5.3.4 Summary

From the perspective of CSCL, the investment in containerized car shipping on the Asia-Europe route is risky. On the one hand, the return in the ideal situation is not attractive enough. On the other hand, the cost cannot be covered if competing against PCTC's breakeven freight rate.

There are three main factors that can be concluded influencing the return of the investment, freight rate, rotation and ship running cost. In the Asia-Europe trade, though the freight rate level is high, the slow rotation of car rack due to the long distance restrains the yearly total income, and the high ship unit running cost greatly offsets the limited earning too. Therefore investment in shorter distance routes where equipment rotation is faster and unit running cost is lower could be more profitable, even though with a lower freight rate.

6. Suggested Marketing Plans for China Shipping

Although the case studies prove that the total outbound logistic cost for part of the vehicles of high value from Asia to Europe is lower in the container modal, there is still doubt that if the carmakers are motivated enough to change to container modal or shift enough volume on to the container ships. That will directly affect the investment return of the container shipping line. In this chapter, a SWOT analysis is carried out to evaluate the competiveness of CSCL to launch the container car shipping service, and a marketing plan is suggested to the China Shipping Group Company.

6.1 SWOT Analysis

6.1.1 Strengths

- CSCL has expertise in containerized car shipping. It started the service in the China domestic market in 2010 by providing door-to-door service supported by the car rack system. Therefore, it is not a brand new area for the company, but an expansion to overseas markets. So far, among global carriers, only Maersk and CMA CGM have project teams in the automobile sector. It is not too late for CSCL to enter. With the experience in operation and the understanding of the finished automotive logistics industry, the company can quickly adopt itself to the new market.

- CSCL has 3 affiliated feeder companies covering Yangtze River Delta and Pearl River Delta in China as well as South East Asia ports. It also owns dedicated terminals in 12 major sea ports along the coast of China. Therefore, compared with foreign based shipping lines, CSCL has predominance in the Chinese market in terms of space guarantee, service connectivity and equipment availability.

6.1.2 Weaknesses

- The container modal has a disadvantage in accepting huge volumes in a single call. For example, CSCL allocates space to all the ports of loading, and each POL usually works against the assigned allocation. If there is a huge car shipment loaded from a port, it probably squeezes the number of slots assigned to other ports. In particular when the car shipment is not regular, it may cause space waste in the slack seasons, and heavy pressure in the peak seasons.

- CSCL, like all other shipping lines, despite its cost efficiency in ocean shipping, does not have competitive advantage in land transportation over the specialized car carrier trailers. If providing container door-to-door service, the trucking cost is estimated to be higher than the RORO modal. Although the container can deliver the new cars in a protected environment at a faster speed, these merits are yet to be justified by the extra inland cost.

- Compared with car carriers' close ties with carmakers, the connection between the company and car manufacturers is much looser. CSCL serves as a common carrier for all range of general goods, while car carriers are highly dependent on finished vehicles. Sometimes, even the car carrier fleet is financially backed up by the car manufacturers. Therefore, it will be difficult to break through such a close partnership and share the market with car carrier companies.

6.1.3 Opportunities

- The finished automotive shipping market is a huge market, while container lines have just stepped into this new field. The total automotive seaborne trade is projected to exceed the historical height of 22.4 million units this year, while possibly the new cars carried by containers is only around 0.7 million, equal to about 0.5 million TEUs (Donaldson, 2014).

- In spite of the huge total market volume, there is a growing trend in the increasing share of emerging economies. For example, exports from China, India, Thailand, Turkey, and imports to China, Brazil, Argentina, Russia, have all experienced rapid growth in recent years. The total seaborne car trade volume of those emerging countries is remarkable, but it is fragmented and widely scattered. This is the favorable trend towards the container shipping sector, because the smaller volume of car shipments can be well served by the container services of higher sailing frequency to various destinations, and most importantly in a cost efficient way.

- There is increasing demand in container car shipping to some destinations where the volume is not large enough for RORO vessels to cover, or where there is no RORO facility.

- China is the biggest automotive market in the world measured by both production and sales. In 2013, the figures reached 22.12 million and 21.98 million respectively (China Association of Automobile Manufacturers, 2014), and the seaborne trade volume stood at 1.06 million for import and 1.1 million for export (Clarkson Research Services, 2013). Nearly all the major manufacturers have had their production facilities in place to feed the market locally, but they do not export their China made vehicles to overseas markets. The Chinese brands such as Geely, Chery etc. are the dominant export forces, mainly to the Middle East, South America, North Africa, Russia and India, while the imports are from the traditional auto producing countries such as Japan, Germany, the USA and South Korea. As a Chinese shipping line, such a big home market provides the company with great opportunities to benefit from its growth.

- The RORO shipping market connecting China with the overseas destinations is monopolized by foreign carriers. However, it is an opportunity for Chinese container lines. After China's entry into WTO, three major Japanese car carriers established joint ventures with three state-owned shipping companies in order to have the licenses to operate in its coastal market. As a matter of fact, the joint ventures are actually dominated by the foreign party. Take China Shipping Car Carrier Company as an example, it only acts as a bareboat leaser, but the fleet is operated by K-Line. Now the foreign car carriers are not only authorized to operate in China, but rule the overseas routes connecting China as well. Ministry of Commerce of China recommended the strategic cooperation of building a national PCC fleet for the sake of the development of China automotive industry. However, due to the absence of commitment from Chinese carmakers and the lack of experience and resources in RORO shipping, the shipping companies yet have not taken actions.

6.1.4 Threats

- The whole finished automobile distribution system was not designed according to the container logistics modal. Most of the carmakers are comfortable with the conventional RORO modal and prefer to keep the old style of outbound logistics. Although the cost per unit carried by container ships is decreasing every year, the RORO modal is much more mature and regulated after decades' practice. It is not likely to change overnight what people have been used to for ages to a new unfamiliar way of doing business.

- Car carrier companies have more insight and sensitivity to the car shipping market. They have already noticed the change of the global seaborne car trade, and started adjusting the current service networks to cope with the emerging markets. For example, K Line will appropriately respond to new customer needs resulting from this new trade pattern and the diversification of existing trends. In order to meet the demand of RORO cargo, the company will make full use of his network including container sector in addition to the car carrier services ("K" Line, 2012). NYK also pointed out that earnings through ocean transport would be difficult due to the reduction in deep sea demand and increase in diversified short sea services. Hence, they would invest more in shipping related logistic services to strengthen their competitiveness (NYK, 2013).

- Some container lines have already entered into container car shipping market. For example, in 2006 Maersk started a project using Trans-Rak equipment to ship five Lotus Elise cars in one 40ft high-cube box from UK to US (Min & Jianhua, 2007). The company also encouraged car shipping to Latin America by using NORs (Non-Operational Refrigerated containers), which usually have to be sent back from Asia empty. Another leading shipping line CMA CGM has been carrying shipment of Chinese carmaker BYD since 2006 to reach markets such as Middle East, Africa and South America. Recently the carrier signed new contract with BMW for its export from Antwerp (Malcolm, 2010). Safmarine similarly drove the rise of containerized car shipping in South Africa, by using the boxes carrying car parts from Europe, which had difficulty in finding return cargo after unloaded.

- Competing container lines have bigger fleets and service coverage than CSCL. Although CSCL ranks No.7 in the world by carrying capacity, the gap between it and the tops ones is huge. In addition, shipping lines are working in the form of alliances, such as 2M, CKYHE and G6. Shipping lines in the same group can share space on their partners’ services. Therefore, even the smaller company has a wider service coverage than before. There is great possibility that CSCL will team up with CMA CGM and UASC to compete with the others, but it is still difficult to differentiate itself from other shipping lines.

6.1.5 Summary

Through the above SWOT analysis, it is found that CSCL, as an individual container line, is not competitive enough in the face of both competitors from the RORO and container sectors. The major deficiency is the sailing frequency and service coverage, which is supposed to be the most significant advantage over RORO shipping. However, a single container line is not able to distinguish itself in those aspects and could be struggling to attract enough cargo to support its car shipping investment. Instead, there had better to be a platform that can provide the facilities for containerized car shipping, consolidating the demand from various car makers, and matching them with available services supplied by all the container lines in the market. Such a platform can be performed by CSL (China Shipping Logistics Co., Ltd).

6.2 Market Segment and Target Market

CSL is a company under the direct administration of China Shipping Group. Based on the networks and resources of the mother company, it is able to provide integrated logistics service closely related to container shipping around the globe. However, its strength mainly lies in the Chinese market. Therefore, to start containerized car shipping, the company needs to decide which market segment to target and what strategy to implement.

6.2.1 Market segmentation by trade routes

According to the trade routes, the global car shipping market can be generally divided into three categories, East-West, North-South and regional trade. East-West is the traditional car shipping route dominated by RORO carriers. North-South and regional are those trades mainly related to emerging economies. According to the characteristics of each market, the segment attractiveness is estimated (Table 14). Regional trade turns out to be the most attractive one, followed by North-South. This is mainly due to the higher growth rate of seaborne car trade in the developing countries and the competitiveness of container services in terms of frequency and coverage between those countries.

Table 14 Market Segmentation by Trade Routes

Segment Attractiveness Factor	Weight	Parameters			East-West		North-South		Regional	
		High 10-7	Med 6-4	Low 3-0	Sore	Total	Sore	Total	Sore	Total
Profitability	35	>15%	10-15%	<10%	3	1.05	5	1.75	4	1.4
Volume Growth	25	>10%	5-9%	<5%	0	0	4	1	8	2
Size	15	>100	33-100	<33	5	0.75	3	0.45	3	0.45
Competitiveness	20	High	Med	Low	4	0.8	5	1	6	1.2
Seasonality	5	Low	Med	High	5	0.25	5	0.25	5	0.25
Total	100					2.85		4.45		**5.3**

Note:
East-West trade incl. Transpacific, Asia-Europe/Mediterranean, Transatlantic
North-South trade incl. Australasian, East/West Coast South American, South/West African
Regional trade incl. Intra-Asia, Intra-EU etc.

6.2.2 Market segmentation by car value

Similarly a segment attractiveness analysis is carried out by car value. Cars of high value turn out to be the most attractive segment (Table 15). Compared with the RORO modal, containers are believed to better in meeting the demands of expensive cars, as their inventory holding cost could be greatly reduced through fast quality delivery by containers.

Table 15 Market Segmentation by Car Value (in USD)

Segment Attractiveness Factor	Weight	Parameters			Unit Value <15,000		Unit Value 15,000-30,000		Unit Value >30,000	
		High 10-7	Med 6-4	Low 3-0	Sore	Total	Sore	Total	Sore	Total
Profitability	35	>15%	10-15%	<10%	3	1.05	5	1.75	7	2.45
Volume Growth	25	>10%	5-9%	<5%	7	1.75	4	1	5	1.25
Size	15	>100	33-100	<33	5	0.75	6	0.9	3	0.45
Competitiveness	20	High	Med	Low	3	0.6	5	1	8	1.6
Seasonality	5	Low	Med	High	7	0.35	5	0.25	3	0.15
Total	100					4.5		4.9		**5.9**

6.2.3 Market segmentation by car dimension

Based on the empirical study of loading cars with the support of Trans-Rak’s R-RAK system, cars can be categorized into five segments, ranging from six to two cars in one 40ft high-cube container. For example, six Toyota Aygo L3415xW1615xH1465 (mm) can be fitted into one box; five Hyundai i10 L3566xW1595xH1550 (mm) into one; four Volkswagen Passat CC L4796xW1852xH1422 (mm) into one; three BMW 5 Series L4907xW1860xH1464 (mm) into one and any two of the common large cars, SUVs and MPVs can be loaded into one 40ft high-cube box (Table 16). The result shows that mini cars suitable for the ‘6 in 1’ mode scores the highest, closely followed by ‘5 in 1’ and ‘4 in 1’. Cars that can only fill the box with less than 4 are relatively less attractive to the container modal.

Table 16 Market Segmentation by Car Dimension

Segment Attractiveness Factor	Weight	Parameters			6 in 1		5 in 1		4 in 1		3 in 1		2 in 1	
					Toyota Aygo		Hyundai i10		Volkswagen Passat CC		BMW 5 Series		Larger Cars / SUV / MPV	
		High 10-7	Med 6-4	Low 3-0	Sore	Total	Sore	Total	Sore	Total	Sore	Total	Sore	Total
Profitability	35	>15%	10-15%	<10%	9	3.15	7	2.45	5	1.75	3	1.05	1	0.35
Volume Growth	25	>10%	5-9%	<5%	5	1.25	6	1.5	7	1.75	3	0.75	7	1.75
Size	15	>100	33-100	<33	4	0.6	6	0.9	9	1.35	5	0.75	4	0.6
Competitiveness	20	High	Med	Low	8	1.6	7	1.4	6	1.2	3	0.6	2	0.4
Seasonality	5	Low	Med	High	5	0.25	5	0.25	5	0.25	3	0.15	3	0.15
Total	100					**6.85**		6.5		6.3		3.3		3.25

6.2.4 Target market

Based on the analysis of market segments and the strength of CSL, the company needs to focus on regional trade connecting the Chinese market, e.g., imports from Japan and South Korea, and exports to South East Asia, India and the Middle East. The transit time between these markets are comparatively short so that the turnaround time of the specialized car racks can be reduced. Return cargo is also an important factor that cannot be overlooked, which helps increase the utilization of the racks.

The result of segmentation by car value and dimension seems to be contradictory, as high value cars are usually big and small cars are normally of low value. However, CSL should give an equal weight to both of them. Because high value cars bear higher inventory holding cost so that they tend to require fast and protected container services, and small cars can be attracted by the efficient loading solutions that may greatly reduce the unit shipping cost. Therefore, both cars of high value and high loading efficiency can be the target markets for CSL.

6.3 Marketing Strategy

6.3.1 Niche marketing strategy

Container car shipping today only has a tiny share of the total seaborne volume. Though car carrier lines have noticed the growth in the container sector, it is still negligible to them. On the other hand, some car makers are showing growing interest in the container solution (Cross, 2012). This provides a good opportunity for the container sector to start investing in such a growing niche market.

CSL should enter this market before it is too late, and implement a nicher's strategy, starting from forming partnerships with Chinese auto exporters, such as Geely, Chery and BYD. Since the market has great potential in growth, when the container solution is widely recognized by the carmakers, and when the automotive industry finds its way through to a comprehensive BTO approach, CSL can expand its customer base to more foreign carmakers.

6.3.2 Marketing mix

- Product / Customer wants and needs

Providing fast and damage free containerized finished vehicle logistics services from end to end.

Integrating comprehensive and value added services such as customized loading plans, customs clearance, PDI, loading/unloading supervision, carrier management, cargo tracking and final mile delivery.

Prioritizing CSCL's Intra-Asia, Australia, Middle East and Red Sea services and using other services in the market as alternatives.

- Price / Cost

  Pricing by car unit instead of by container.

  Closely following RORO shipping ocean freight rate and other related costs.

  Contracting long term freight rates with container shipping lines as well as other suppliers.

  Being attractive in total logistic cost.

- Promotion / Communication

  Advertising on the media specializing in automotive logistics.

  Paying regular visits to carmakers to dig out their wants and needs, and promoting container solutions.

  Using social networks and platforms to interact with potential users and the public.

- Place / Convenience

  Appointing account managers in CSL headquarter in Shanghai.

  Setting up local supporting teams in ports in Asia, Australia, the Middle East and Red Sea area.

7. Conclusion and Recommendation

The container way of automobile shipping is not really new, but it is mainly applied for shipping secondhand vehicles due to the small volume, diversified flows and volatility in shipping demand of secondhand vehicles. For new car shipping, the RORO used to be considered as the only right way to go. However, today the new car seaborne trade too, is partly converted into a more fragmented style as a result of the growing demand from the emerging economies and scattered production sites around the globe. Thus, container shipping finds its opportunity in the field of new cars shipping.

Based on the results of this research, in the traditional East-West car shipping routes, container modal so far has not been appealing enough to carmakers. Firstly, the RORO logistic chain is so mature that the total logistic cost is kept low and operations are well regulated. Secondly, the majority of deep-sea car traffic follows the BTS approach, so that the merits of short transit time, smooth intermodal transport and door delivery of container shipping are not well appreciated. However, in some emerging trade lanes where there is a constant but small shipping demand, while limited RORO shipping service and handling facilities are available, the container solution can be the default choice for car shipping.

Supported by the innovative designs of car containerization facilities, a standard box now can accommodate more vehicles in an easier, safer and more cost efficient way than ever before. When there is an ocean leg involved, the container modal today is not inferior to the RORO modal in terms of the total logistic cost. Thanks to the economy of scale of container ocean shipping, its deficiency in inland transportation can be compensated. Besides, the container modal can provide a faster door service that enables a damage free delivery with shortened lead time, which increases the attractiveness to the carmakers. Moreover, on the one hand, the cost of container shipping is decreasing every year, while that of RORO shipping is increasing. On the other hand, the auto industry has been trying hard to move towards the BTO approach, indicating an increasing demand in door delivery. Therefore, the competitiveness of container modal is expected to be significant in the future, especially when the auto industry breaks through its bottle neck to new production approaches. However, as long as vehicles are massively produced according to sales forecast, RORO will remain the major way of car shipping by volume.

It is always better for a service provider to identify an opportunity and enter the market earlier than the competitors. China Shipping Group should take advantage of its strengths in container shipping and network worldwide to launch the container car shipping service as an NVOCC. A niche marketing strategy can be adopted by starting from its home market for Chinese auto exports, and then expanding its customer base step by step. Though CSL will not be the earliest comer to the field of auto shipping, it can benefit from the experiences of the pioneers and mature technologies now available in the market. Maersk can be set as an example in that way. It was nobody in the 1970s when Sea Land and others led the industry, but later it determined and devoted all its strengths in this sector, learning from competitors but differentiating itself from them.

For China Shipping there is great possibility to become one of the leading companies in the container car shipping sector as well. A five-year action plan can be set up for CSL to start the container car shipping service. In the first year, equipment (e.g. 200 sets for the first phase), trained technical staff, and dedicated marketing and equipment control teams should be in place. Before that, marketing campaigns to all Chinese car exporters need to be carried out to figure out the existing and potential trade routes and volume. The total logistic cost of each route compared with the RORO modal should be studied for the sake of competitive pricing and possibly trial shipment should be started. From year 2 to year 3, the service is projected to officially get started. In the meantime, the customer base needs to be expanded, especially for overseas return cargo. From year 4 to year 5, expansion should be kept up and more attention should be paid on optimizing the services and benefits.

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Appendices

Appendix 1 Cost-Benefit Evaluation of Car Rack Investment (max)

USD/set

Far East / Europe Trade	Year								
	0	1	2	3	4	5	6	7	8
Income		3,792	3,792	5,688	5,688	5,688	5,688	5,688	5,688
WB Voyage		2	2	3	3	3	3	3	3
WB Ocean Freight Rate per TEU		1,296	1,296	1,296	1,296	1,296	1,296	1,296	1,296
EB Voyage		2	2	3	3	3	3	3	3
EB Ocean Freight Rate per TEU		600	600	600	600	600	600	600	600
Cost		4,622	4,562	4,557	4,556	4,559	4,565	4,575	4,587
Running cost per TEU		3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984
Depreciation		138	138	138	138	138	138	138	138
Maintenance		100	110	121	133	146	161	177	195
Reposition		100	100	100	100	100	100	100	100
Administration		100	50	50	50	50	50	50	50
Marketing		100	80	64	51	41	33	26	21
Storage		50	50	50	50	50	50	50	50
Others		50	50	50	50	50	50	50	50
Profit		(830)	(770)	1,132	1,132	1,129	1,123	1,113	1,101
Corporate Income Tax		(207)	(192)	283	283	282	281	278	275
Net Profit		(622)	(577)	849	849	847	842	835	825
Depreciation		138	138	138	138	138	138	138	138
Residual									100
Cash Inflow		(485)	(440)	986	987	984	980	972	1,063
Cash Outflow	1,400								
Net Cash Flow	-1,400	(485)	(440)	986	987	984	980	972	1,063
Cumulative Cash Flow	-1,400	-1,885	-2,324	-1,338	-351	633	1,612	2,585	3,648
Discount Rate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Discounted Net Cash Flow	-1,400	-441	-363	741	674	611	553	499	496
Discounted Cumulative Cash Flow	-1,400	-1,841	-2,204	-1,463	-789	-178	375	874	1,370

NPV	**1,370**
IRR	**19%**
Static Payback Years	**4.36**
Dynamic Payback Years	**5.32**

Note:
1.Ocean Freight Rate exclude THC and local surcharges both ends
2.Assuming one car rack with two cars in one TEU
3.Running cost per TEU is based on 14000TEU vessel's FE/Europe round trip cost

Appendix 2 Cost-Benefit Evaluation of Car Rack Investment (min)

USD/set

Far East / Europe Trade	Year								
	0	1	2	3	4	5	6	7	8
Income		3,200	3,200	4,800	4,800	4,800	4,800	4,800	4,800
Round Trip		2	2	3	3	3	3	3	3
Round Trip Average Ocean Freight Rate per TEU		800	800	800	800	800	800	800	800
Cost		4,622	4,562	4,557	4,556	4,559	4,565	4,575	4,587
Running cost per TEU		3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984
Depreciation		138	138	138	138	138	138	138	138
Maintenance		100	110	121	133	146	161	177	195
Reposition		100	100	100	100	100	100	100	100
Administration		100	50	50	50	50	50	50	50
Marketing		100	80	64	51	41	33	26	21
Storage		50	50	50	50	50	50	50	50
Others		50	50	50	50	50	50	50	50
Profit		(1,422)	(1,362)	244	244	241	235	225	213
Corporate Income Tax		(355)	(340)	61	61	60	59	56	53
Net Profit		(1,066)	(1,021)	183	183	181	176	169	159
Depreciation		138	138	138	138	138	138	138	138
Residual									100
Cash Inflow		(929)	(884)	320	321	318	314	306	397
Cash Outflow	1,400								
Net Cash Flow	-1,400	(929)	(884)	320	321	318	314	306	397
Cumulative Cash Flow	-1,400	-2,329	-3,212	-2,892	-2,571	(2,253)	(1,940)	(1,633)	(1,236)
Discount Rate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Discounted Net Cash Flow	-1,400	-844	-730	241	219	198	177	157	185
Discounted Cumulative Cash Flow	-1,400	-2,244	-2,974	-2,734	-2,515	-2,317	-2,140	(1,983)	(1,798)

NPV	**-1,798**
IRR	**-15%**
Static Payback Years	
Dynamic Payback Years	

Note:
1.Ocean Freight Rate exclude THC and local surcharges both ends
2.Assuming one car rack with two cars in one TEU
3.Running cost per TEU is based on 14000TEU vessel's FE/Europe round trip cost