A SYSTEMS VIEW OF SUPPLY NETWORK INTEGRATION IN MARITIME LOGISTICS

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Introduction

Supply chain integration (SCI) is an emerging fashion where manufacturers strategically collaborate with their supply chain partners to manage intra- and inter-organizational processes, in order to achieve effective as well as efficient flows of products and services, and to provide maximum value to the customer. As shipping is a vital component in global supply chains, it is important for maritime logistics service providers to be embedded well in this system. The dominant consideration of research about SCI in maritime logistics has been focused on dyadic relationships between two of the major players in the chain. There has been little research that has looked at this issue from a systems view, and identified the network benefits among all the major players both theoretically and empirically.

Secondly, even though the number of publications considering managing maritime logistics as an integrated chain is increasing, few of them distinguish the different relationship structures that exist between the main players in different situations. According to the view of contingency theory, relationships between relevant firms do not need to be integrated closely through the supply network. The most appropriate supply network relationships should depend on different products or services.

Therefore, this research aims to identify the major players in the maritime logistics network and create conceptual as well as visualized models to analyse the relationships and interactions among them, considering different attributes which may create the different levels of service complexity and matching relationships. In doing so, empirical research obtained through 36 interviews is presented.

Supply chain integration research in maritime logistics area

Previous studies have shown that there are a number of benefits to integration strategies in the maritime transport industry. Notteboom (2004) indicates that competition within container transport industries has not only been reliant on the single player, but on the whole chain. Song and Panayides (2008) and Woo et al. (2012) argue that the integration of ports into supply chains will have a positive impact on port performance, while Carbone and De Martino (2003) and Lam (2013) point out that SCI in the maritime industry will contribute to total supply chain value. However, knowledge of the effective and efficient extent and forms of integration relationships between major players within the maritime logistics chain remains scarce in the literature.

On the other hand, SCI research in the maritime logistics field is largely dominated by analyses on the basis of the dyadic relationship between two of the major members in the chain (limited either to shipping carriers and shippers, or shipping carriers and port operators, or freight forwarders and shippers, or port operators and shippers), which might lead to sub-optimisation bias. The number of publications in managing maritime transport and logistics as an integrated chain are increasing but limited to date (e.g. Heaver, 2002, Panayides, 2006).

A similar trend exists in logistics research, which is gradually moving from the dyadic view to triadic and network perspectives. Since Beier (1989) launched the concept of logistics triads, which involves consignor, consignee and logistics service provider (LSP), a number of studies (Bask, 2001, Larson and Gammelgaard, 2001, Naim et al., 2010) have argued that this logistics triad should succeed the dyad

and be seen as a fundamental building block of logistics provision and supply chain practice (see Figure 1a). Further, as Borgatti and Li (2009) point out, supply chain management research is beginning to see the supply network supplant simple chain and dyadic relationships.

However, it is important to recognise that relationships at different interfaces in the supply chain will vary, all relationships need not be closely integrated and coordinated throughout the supply chain (Cooper et al., 1997). In terms of matching relationships, the contingency approach to logistics, through identifying the most appropriate supply chain for different products with different market characteristics, is widely accepted in the supply chain literature. Bask (2001) indicates that in order to offer services more effectively and efficiently to different needs of shippers and different types of supply chains, that the LSP needs to develop matching inter-business relationships with supply chain and industrial network partners. She distinguishes three types of efficient service relationships: routine service, standard service and customized. While a loose customer relationship and a simple type of service characterise routine services, a close relationship and a complex type of service characterise customised services. The intermediate type of service is entitled standard services.

Such an approach has been applied successfully in general transport and logistics. Naim et al. (2006) developed three logistics service types in terms of their flexibility, and highlight the contingency of collaboration approaches to relationships between carrier, supplier and customer. They also argue that the degree of collaboration is actually dependent on the type of supply chain (efficient versus responsive) and the type of competitive outcome sought. Lagoudis et al. (2010) extend the conceptual work of Naim et al. (2006) through its application to ocean freight transport, in which four secondary-data case studies (liquid market, dry market, container market, ferry market) are conducted. They conclude that shipping companies have to be responsive to a range of different customer demands.

Based on the above, three questions emerge which are tackled through the research below:

- RQ1: Who are the major players in the maritime logistics network?
- RQ2: What is the relationship structure between these major players?
- RQ3: What factors affect the relationships between these major players?

Research method

Starting with a literature review, a conceptual framework was developed by which to visualise the various relationships. Exploratory in-depth interviews were conducted to refine this model and gain industrial insights into the factors affecting the relationships. Semi-structured interviews with 36 interviewees from 21 different companies/organizations/authorities, three site observations and supplementary document analysis were conducted during autumn 2013. The participants included 14 professionals from leading shipping carriers, nine from freight forwarders, eight from port operators and five from cargo owners, from managerial level to operational level in order to provide a wide range of perspectives and verify the initial model in accordance with industry practice. The participants were mainly based in Taiwan, which has well-developed manufacturing and maritime sectors, and the majority of these participants' companies/organizations are involved in global scale business. Most of the participants are senior managers including company owners, chairmen, presidents as well as chief operators, and 67% of them have over 20-years work experience. The site observations include the handling of a container ship in a port, and advanced warehouses which provide vendor-managed inventory, multi-temperature storage and value-added services. Confidentiality of the participant firms was assured according to the Association of Business Schools ethics guide.

The interview questions were asked mainly in line with the concepts of the Bask (2001) and Lambert (2001) models, and consist of three inter-related elements of the supply chain: (1) the structure, e.g. the member firms and their links (relationships); (2) the business processes, e.g. the activities

(supplied services) that provide value to the customer; (3) the management components, e.g. the variables by which the integration can be realized, information and communication technologies (ICTs), and performance measurement. The data were analysed by discourse analysis and an attribute-relationship table.

Framework development

Based on the Bask (2001) model (see Figure 1a), shipping carriers and freight forwarders were included as the maritime logistics service provider (MLSP), and port operators were added as an additional analysis unit within the logistics triad because of their unique and crucial role in the maritime logistics chain suggested by the literature (see Figure 1b). The majority of interviewees agreed with this research setting, but many suggested that there should be other important players who can also significantly influence the freight flow within this chain:

"The major players should include all the service providers who help the cargoes move."

These players include the customs agents, inland transport operators, cargo warehouse operators and government authorities which deal with customs and port governing.

When interviewees were asked who can be the integrator in the maritime logistics chain, some of them indicated that the shipping carriers are more competent than port operators as they are mobile, while others claim freight forwarders could be the integrator as they provide a wider range of services. Some interviewees pointed out that the government sector has public authority and more resources to be the integrator. It is worth noting that interviewees suggested that each major player has their strength to integrate other resources in their own specific area. For instance, shipping carriers could integrate the container transport and terminal operation, freight forwarders could integrate cargo flows, and port operators could integrate inland resources as well as the government authorities:

"The major players have their own industrial clusters, and can act as an integrator in line with their ambitions, resources and needs."

In addition, when interviewees were asked about their vertical integration strategies, most of them stated that they only integrate the most relevant and easier aspects into their in-house operation. In other cases, they intend to take advantage of the resources (or buy the other players' services) in the chain. For example, leading shipping carriers would often invest in their terminal operators to obtain long-term benefits; freight forwarders are interested in owning and managing their own warehouses if needed, but tend not to own land transport fleets as they are harder to manage.

Although there are many relevant players within the maritime logistics chain, the interviewees suggested that only some are capable of coordinating the resources, and willing to do so. From the interviews, the consignor, consignee, MLSP and port operator were confirmed as being able to act as integrators coordinating the other players in the maritime logistics chain. The government sectors are not considered in this study given their role as a regulator rather than dealing with cargo transport (see Figure 1c).

Because the nature of shipping carriers and freight forwarders are very different to each other from the perspectives of assets ownership, expertise of core business and range of services offered, many interviewees strongly suggested they should be divided into two analysing units instead of only single MLSP. In order to keep the balance between convenience of data collection and practical reality, we decided to limit the focus on the network made by the aforementioned integrators, which includes consignor, consignee, shipping carriers, freight forwarders and port operators as the major players (see Figure 1d). Consequently the initial triadic conceptual model has been revised as a more complicated network framework in the maritime logistics context, and the evolved diagram could be a useful visual tool to describe and discuss the relationships structure within this network.

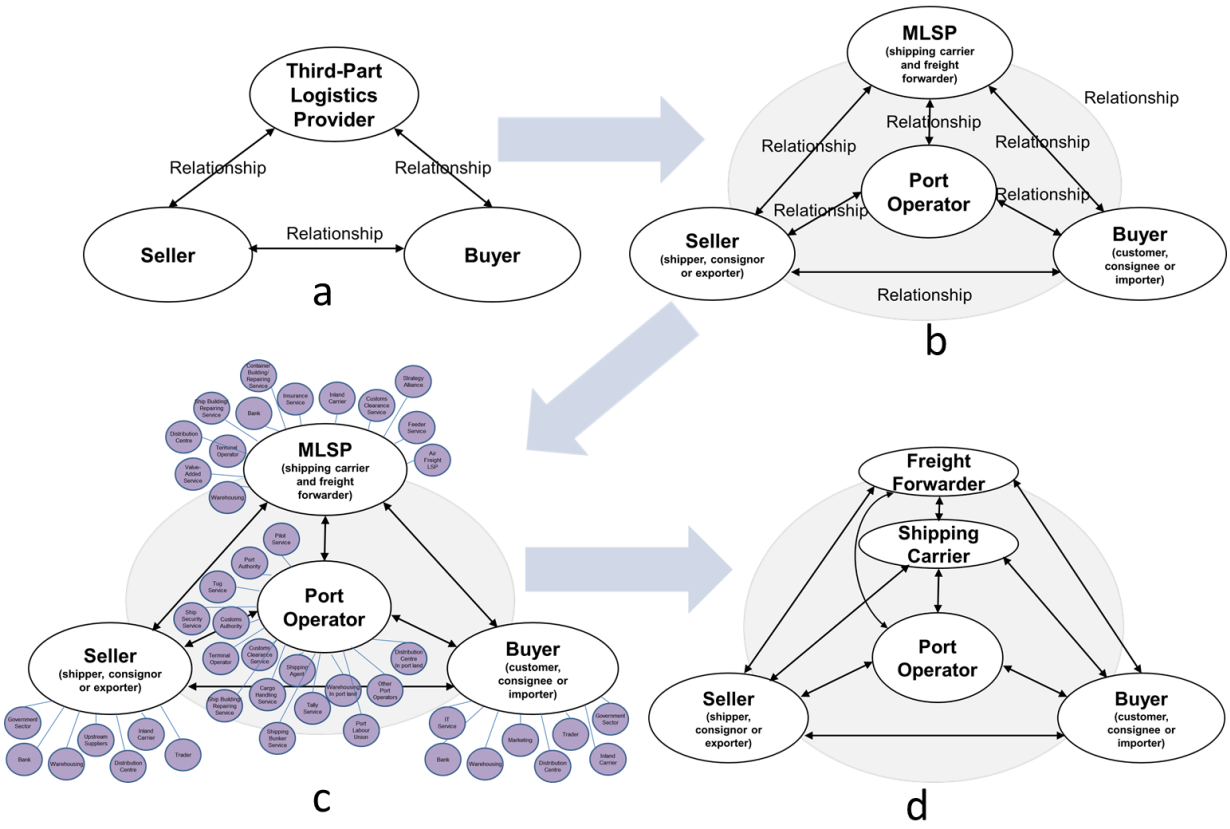

Figure 1: Evolution of the maritime logistics network (source: authors developed from Bask 2001)

Strengths of relationship

The interviewees highlighted that a wide range of attributes, and not only service complexity, influence the relationships between the major players within the maritime logistics network. These different existing relationship structures caused by different attributes found in the interviews are detailed below, with a summary in Table 1.

By trade terms (CNF, FOB)

The Incoterms (International Commercial Terms) rules published by the International Chamber of Commerce (ICC) that are widely used in international commercial transactions or procurement processes, are intended primarily to clearly communicate the tasks, costs, and risks associated with the transportation and delivery of goods. Theoretically, sellers (consignors) and buyers (consignees) are different players sitting at the two ends of the maritime supply chain. However, in practice, logistics service providers only have a direct relationship with one of them, depending on the trade term pre-defined in the Incoterms. For example, if the trade term is CNF (Cost and Freight), by which the sellers must pay the costs and freight to bring the goods to the port of destination, the interactions will occur between the MLSPs and the sellers. In contrast, if the trade term is FOB (Free on Board), by which the buyers arrange for the vessel and pay the cost of marine freight transportation, insurance, unloading and transportation cost from the arrival port to destination, the MLSP will have more interactions with the buyers. In Table 1, we simplify the number of relationships by only referring to the cargo owner.

"The consignor and consignee should be summarized as the cargo owner who is responsible for paying the freight, can ultimately decide on the shipping, and easier to be recognized."

	Cargo Type		Service Complexity			Trade Route			Port Type				Cargo Owner Type		Market Type	
	FCL	LCL	R	S	C	US	EU	IA	NV	V	T	I/E	M	B/R	L	T
R1	++	+++	+	++	+++	+	+++	+++	+	++	+	+	++	+++	++	+
R2	++	0	+	++	+++	+++	++	++	+	+	+	+	+	++	++	+++
R3	0	0	0	0	+	+	++	++	0	++	0	++	0	+	0	+++
R4	++	+++	+	++	+++	+	+	+	+	+	+	+	++	+	+	++
R5	0	++	0	+	+	0	+	+	0	+++	+	++	0	0	0	0
R6	+	+	+	++	+++	++	+	+	+	++	+++	++	+	+	+	+++

R1: Relationship between cargo owners and freight forwarders
R2: Relationship between cargo owners and shipping carriers
R3: Relationship between cargo owners and port operators
R4: Relationship between freight forwarders and shipping carriers
R5: Relationship between freight forwarders and port operators
R6: Relationship between shipping carriers and port operators

0 = No relationship
\+ = Loose relationship
++ = Medium relationship
+++ = Close relationship

Table 1: Relationship structures between major players in maritime logistics chain (source: authors)

By cargo type: Full container load [FCL in Table 1], Less-than-container load [LCL]
There are two cargo types, which are distinguished by whether they can fill a container. They are the full-container-load (also known as container yard cargo) and the less-than-container-load (also known as container freight station cargo). Shipping carriers are more interested in and mainly deal with FCL cargoes in container yards located at shipside. These are usually booked by large cargo owners and freight forwarders. LCL cargos usually come from many small cargo owners, and need to be consolidated in the container freight station by freight forwarders before they are delivered to container yards and then passed to shipping carriers. Freight forwarders can also receive FCL cargoes from cargo owners. Therefore, in the case of FCL cargo, both shipping carriers and freight forwarders will have business relationships with cargo owners. In the case of LCL cargo, freight forwarders will have more opportunities to build close relationships with the cargo owners, and freight forwarders become the shipping carriers' main customers.

By service complexity: Routine [R], Standard [S], Customized [C]
Many participants pointed out that from the perspective of containerised transport, the degree of complexity/customization for services could be categorised by the different types of container or operation which can deal with three types of cargo including general purpose cargo (by dry cargo container), reefer cargo (by reefer container) and out of gauge (OOG)/project cargo.

The dry cargo containers provide the simplest services for general purpose cargo (e.g. commodities, recycling waste) that do not contain any specific arrangements. These services are volume-based, and the most important factors in decision making are competitive price and ease of service procurement. The reefer container services provide some degree of customised operations for temperature-sensitive cargoes (e.g. fruit, sea food, meat, flowers, high-tech parts and chemicals), which include air ventilation, temperature setting, controlling and monitoring. Not all of the MLSPs have equivalent facilities and specialists to offer such services.

The OOG/project cargo services are the most complicated and highly customised services, and could include transportation of large, heavy, high value, critical pieces of equipment. The items made of various components need to be disassembled for shipment and reassembled after delivery. Some participants shared their experiences for delivering yachts, helicopters, sensitive equipment, turnkeys, exhibiting antiquities and project cargo management for their customers. These highly specialist shipments require individual transport planning from origin to destination, and all players

work as a team to deal with these tasks. The rationales behind such services are economies of scope, basing on long-term contracts, and the requirements of special knowledge, facilities and marketing channels. There are often only a few providers which can offer such services.

It was found that the more complexity/customisation of the services, the closer the relationship should be kept between the MLSPs and cargo owners. For instance, an increasing level of complexity or customization increases the possibilities that customers have to influence services output and services flexibility, and calls for more joint work between the cargo owners and MLSPs, from planning to operations. In addition, more communication, information sharing and application of IT technology are needed. This type of service often causes high transaction costs because of dedicated investment, but can also develop strong loyalty from the customers. Many interviewees noted that highly complex or customised services imply gaining higher financial revenues but also higher risk.

By trade route: North America [US], Europe [EU], Intra-Asia [IA]
According to the literature, maritime trade is dominated by three economic centres, namely North America, Europe and Asia Pacific. MLSPs in such different regions have seen different trends in service offering, which has significantly influenced the relationships among cargo owners, shipping carriers, freight forwarders and port operators. The reasons for such different trends include historical evolution, the power of freight forwarders, geographical difference and the length of shipping routes. Interviewees highlighted that freight forwarders in western Europe and Asia Pacific tend to offer more integrated services than those in North America. In North America, shipping carriers usually need to provide shipping and inland rail or truck services to cargo owners' depots, but they only need to provide shipping services in western Europe, as traditionally, inland transports in this area are mainly managed by freight forwarders. In terms of intra-Asia routes, which are shorter shipping routes, shipping carriers and freight forwarders need to spend more time in communicating with cargo owners, dealing with relevant documents and making quick responses. In such cases, both need to keep closer relationships with cargo owners.

By port type: Non-value-added [NV], Value-added [V]; Transhipment [T], Import/Export [IE]
Many participants mentioned that port operators usually have no direct relationships with cargo owners (and freight forwarders), but if port operators could provide the value-added services or spaces to operate these activities for cargoes (e.g. multi-national container consolidation, re-export, distribution centre or free trade zone), they may have more opportunities to establish direct relationships with these two players. This could reflect the point suggested by some interviewees, that is landlord ports will have more possibilities than public ports to establish relationships with other players. In the case of service ports, port authorities own the land and all available assets, and perform all regulatory and port functions. In the case of landlord ports, the port authorities maintain ownership of the ports and the infrastructures are leased to private operating companies. These initiatives should lead to more traffic and value-added services and more interactions with other players.

Some interviewees also pointed out that relationship structures can be influenced by whether the ports mainly operate transhipment or import/export cargoes. The shipping carriers could only decide which transhipment ports they call at, while import/export ports usually are decided by cargo owners. Therefore, transhipment ports have closer relationships with shipping carriers, and import/export ports should keep closer relationship with cargo owners. One example was mentioned that the Port of Rotterdam encourages local buyers (cargo owners) to apply the FOB trade term to indirectly arrange shipping carriers to call at this port.

By cargo owner type: Manufacturer [M], Brander/retailer [B/R]
The previous literature often emphasizes that many manufacturers have adopted global logistics strategies rather than simply relying on conventionally segregated shipping or forwarding activities

(Notteboom and Merckx 2006). However, it was found that different types of cargo owner have different logistics outsourcing strategies. Compared with manufacturers, branders (e.g. ASUS, Acer) and large retailers (e.g. Wal-mart) usually dominate the logistics process. The branders and retailers, with their strong bargaining power, tend to contract with freight forwarders and shipping carriers separately, while manufacturers tend to accommodate their customer's logistics arrangement or contract with freight forwarders to make them deal with all the logistics processes.

By shipping market: Liner shipping [L], tramp shipping [T]

Although this research mainly looks at the liner containerised cargo transport, some participants mentioned that tramp shipping which carries bulk cargo is based on very different supply chains and has very different relationship structures within the maritime logistics network. In practice, the buyers of tramp cargoes tend to choose destination ports, allocate proper storage areas at the quayside, manage the ocean transport and terminal operation at the port on their own, which will cause them to be closer to port operators directly, rather than through ocean carriers:

"Most of the state-owned and large tramp cargo buyers act as the cargo owner, shipping carrier and terminal operator in the port area at the same time."

Discussion and conclusion

For RQ1, cargo owners, shipping carriers, freight forwarders and port operators are the major players in the maritime logistics network. For RQ2, referring to the Figure 1d which evolved from the logistics triad, these major players have more complicated network relationships, and need to be looked at from a systems view. For RQ3, a wide range of attributes including industrial practice and service complexity, influence the relationships between the major players within this network.

The originality in this study is using a systems view to analyse supply network integration in maritime logistics empirically, which reflects the emerging appeals by maritime researchers (e.g. Carbone and De Martino, 2003, Song and Panayides, 2008, Woo et al., 2012, Lam, 2013), while also taking into account the contingency of different circumstances. This paper adds evidence in identifying the interactions between the major players in the maritime logistics chain based on a network consideration rather than simple dyads. This verifies Magala and Sammons' (2008) statement which the choice of a port made by the shipping carrier could be interrelated to the choice made by the cargo owner, and both choices are only one part of the supply chain selection process. Likewise, the choice of a maritime transport chain by shipping carriers, ports and cargo owners is considered to be jointly rather than independently determined (Talley and Ng, 2013).

On the other hand, while the contingency method is widely applied in SCM research, maritime research still overemphasises the close integration through all the maritime logistics chain (e.g. Nassirnia and Robinson, 2013). This paper has successfully verified the different relationship structures within the maritime logistics network by different cargo attributes, which could move maritime research forward. In addition, three types of transport service for containerised cargo and the matching relationships by the degree of complexity/customisation have been identified. These are in line with the logistics strategies for routine, standard and customized services (Bask, 2001).

This research contributes to academia by offering a systems view and a visualized tool to analyse the industrial relationships within the maritime logistics network. The research framework could also apply to other modes in international transport. For industry and policy makers, this study will provide a foundation for the above major players to develop effective and efficient collaborative and integration strategies in the industry, and help policy makers to gain a deeper understanding of the maritime logistics industry's network structure in order to design policies fit for purpose. Future research could also consider the network benefits from different relationship structures. In terms of limitations, the framework and findings in this study were developed mainly based on qualitative

interviews conducted with participants in Taiwanese industry. More participants and further quantitative methods could be involved to overcome this.

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