Potential Solutions to Upstream Buyer Consolidation in the China-Europe Container Trades

An Exploratory Study

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***Abstract*—The Asia-Europe container trade is the most important trade in the world in terms of volumes transported (overtaking the Trans-Pacific trade in 2014). The typical structure of the supply chains associated with this trade is that containers are stuffed in China and the cargo is subsequently cross-docked at a major European logistics hub or closer to the customer, for further shipment to the final retailing point. This may be one of the reasons why short sea container shipping has only a limited market share of intra-European cargo flows, since once the cargo is unloaded from containers, it is more likely to be forwarded by land-based modes of transport. Paving the way for a greater proportion of cargo being cross-docked in China rather than Europe, may prove to be more cost-efficient and less environmentally damaging than the typical solution. This paper discusses the strengths and weaknesses of the typical solution and alternative solutions such as buyers' consolidation and concludes that new alternative solutions are worth investigating further. The potential for shifting from the typical solution to new alternatives is dependent on the identification of key decision makers in the design of these supply chains. As such, a careful analysis of this must be undertaken and the capability of Logistics service providers (LSPs) in China assessed.**

Keywords— upstream buyer consolidation, short sea shipping, Asia-Europe container supply chains, environmental impact, logistics providers in China

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I. INTRODUCTION

Worldwide containerized trade in 2014 was estimated to have increased by 5.3% from 2013, and reached 171 million TEUs. More specifically, containerized trade volumes have increased by 7.5% and 6.3% in the Asia–Europe and transpacific head haul journeys respectively. The pursuit of less expensive sources of supply by European importers is the main driving force that has boosted the Asia-Europe trade, with an increasing number of European retailers having chosen to source from Asia. The higher growth rate in the Asia-Europe trade means that in 2014 at 22.4 million TEUs, it now exceeds the Trans-Pacific trade (22.2 million TEUs) in terms of volumes transported [1].

Sea containers coming from China to Europe are typically stuffed at the location of manufacturers in China. The consignments are thereafter transshipped in logistics hubs in Europe. Reconsolidation for onward movement to the final destinations is typically conducted in logistics hubs in North-West Europe or consolidation centers in destination countries. This is what we label as the "business-as-usual" (BAU) solution. The problem is that these reconsolidated shipments are most often moved by road to their final destinations, even if sea transport could provide a less costly and better environmental solution. The BAU solution using road transport effectively contributes to more congested road networks at both higher logistics costs and societal costs than if these cargoes were transported by sea on maritime feeder links. Although there exists improvement potential for short sea shipping (SSS) in

Europe, only about 37% of cargo is transited among EU Member States in this way [2]. SSS can be an effective and economic method for cargo owners to transport their cargo from logistics hubs in Europe to their destinations by sea. Fig. 1 shows an example of such a SSS solution for cargo with destinations in peripheral area. An Iceland-based world leading cold-chain logistics service provider routinely services these markets. This itinerary starts at Rotterdam and ends at Murmansk in Russia, serving 2 British ports, 28 Norwegian ports and 1 Russian port. On individual trips, some of the Norwegian ports will be omitted if there is no cargo.

Source: shortseaschedules.com

Fig. 1. A case of SSS serving British, Norwegian and Russian markets

The purpose of this paper is to analyze strengths and weaknesses of the typical solution and alternative solutions such as buyers' consolidation. Furthermore, the paper analyzes the design of these sea- and container-based supply chains, key decision-makers and the capability of LSPs in China.

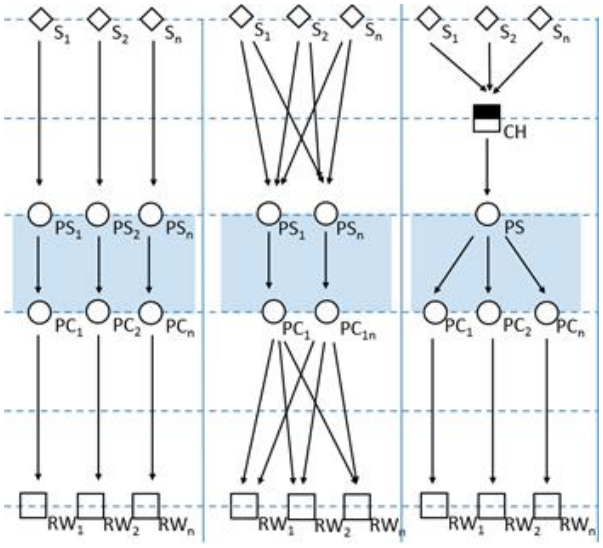
This paper is structured as follows: Section 2 provides a review of the research literature relating to Asia-Europe sea container supply chains. In Section 3, the chosen research method is described. Section 4 presents primary data that were collected through interviews. Based on Sections 2, 3 and 4, we then analyze and discuss the BAU solution in comparison with new supply chain alternatives in Section 5. The ability of logistics service providers (LSPs) in China is also briefly analyzed in Section 6, because their ability is crucial to the implementation of the supply chain solutions proposed in this paper. Finally, conclusions are presented in Section 7, along with an assessment of research limitations and suggestions for further research.

II. LITERATURE REVIEW

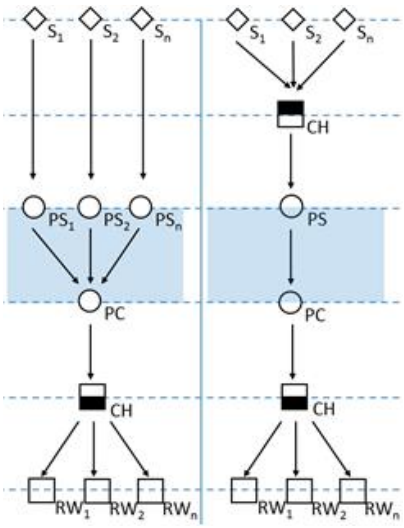
A. *Asia-Europe Sea Container Supply Chain Configurations*

In terms of global supply chain management, Cheong et al. [3] considered a network design model by deciding the number and location of consolidation hubs to minimize the total logistics cost of international inbound logistics. Other researchers have proposed frameworks for supply chain strategy selection in relation to different aspects such as air-freight or sea-freight, centralized or decentralized inventory holding and lean and/or agile supply chains [4, 5].

On the basis of a literature review and interviews with LSPs, Creazza et al. [6] mapped five containerized sea-based supply chain configurations from Asian factories to European retailers. The framework proposed for the supply chain design and setup process was based on characteristics of the business environment relating to a pure cost perspective. These five configurations are as follows: (1) direct deliveries with FCL from individual suppliers to retailer's regional warehouses (RW); (2) direct deliveries with LCL from individual suppliers to retailer's RWs; (3) a one echelon supply chain with consolidation hub in the Far East; (4) a one echelon supply chain with consolidation hub in Europe; and (5) a two echelon supply chain with consolidation hubs in both the Far East and Europe – see Fig. 2. All these configurations differ in terms of complexity, lead-time, risk of delay and cost structure. Supply chain lead-times tend to increase with an increasing number of transit nodes. That is to say, direct deliveries with FCL from suppliers to RWs (Solution 1) generally lead to the least complexity, lowest risk of delay and shortest supply chain lead-times. However, it does not always imply the most cost-efficient supply chain solution [7]. In addition, pursuing economies of scale in transportation by means of reducing shipment frequency will definitely lead to an increase of inventory cost. However, the research conducted by Creazza et al. [6] only considered supply chains from suppliers to retailer RWs, with an important segment of these Asia-Europe container supply chains being ignored – the final leg from RWs to retail stores. In addition, because of the typical location of RWs in Europe, road haulage is usually used in the last segment of these supply chains, which is typically more environmentally damaging than short sea shipping [8].



Solution (1) Solution (2) Solution (3)



Solution (4) Solution (5)

Key:

S	Suppliers
CH	Consolidation Hub
PS	Ports in Suppliers' Countries
PC	Main Port in Customers' Countries
RW	Regional Warehouse
	Sea Transport

Fig. 2. Five Asia-Europe container supply chain solutions (adapted from [6])

Bygballe et al. [9] discussed the pros and cons of different Asia-Europe container supply chains. They described four supply chain configurations within the context of containerised sea-based supply chains from Chinese suppliers to Norwegian retailers, based on their working experience and observations on a focal company. The benefits and drawbacks of each configuration were discussed from both a logistics cost and a customer service perspective. This focal Norwegian retailer adopts four supply chain configurations according to different cargoes: (1) deliveries between individual producers and retail stores; (2) consolidation in the customer country; (3) consolidation in the supplier country; and (4) consolidation in both countries, which are similar to solutions (1), (4), (3) and (5) as mentioned earlier. Compared with the research conducted by Creazza et al. [6], Bygballe et al. [9] also takes the customer service issue into account. However, this does not imply that the latter applied a more holistic perspective than the former, as the latter only considered four supply chain configurations. The differences in dimensions and configurations make the findings of these two papers different to some extent. For instance, solution (5) in Creazza et al. [6] is not cost-efficient under any circumstances when compared with other solutions. While, Bygballe, et al. [9] proposes that solution (4) is the most appropriate design for high-value products that are moved in lower volumes. Moreover, neither studies consider the possibility of adopting less environmentally damaging transport solutions after consignments arrive in Europe.

This research presented herein will explore new alternative supply chain solutions based on primary information collected from interviews with logistics service providers (LSPs) and cargo owners (COs) involved in the China-Europe trades. An important objective of the paper is to analyse the pros and cons of different alternative container supply chain solutions.

B. The potential of Short Sea Shipping

To different degrees, the alternative supply chain configurations discussed above may facilitate short sea shipping for the European part of the supply chain. Since around 70% of industrial production in Europe is located within 150-200 kilometres of the sea, it has been argued that the geography of Europe should favour short sea shipping [10]. In addition, SSS is broadly regarded as a less environmentally damaging [8, 11, 12] and economically competitive [13] mode of transport, at least compared with road haulage. The main comparative drawbacks of SSS are typically that it has low frequency, weaker reliability and longer door-to-door transit time [14, 15]. These problems may not be insurmountable, however, and many researchers have proposed possible solutions to tackle these drawbacks [11, 16-18]

III. METHODOLOGY

In order to investigate the new alternatives to the BAU solution in terms of containerized sea-based supply chains from Chinese suppliers to European retailers, a series of 10 interviews with COs and LSPs were conducted in the UK, Netherlands, Norway, Sweden and China. All informants are at management level and involved in the cargo flows from Asia to Europe. All interviews were conducted according to a semi-structured interview guide based on the literature review and the main research questions. This guide was developed in English. However, interviews were conducted in the native language of the respondents (English, Dutch, Norwegian, Swedish and Chinese). After each interview, the interviewer took the responsibility of transcribing and later translating the transcripts into English. For reasons of commercial confidentiality, the names of the respondents and focal companies have been anonymized. However, the roles and background of respondents and the relevant business of these focal companies are described in the final transcripts. All interviews have been conducted in the following manner:

- All interviews are made with audio recording, and conducted according to a common interview guide
- Interviews were made in the native language of the respondent
- Transcripts of the interviews were made, based on the audio recordings
- All transcripts were e-mailed to the informants for verification and corrections
- After the final version of the transcript is agreed upon by the interviewer and the respondent, the audio-file was deleted
- The quality-checked transcribed interview was then translated into English
- All interviews were made face-to-face or via telephone/video-link

- The duration of the interviews was between 20 and 50 minutes
- Interviews were conducted between November 2015 and January 2016

IV. Presenting Data

Based on these exploratory interviews, the authors identify five different Asia-Europe containerised sea-based supply chain solutions currently in use, including one BAU solution and four alternative supply chain solutions that serve to illustrate the principle of upstream consolidation. The Concept BAU (Section 4.1) and Concept C (Section 4.5) are similar to solution (4) and solution (5) in Fig. 2 respectively, although previous literature did not clearly mention which transport mode(s) (sea, rail or road) is/are adopted within the European leg. Other solutions (Concepts A1, A2 and B) are to be considered new concepts, based on the findings to emerge.

A. *Concept BAU: Consolidation in Customer Country. (Fig. 3 (a))*

Company A is a Norwegian textile retail chain offering a large variety of curtains, bed sets and other useful interior products for the home. It has more than 130 wholly-owned stores across the country. They typically ask LSPs to transport FCL shipments (40 feet containers) from China to Norway which have not been opened in other places in Europe. After containers arrive at their main warehouse in Norway, they are cross-docked for final shipments. Cargos are distributed by PostNord via road transport during this final leg.

B. *Concept A1: Upstream Consolidation for One Buyer. (Fig. 3 (b))*

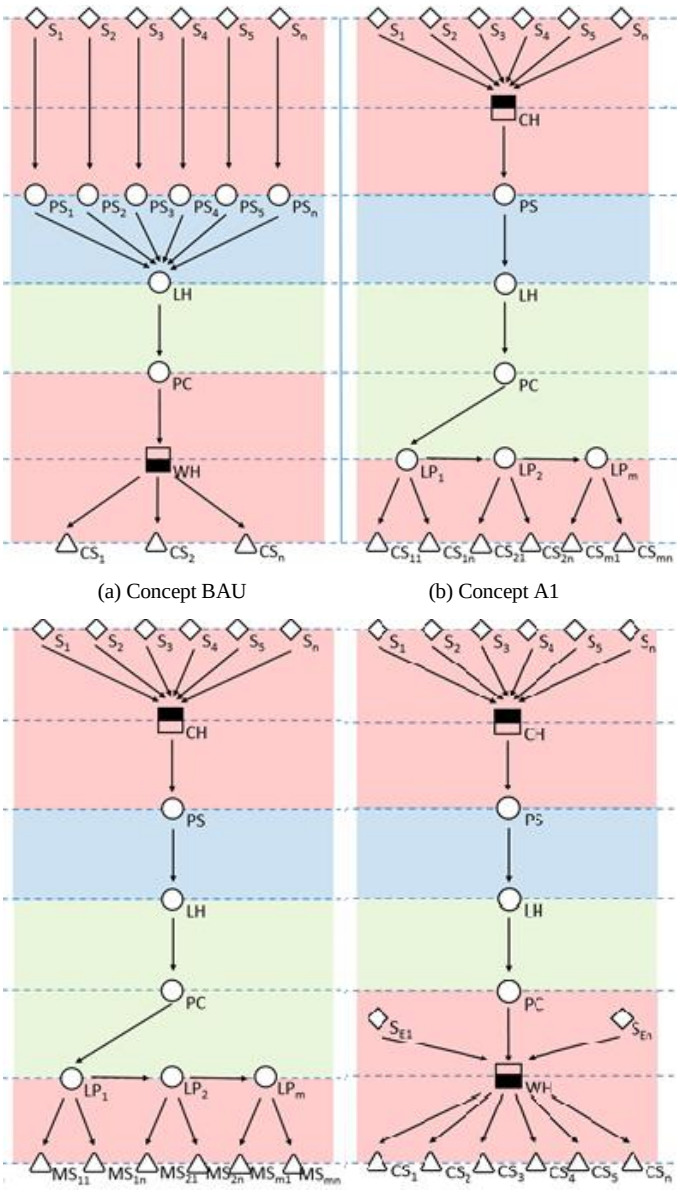
Company B is a Norwegian no-frills supermarket with cut-price articles sold in approximately 200 shops located all over Norway. Products from different producers in mainland China are consolidated close to the major ports of Shanghai and Ningbo. Load carrying units from China to Norway are 40-foot containers loaded with palletized products for the shops. Each loaded container is dedicated for a certain shop. Without having been split elsewhere in Europe, after arriving at the Port of Borg in Norway, containers are transported by NorLines along the coast to the nearest port for each store. Therefore, this solution dramatically decreases road travel distance to the shops compared with the BAU solution. This respondent also mentioned that there are certain LSPs, including Greencarrier and ColliCare that have been offering upstream buyer consolidation in China for many years in Shenzhen, Shanghai and Hong Kong. Moreover, this business enables them to obtain increasing volumes and establish new offices in the Far East for offering these services.

C. *Concept A2: Upstream Consolidation for a Group of Buyers. (Fig. 3 (c))*

Company C is an LSP headquartered in Norway and have their own warehouses, distribution centers, and trailers in Norway and Sweden. They also have buyer consolidation in China. Their containers are normally transported by Maersk or Hanjin. After arriving at Rotterdam, containers are transshipped at Hogezoom onto short sea ships operated either by Unifeeder or themselves for final destinations in Norway. These short sea ships either go directly via a milk run route to 3 or 4 customers where the goods are delivered, or it goes to their warehouse in the Oslo area, from where they distribute all over Norway. In addition, one shopping mall contains a large number of stores. Company C can arrange all deliveries for a shopping mall under one contract. After containers arrive at a mall, their employees can unpack and label goods in this mall and place them in stores.

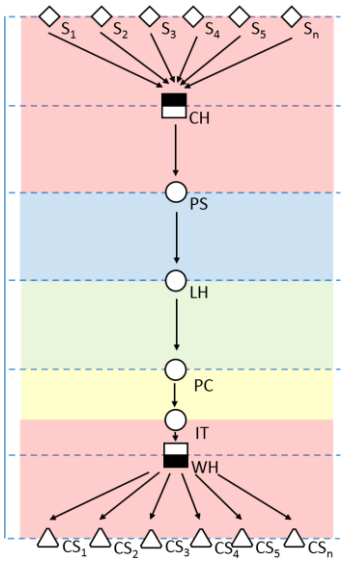
D. *Concept B: Upstream and Downstream Buyer Consolidation. (Fig. 3 (d))*

This supply chain solution also includes consolidation with European suppliers. Before being transported to Norway, the products are consolidated in China. At the warehouse in Norway the products from China will be consolidated with other products from Europe or Norway before being distributed to shops.



(a) Concept BAU (b) Concept A1

(c) Concept A2 (d) Concept B



(e) Concept C

Key:

S	Suppliers
S E	European Suppliers
CH	Consolidation Hub
PS	Ports in Suppliers' Countries
LH	Logistics Hub in Europe
PC	Main Port in Customers' Countries
IT	Intermodal Terminal
WH	Buyers' Warehouse
LP	Local Ports
CS	Stores Belonging to The Same Chain
MS	Different Stores in One Shopping Mall
	Road Transport
	Intercontinental Deep Sea Transport
	Short Sea Transport
	Rail Transport

Fig. 3. Asian-Europe sea container supply chain soluions

E. *Concept C: Upstream and Downstream Buyer Consolidation with Hybrid Solution in Europe. (Fig. 3 (e))*

Company D offers all kinds of professional and DIY products in Norway, Sweden and Poland at competitive prices. DB Schenker has been a long-term partner of this focal company since the beginning of the 1990s and helps them to consolidate in China according to buyer requirements. In the European leg of this supply chain, the Port of Gothenburg is the container unloading port. Company D has one central warehouse / DC which is located in Skara, Sweden that serves all markets, including Norway, Sweden and Poland. From the Port of Gothenburg the company uses a daily rail-based intermodal solution to a dry port located in Falköping, about 25km from the central warehouse. The rail-based intermodal solution enables cost-efficient and less environmentally damaging transport and higher service quality through the use of the dry port in Falköping as a buffer for full containers and as a depot for empty containers [19, 20]. The final distribution from the central warehouse to the company's stores is made by road. However, the company is currently investigating the possible future use of rail-based intermodal solutions for stores in northern Sweden and Norway.

V. Discussion

Based on the sea container supply chain configurations proposed by Creazza et al. [6] and Bygballe et al. [9], and the outcomes from exploratory interviews illustrated in Section 4, alternative solutions that are characterized by upstream buyer consolidation and downstream short sea shipping can be reviewed. In this section, the pros and cons of these solutions are discussed, the key potential decision-makers behind a shift from the BAU solution to new alternatives can be identified and the impediments that could challenge such a shift of supply chain design and setup can be explored.

A. *Strengths and Weaknesses of the Identified Supply Chain Designs*

Most of the respondents confirm that the BAU solution is the prevailing supply chain organization in the market. One of the respondents, however, reports that there is already a substantial amount of cargo that is consolidated in China, based on customer preferences, and afterwards shipped to Rotterdam for distribution. This respondent perceives that there are many competitors offering the Concept A1 solution to his customers in the Netherlands. Concept A2 is the least frequently used for the reason that stores are not willing to share sensitive information with external parties, especially other stores located in the same shopping mall, who might be their competitors. In addition, the potentially higher risk of disturbances relating to the cargoes of other stores and the fact that stores need to decide on orders much earlier are also impediments of the implementation of Concept A2. Therefore, only a handful of companies agree to consolidate together. The widespread use of the BAU solution shows that it should have certain advantages. In what follows, the comparative advantages and disadvantages of Concept BAU are assessed vis a vis upstream buyer consolidation or short sea shipping.

Responsiveness. Sending cargoes from local distribution centers in Europe may reduce lead-times compared with sending cargoes from the Far East every time (taking at least 21 days from China to the UK). Accordingly, higher responsiveness and agility is achieved by the BAU solution, because of its ability to meet changes in customer demand.

Lead-time. Road transportation is normally faster than short sea shipping. One of our respondents points out that if ships leave Rotterdam on a Friday, they will arrive in the south of Norway on Sunday. Cargo can then be delivered on Monday for customers located in the south of Norway, in 2-3 days for the middle part of Norway (Bergen and Ålesund) and in 4-5 days for customers in the far north. At the same time, the lead-time for SSS is around 6-7 days for the far north of Norway, though waterborne transport is only 50% of the cost of road transport.

Punctuality. Ship delivery times are not as precise as those of trucks. One respondent suggested that some clients, like Nike, are very strict in terms of time constraints. They request products to be delivered at shops by 10:00 am. For this reason, his company has taken the decision to use road transport.

Simplicity. Trucks can easily deliver a door-to-door service. Road-based transportation has better hinterland access than its water-based counterpart. If LSPs shift from the BAU solution to any of the alternatives, they still need trucks to deliver cargo from a local port to destinations (stores). In addition, more connection nodes means greater possibilities for delay.

By contrast, alternative solutions also have certain comparative advantages. The following are the advantages associated with combining upstream buyer consolidation and short sea shipping.

Logistics cost. Due to the consolidation of freight in Asia, the transportation of the cargo from the consolidation center in Asia to the final destinations has huge potential for economies of scale [9]. In addition, transporting containers in Europe by short sea shipping is normally cheaper than trucks [13].

Inventory cost. Inventory cost can be considerably lower in the Far East, mainly because of the lower costs of labor and warehousing. By arranging consolidation in Asia, COs and LSPs can position the most intensive logistics work where the labor cost is the cheapest.

Environment. Making a shift from road to short sea shipping in Europe is a major characteristic of Concept A1 and A2. Many researchers have made comparisons between short sea shipping and road transport in terms of CO_2e emissions per metric ton-kilometer. Generally speaking, the former performs better [8, 12]. The emissions of SSS causes less local impact than road transportation unless inland waterways are located in the middle of cities or fairways lie close to the coast [8]. In addition, the new legislation, SECA Directive 2012/33/EU [21], was published in 17 November 2012, amending Council Directive 1999/32/EC about the Sulphur content of marine fuels. That is to say, SSS performance in terms of Sulphur emissions should have improved since 1 January 2015 in the North Sea, the Baltic Sea and the English Channel (cf. Cullinane and Bergqvist, 2014) [22] (22) (22) [22].

Respondents describe several cases where their customers focus on the environmental aspect when designing their supply chains. A paper manufacturer is one of them. All their transport from Hogezoom and Hayen (Netherlands) to Norway and Sweden were originally by road. They reorganized their production to fit their pallets to containers. The investments for these changes have soon been won back as this "greener" transport is also cheaper. SSS has thus created a "win-win" situation, both for the operator and for the environment. Toyota also considers environmental performance in their distribution chains. Spare parts for the Norwegian market are supplied from Brussels. Earlier they utilized 12-15 trailers every week, driving 1500 kilometers one way to Norway. Now these cargoes are shipped by sea in 45-foot containers. The same goes for IKEA who also focus on environmental performance, as they prefer to send their cargoes for the Norwegian market by sea; directly from Baltic producers to their Norwegian warehouses.

Security wait time. For security reasons, the EU needs to screen containers coming into the EU. That is to say, containers delivered to Norway from Asia adopting the BAU solution, with a consolidation center near a logistics hub, might need to be screened twice: once in the European logistics hub and once in Norway. However, containers coming to Norway under the alternative solutions will only need to be screened once, in Norway, because containers move through the logistics hub under the "in transit" regime, thereby reducing the total security screening time. In addition, the upcoming regulations by IMO [23] about weight verification will become legally binding on 1 July 2016. Given that weights need to be verified at or near the point of departure, consolidation in Europe means weight verification should be conducted again in Europe, as it could become a combined activity or service of consolidation. Therefore, upstream buyer consolidation has advantages in both cost and time saving in this aspect.

Upstream buyer consolidation and downstream short sea shipping are two main characteristics of the alternative solutions. On the one hand, SSS may have an advantage in terms of environmental sustainability and cost saving. The slightly increased transit time associated with the leg from logistics hub in Europe to final destination can be compensated for by more advanced planning systems. Making a shift from road to sea is feasible and can lead to a "win-win" situation, both for cargo owners and for the environment. This has been attested to by some of the early movers.

On the other hand, upstream buyer consolidation also brings other benefits. As discussed above, to shift consolidation center from Europe to China may reduce logistics cost and inventory cost. If there is no inventory kept in Europe under this scenario, however, such a shift may have a negative impact on customer service. Therefore, cargo owners should balance the tradeoff between cost and customer service level. It is also possible to adopt a hybrid solution. Different products may require different supply chain configurations with different responsiveness. For products with stable demand and limited customization, upstream buyer consolidation may provide a suitable solution. More specifically, according to Creazza et al. [6] and Bygballe et al. [9], upstream buyer consolidation suits products with the following characteristics: (1) high overall annual demand, (2) low annual average demand between a supplier and a store, (3) medium value products, (4) low supplier dispersion, (5) high labor cost differential between supplier country and customer country.

B. Who is the Decision Maker?

Based on the discussion above, new alternative solutions with upstream buyer consolidation and downstream short sea shipping may have many advantages, including cost efficiency and lower environmental impact. A potential redesign of supply chains could therefore be desirable. Identifying the key decision-makers in the design of such supply chains is therefore of interest. According to our findings, decision makers can be different in various cases.

The specific Incoterms which are applied in each trade plays an important role in the determination of the central decision-maker. For instance, under EXW, European buyers have full control of this supply chain. By contrast, Asian sellers are responsible for designing the Asian-Europe supply chain when the DDP Incoterm is used. Certain professional cargo owners with good supply chain management knowledge and competence seem to choose to take care of the design by themselves. In this situation, the cargo owner (buyer or supplier)

is the decision-maker. However, sometimes, cargo-owners choose to outsource their logistics operations and the actual design of the supply chain. In this case, the LSPs make the decisions. However, it is not common that they do this all on their own. Typically, LSPs propose solutions to cargo owners, who ultimately make the final decision.

C. Impediments to Upstream Buyer Consolidation

According to the experience of respondents, the process of making a shift from the BAU solution to these new alternative supply chain solutions may face several impediments. The most prominent reported impediments are:

Unwillingness of sharing data. In terms of Concept A2, the biggest challenge is that stores need to share information with external parties. Revealing traded quantities, especially with direct competitors within the same shopping center may prove an impediment to the realization of such a concept.

Vested interests. Some powerful vested interests might oppose the change from the BAU solution to these alternatives. They may be European consolidation hubs / distribution centers and large truck companies. More specifically, if consolidation hubs are relocated in China and local distribution shifts from road to sea, the profitability of European companies may be undermined by these alternative supply chain solutions.

Lack of awareness. LSP respondents complained that one difficulty is to get into a dialogue with their customers. Normally, the first thing their customers will consider is the ocean freight rate. However, this rate is only a small part of the overall logistics costs. They do not always see the benefit of shifting consolidation center from Europe to China. Customers are also reluctant to share information about the full costs of the whole supply chain.

Longstanding working habits. Some European retailers want to do the local distribution themselves, because they think it is better for them to have more control over the consolidation center. They are used to having the consolidation center in Europe instead of at the other side of the world, where they may have more limited control.

Knowing too little about medium and small cities in Europe. One respondent explained that, taking Norway as an example, when shippers from China type in "Norway" in their system they only see Oslo. Therefore, everything goes to Oslo, even if the cargo needs to arrive in Trondheim. The only destination available in the system is "Oslo". That is where containers will be unloaded from ships. Thus, these containers are more likely to go by road during the final leg.

VI. Logistics Industry in China under the Context of International Trade

Upstream buyer consolidation requires high quality logistics services in China to serve European buyers. Therefore, a brief analysis of logistics service providers in China is necessary. Generally speaking, China's transportation and logistics industry grows in line with economic growth, even though the GDP growth rate of China has reduced to 6.9% in 2015 from 14.2% in 2007 [24] and will probably remain around 6% in the foreseeable future. However, most of China's logistics service providers are still in the early stage of their development. By contrast, foreign LSPs have significant advantages. Nevertheless, domestic players are likely to experience quite strong growth in the next few years due to a combination of support from the government and the robust economic environment.

A. Current Situation of Logistics Industry in China

Total logistics value is an important indicator of the logistics sector in China. This refers to the total value of products being transported during the recorded period, including both domestic products and import/export products. The increase of this indicator illustrates the robust growth of China's logistics market. See Table 1.

TABLE I. China's Total Logistics Value, 2011-2015 (Trillion Yuan)

	2011	**2012**	**2013**	**2014**	**2015[a] (Jan. – Nov.)**
Total logistics value	158.4	177.3	197.8	213.5	202.4

[a] Data is not available for December 2015

Source: Compiled from various Chinese government reports [25-29]

Although China's logistics market has grown steadily during the past few years and has provided a good environment for the development of domestic LSPs, most of these LSPs still operate in an inefficient way, which is evidenced by high logistics costs. China's total logistics costs reached 9.3 trillion yuan (around 1.44 trillion USD) in the first eleven months of 2015 and have increased year by year. See Table 2. In addition, the ratio of total logistics cost to GDP fluctuated around 17%, with a slightly decreasing trend from 2012 to 2014 [24-29]. See Table 3. However, these ratios are almost twice as much as those of developed countries.

TABLE II. China's Total Logistics Costs, 2011-2015 (Trillion Yuan)

	2011	**2012**	**2013**	**2014**	**2015[a] (Jan. – Nov.)**
Transportation	4.4	4.9	5.4	5.6	4.7
Inventory	2.9	3.3	3.6	3.7	3.3
Management	1.1	1.2	1.3	1.3	1.3
Total	8.4	9.4	10.3	10.6	9.3

[a] Data is not available for December 2015

Source: compiled from various Chinese government reports

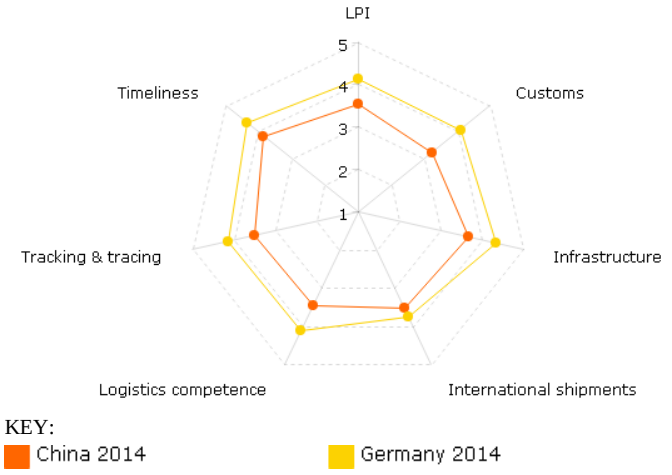
TABLE III. The Ratio of Total Logistics Cost to GDP, 2011-2014 (Trillion Yuan)

	2011	**2012**	**2013**	**2014**
Total logistics costs	8.4	9.4	10.3	10.6
GDP	48.4	53.4	58.8	63.6
Ratio	17.36%	17.60	17.52%	16.67%

Although there are problems in China's logistics industry, cargo owners including European retailers and Chinese suppliers tend to have a positive perspective on the further development of this industry in China. This is because the Logistics Performance Index (LPI) score of China, according to The World Bank [30], was ranked 28th out of 160 in 2014, and 30th, 27th and 26th in 2007, 2010 and 2012 respectively. That is to say, China's performance in logistics is better than around 80% countries in the world. In addition, China was in the second

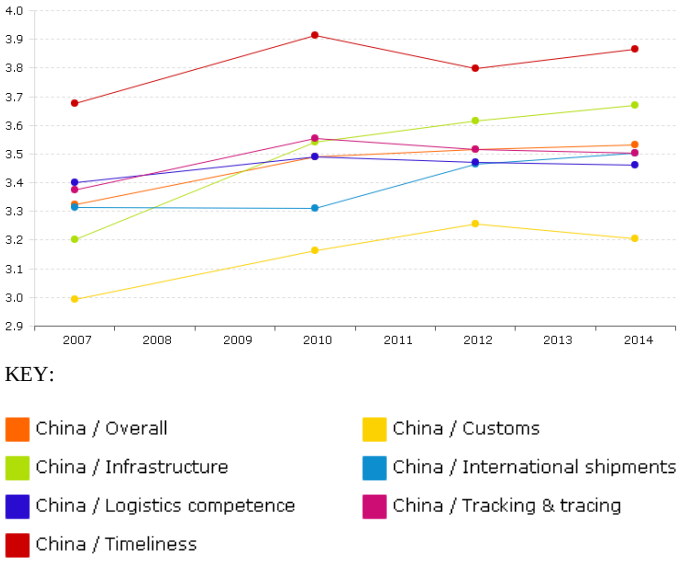
place in the upper middle-income performers group. However, there is still a huge gap between China and developed countries. The LPI score of China in 2014 was 3.53 at 81.1% of the top score (Germany). All G7 countries rank higher than China [31].

As can be seen from Fig. 4, the strength of China is international shipping which ranked 22th in the world in 2014 and the main weakness is customs (38th). Obviously, Chinese government has noticed this impediment and issued a policy in 2015 to improve port and customs services thereby supporting the development of foreign trade (Table 5). In addition, China's performances in infrastructure and international shipping have improved during the period from 2007 to 2014 and the performance in other indicators fluctuated during the same period. See Fig. 5.



Source: The World Bank [32]

Fig. 4. China's LPI against the top performance in 2014



Source: The World Bank [33]

Fig. 5. China's LPI Score, 2007-2014

B. *LSPs' Development in China*

There are a great number of small-sized LSPs in China, with most having only a tiny market share. Although no official data provides the specific number of logistics enterprises operating in China, Wang [34] stated that the number is over 800 thousand in 2012. According to China's Ministry of Commerce (MOFCOM) Department of Circulation Industry Development [35], the top 20 road transport companies in China account for less than 2% of market share. Nearly 40% of the market share is accounted for by self-employed LSPs, with each of them having only one vehicle. In contrast, in America, the top five road transport companies have a 60% market share. The fragmented logistics services in China give rise to low efficiency and high logistics cost. By contrast, big state-owned LSPs normally operate in the rail and ship transport sector, like COSCO and Sinotrans. However, even the biggest companies are not monopolies. They only serve a small segment of the total market. The total revenue of the top 5, top 10 and top 50 LSPs (including domestic and foreign LSPs) in China only accounted for 4%, 5.6% and 8.1% respectively of total social logistics costs in 2013 [36]. In addition, most manufacturers and retailers have their own logistics department, with only 25% cargo being outsourced and transported by 3PLs (third party logistics providers). In Europe, the equivalent figure is higher than 70% [35].

Although domestic and leading foreign LSPs have small market shares in China, they have grown steadily. According to the China Federation of Logistics and Purchasing (CFLP), in 2015, the total main business income of China's top 50 logistics enterprises was 793 billion yuan, up by 1.9% year-on-year [37]. Although they may still have problems with establishing international networks and providing value-added services, they possess comprehensive domestic networks and a good relationship with the government. Foreign LSPs also perform well in China. They have advantages in technology, capital, professional human resources and international logistics networks, which enables them to provide international services and fulfil customer demands. For instance, DB Schenker and ColliCare offer upstream buyer consolidation according to European retailers' requirements, while few Chinese LSPs offering such services can be identified. Certain well-known multinational LSPs who have business in China are listed in Table 4. Their businesses cover freight forwarding, warehousing and international shipping, which are important services related to upstream buyer consolidation.

TABLE IV. MULTINATIONAL LSPS OPERATING IN CHINA

Business Sector	Company Name	The Year of Entering into China
Freight Forwarding	Burlington	2004
	Dachser	2006
International Ocean and Air Shipping	Nippon Express	1995
	Kintetsu Worldwide Express	1996
	Maersk	1998
Warehousing	Prologis	2003
	GLP	2003
	Mapletree	2005

Source: Adapted from Deloitte [36]

As the logistics is the foundation of economic development, Chinese government has issued many related policies in the past few years to support the development of Chinese logistics industry. Table 5 illustrates the major policies. Through the support of these incentives, domestics LSPs have tended to grow at a higher speed and may have the ability to compete with

foreign players in the high-end logistics market in the near future. In addition, foreign LSPs can also benefit from some of these policies.

TABLE V. RELATED POLICIES AND THEIR KEY POINTS

Date of Issue	Issued by	Policy	Key Points
Mar. 2016	NDRC[a]	Some opinions on tackling logistics bottlenecks for promoting effective investment and consumer expenditure (关于加强物流短板建设促进有效投资和居民消费的若干意见 (发改经贸[2016]433号))	- Strengthening the application of information technology - Strengthening intermodal transport facilities - Increasing government support in terms of investment, taxation and land. [38]
Apr. 2015	The State Council	Some opinions on improving port and customs services and supporting the development of foreign trade (国务院关于改进口岸工作支持外贸发展的若干意见(国发〔2015〕16号))	- Strengthening the construction of port infrastructure - Strengthening port services [39]
Nov. 2014	NDRC	Guiding opinions on a credit system to support China's logistics industry (关于我国物流业信用体系建设的指导意见(发改运行[2014]2613号))	- Promoting credit recording and sharing of logistics enterprises [40]
Mar. 2013	MOFCOM[b]	Guiding opinions on accelerating the robust development of the international freight forwarding industry (关于加快国际货运代理物流业健康发展的指导意见)	- Cultivating certain large international logistics enterprises with advanced business model, comprehensive overseas network and strong competitiveness - Cultivating a number of well-equipped medium-sized logistics providers with strong ability to integrate resources - Cultivating a large number of small and medium-sized professional freight forwarders [41]
Feb. 2013	The State Council	Guiding opinions on promoting the orderly and healthy development of the "Internet of Things" (国务院关于推进物联网有序健康发展的指导意见 (国发〔2013〕7号))	- Promoting R&D - Cultivating backbone "Internet of Things" enterprises with international competitiveness [42]
Jan. 2013	MIIT[c]	Guiding opinions on promoting the informatization in the logistics industry (工业和信息化部关于推进物流信息化工作的指导意见 (工信部信〔2013〕7号))	- Improving the informatization level of logistics services from government departments - Improving the informatization level of logistics enterprises [43]

a. NDRC: The National Development and Reform Commission

b. MOFCOM: The Ministry of Commerce

c. MIIT: The Ministry of Industry and Information Technology

C. Challenges of Buyer Consolidation in China

The Challenge of cost reduction. As discussed above, upstream buyer consolidation can save inventory costs because of the lower labor costs, as well as logistics cost from the consolidation centers in Asia to the European retailers due to economies of scale. In this section, intra-China transport costs from suppliers to consolidation centers are considered. According to the China statistical yearbook 2015 [24], road transport dominates the logistics industry. The market share of road hauliers was 75.98% in 2014. Waterway transport is in second place, only accounting for 13.64%, followed by railways. See Table 6 and 7. In addition, more transportation in China is inevitable due to upstream buyer consolidation, because logistics service providers have to transport products from different provinces to one consolidation center rather than choose nearby ports for products in different locations. However, most of these cargoes tend to be transported by road. It is widely recognized that transport by rail and waterways are more cost efficient and less environment damaging than transport by road. Increasingly, road transport gives rise to increased logistics cost due to higher road transport cost and higher toll fees. According to the data from the Zero Power Intelligence Group, 95% of expressways and 61% Class A highways in China are toll roads. At the same time as encouraging private capital to invest in highway construction, logistics costs have increased. Toll fees comprise one-third of transportation cost in China [44].

TABLE VI. FREIGHT TRAFFIC VOLUMES BY DIFFERENT MODES, 2011-2014 (TEN THOUSAND TONNES)

	2011	2012	2013	2014
Total freight traffic	3696961	4100436	4098900	4386800
Railways	393263	390438	396697	381334
Highways	2820100	3188474	3076648	3332838
Waterways	425968	458705	559785	598283
Aviation	557	545	561	593
Pipelines	57073	62274	65209	73752

Source: Adapted from 2015 China statistical yearbook [24]

TABLE VII. FREIGHT TRAFFIC PROPORTIONS BY DIFFERENT MODES, 2011-2014 (TEN THOUSAND TONNES)

	2011	2012	2013	2014
Total freight traffic	100.00 %	100.00 %	100.00 %	100.00 %
Railways	10.64 %	9.52 %	9.68 %	8.69 %
Highways	76.28 %	77.76 %	75.06 %	75.98 %

Waterways	11.52 %	11.19 %	13.66 %	13.64 %
Aviation	0.02 %	0.01 %	0.01 %	0.01 %
Pipelines	1.54 %	1.52 %	1.59 %	1.68 %

The challenge of human resources. The scarcity of professional expertise has long been one of the major challenges in China's logistics industry. Many small and medium-sized LSPs lack necessary management skills and IT systems. For example, many warehouses have poor layout design and lack necessary equipment, with manual work lowering the level of efficiency. Lack of information systems means that these LSPs fail to synchronize data with their customers in real time. In addition, the insufficient ability of communication in foreign languages is also an impediment for domestic LSPs to service potential European clients.

D. Summary

China's logistics market has grown steadily during the past several years and provides a good environment for the development of domestic LSPs. Government also provides incentives to this industry. With the greater maturity of the logistics industry in China, more and more mergers and acquisitions will take place, and thereafter a more concentrated market is likely to appear [45]. New giants may operate in a more efficient way and be able to satisfy the requirements of European retailers by offering various value-added services. In this way, domestic actors may be able to compete with foreign LSPs. However, at this stage, foreign players are, to a large extent, the main service providers of upstream buyer consolidation, although there may be some unidentified Chinese LSPs having the potential ability to offer similar supply chain solutions.

VII. Concluding remarks and implications

A. Conclusions

In this paper, we have mapped the most typical Asia-Europe containerized sea-based supply chain solutions (the BAU solution) against identified alternative solutions based on a literature review and interviews with mid- and high-level managers in COs and LSPs involved in the cargo flows from Asia to Europe. Based on these findings, certain main comparative advantages of these solutions are discussed. Based on this exploratory study, it is concluded that new alternative solutions are worthy of further investigation, mainly due to the potential for gains in cost-efficiency and lower environmental impacts. The added complexity may be addressed by the support of more sophisticated information systems. Potentially lower customer service can also be avoided. The shift from the BAU solution needs to be initiated and driven by key decision makers. These potential change-makers may be different actors according to which Incoterms are applied, and to what extent actors have outsourced their logistics services. A number of impediments have also been identified that need to be overcome in order to facilitate such a shift towards upstream consolidation solutions. This shift cannot be implemented without the support of LSPs in China. Although there are certain challenges faced by local players, their development prospects are promising, because of the robust economic environment, practitioner confidence and the support from the government. Many foreign LSPs are also operating in China, which have advantages in technology, capital, professional human resources and international logistics networks. They may be the main actors to serve this shift at this stage.

B. Limitations and Scope for Further Research

The main limitation of this exploratory research lies in the limited number of respondents, which may or may not be representative of the Asia-Europe container trades at large. All findings in this paper are based on knowledge obtained from previous research and the working experience of practitioners as obtained from interviews. Some of the preliminary findings of this exploratory study need to be corroborated and examined in greater detail. In particular, the assumption that certain concepts may prove more cost-efficient or less environmentally damaging needs to be analyzed and substantiated through further research. Also, the identification of key decision-makers, or rather potential change-makers, is worthy of further investigation. The preliminary identification of conceptual solutions might still not cover all existing configurations, and should probably be augmented through further investigation. A potential redesign of supply chains would inevitably mean that the roles, power and profits of supply chain actors may be affected. This raises a need for further knowledge about how different actors are affected by the different alternative configurations. To this end, incentive problems in supply chain collaborations is also an important area for further research.

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References

[1] UNCTAD, Review of maritime transport 2015. [S.l.]: United Nations, 2015.

[2] E. Pastori, "Modal share of freight transport to and from EU port," 2015.

[3] M. L. Cheong, R. Bhatnagar, and S. C. Graves, "Logistics Network Design with Supplier Consolidation Hubs and Multiple Shipment Options," Journal of Industrial and Management Optimization, vol. 3, 2007.

[4] A. Lovell, R. Saw, and J. Stimson, "Product value-density: managing diversity through supply chain segmentation," International Journal of Logistics Management, vol. 16, pp. 142-158, 2005.

[5] C. Martin, H. Peck, and D. Towill, "A taxonomy for selecting global supply chain strategies," International Journal of Logistics Management, vol. 17, pp. 277-287, 2006.

[6] A. Creazza, F. Dallari, and M. Melacini, "Evaluating logistics network configurations for a global supply chain," Supply Chain Management, vol. 15, pp. 154-164, 2010.

[7] A. Z. Zeng and C. Rossetti, "Developing a framework for evaluating the logistics costs in global sourcing proceses: An implementation and insights," International Journal of Physical Distribution & Logistics Management, vol. 33, pp. 785-803, 2003.

[8] H. M. Hjelle, "Atmospheric Emissions of Short Sea Shipping Compared to Road Transport Through the Peaks and Troughs of Short-Term Market Cycles," Transport Reviews, vol. 34, pp. 379-395, 2014.

[9] L. E. Bygballe, E. Bø, and S. E. Grønland, "Managing international supply: The balance between total costs and customer service," Industrial Marketing Management, vol. 41, pp. 394-401, 4// 2012.

[10] A. Suárez-Alemán, J. Campos, and J. L. Jiménez, "SHORT SEA SHIPPING COMPETITIVENESS AND THE EUROPEAN MARITIME

POLICY A CASE STUDY," presented at the 13th world conference on transport research, Rio de Janeiro, 2013.

[11] K. Vanherle. (2008, 01.02). THE ROAD vs. SHORTSEA "RACE": Comparing both transport modes within an intermodal concept. Available: http://www.shortsea.be/html_en/publicaties/documents/finaal rapport race-EN-101008.pdf

[12] H. M. Hjelle and E. Fridell, When is short sea shipping environmentally competitive?: INTECH Open Access Publisher, 2012.

[13] E. Delhaye, T. Breemersch, K. Vanherle, J. Kehoe, M. Liddane, and K. Riordan, "The competitiveness of European short-sea freight shipping compared with road and rail transport," Final Report, 2010.

[14] EU-Commission, "Short sea shipping: a transport success story," Commission of the European Communities, Energy and Transport DG., Brussels2002.

[15] F. Medda and L. Trujillo, "Short-sea shipping: an analysis of its determinants," Maritime Policy & Management, vol. 37, pp. 285-303, 2010.

[16] K. Button and J. Drexler, "Recovering Costs by Increasing Market Share: An Empirical Critique of the S-Curve," Journal of Transport Economics and Policy, vol. 39, pp. 391-404, Sep 2005 2005.

[17] T. E. Notteboom, "The Time Factor in Liner Shipping Services," Maritime Economics & Logistics, vol. 8, pp. 19-39, Mar 2006 2006.

[18] B. Vernimmen, W. Dullaert, and S. Engelen, "Schedule Unreliability in Liner Shipping: Origins and Consequences for the Hinterland Supply Chain," Maritime Economics & Logistics, vol. 9, pp. 193-213, Sep 2007.

[19] J. Monios and R. Bergqvist, "Using a "virtual joint venture" to facilitate the adoption of intermodal transport," Supply chain management: an international journal, vol. 20, pp. 534-548, 2015.

[20] Y. Ye, Shen, J. and R. Bergqvist, "High Capacity Transport associated with Pre- and Post- Haulage in Intermodal Road-Rail Transport," Journal of Transportation Technologies, vol. 4, p. 13, 2014.

[21] EU-Commission, "Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)," Official Journal of the European Union, vol. 18, p. 2010, 2010.

[22] K. Cullinane and R. Bergqvist, "Emission control areas and their impact on maritime transport," Transportation Research Part D: Transport and Environment, vol. 28, pp. 1-5, 2014.

[23] Safety of Life at Sea (SOLAS) convention, IMO, 2014.

[24] NBS, 2015 China statistical yearbook. Beijing: China Statistics Press, 2015.

[25] NDRC, NBS, and CFLP, "Briefing on China logistics operation 2011," Beijing2011.

[26] NDRC, NBS, and CFLP, "Briefing on China logistics operation 2012," Beijing2012.

[27] NDRC, NBS, and CFLP, "Briefing on China logistics operation 2013," Beijing2013.

[28] NDRC, NBS, and CFLP, "Briefing on China logistics operation 2014," Beijing2014.

[29] NDRC, NBS, and CFLP, "Briefing on China logistics operation 2015 Jan. to Nov.," Beijing2015.

[30] WorldBank, "Full LPI Dataset: 2007, 2010, 2012, 2014," WorldBank, Ed., ed, 2014.

[31] J.-F. Arvis, D. Saslavsky, L. Ojala, B. Shepherd, C. Busch, and A. Raj, "Connecting to compete 2014 - Trade logistics in the global economy: The logistics performance index and its indicators," The World Bank2014.

[32] WordBank. (2014). Country Score Card: China 2014 - Radar. Available: http://lpi.worldbank.org/international/scorecard/radar/254/C/CHN/2014#chartarea

[33] WordBank. (2014). Country Score Card: China 2014 - Line. Available: http://lpi.worldbank.org/international/scorecard/line/254/C/CHN/2014#chartarea

[34] Y. Wang, "The ability of medical logistics in China needs to be enhanced," in Modern Logistics News, ed. Beijing, 2012.

[35] MOFCOM-DCID, "Problems and suggestions on reducing logistics costs in China," Market Modernization, p. 3, 2013.

[36] Deloitte, "Investment Promotion Report of China's Logistics Industry 2014-2015 ", Beijing2015.

[37] CFLP, "Announcements on Top 50 Chinese Logistics Enterprises （WLKZ〔2015〕121）," ed. Beijing, 2015.

[38] Some opinions on tackling logistics bottlenecks for promoting effective investment and consumer expenditure FGJM[2016]433, 2016.

[39] Some opinions on improving port and customs services and supporting the development of foreign trade GF〔2015〕16), 2015.

[40] Guiding opinions on a credit system to support China's logistics industry FGYX[2014]2613, 2014.

[41] Guiding opinions on accelerating the robust development of the international freight forwarding industry 2013.

[42] Guiding opinions on promoting the orderly and healthy development of the "Internet of Things" GF〔2013〕7), 2013.

[43] Guiding opinions on promoting the informatization in the logistics industry MIIT GXBX〔2013〕7, 2013.

[44] ZPIG. (2013, 23.03). Highway investment in China improves logistics costs. Available: http://www.chinairn.com/news/20130603/163442977.html

[45] M.-F. Goh, T. Wang, C. W. Gan, J. Li, and Z. Yu, "China 2015: Transportation and logistics strategies," A. T. Kearney, Beijing2015.