The impact of collaborative decision-making on logistics service performance for container shipping services

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Abstract

Purpose – The increasing demand for high-quality logistics services has forced container shipping firms to decrease logistics service failure to retain the customers. This study thus aims to apply organizational information processing theory (OIPT) to construct a maritime supply chain collaborative decision-making model and examine its impact on logistics service performance.

Design/methodology/approach – In total, 142 usable questionnaires were collected from questionnaire survey. A two-step structural equation modeling approach including confirmatory factor analysis was subsequently performed to test the hypotheses.

Findings – The results show that internal information integration positively impacts external information integration, that external information integration positively impacts collaborative decision-making, and that collaborative decision-making positively impacts logistics service performance for container shipping firms. However, a relationship between internal information integration and collaborative decision-making was not found in this study.

Research limitations/implications – This study primarily examines collaborative decision-making from the view of container shipping firms. Future research including other supply chain members is needed to generalize the results and could also incorporate other factors such as relationship quality and culture, into the model to address this issue.

Practical implications – To decrease the occurrence of logistics failures and improve service quality in the maritime logistics process, it is suggested that container shipping firms apply information technology for acquiring and assimilating logistics information internally and externally across the supply chain to facilitate decision-making.

Originality/value – This study contributes to the knowledge about the antecedents and impacts of collaborative decision-making for container shipping firms in Taiwan. Particularly, in line with OITP, the

findings indicate that container shipping firms can facilitate logistics decision-making and strategy formulation through information integration, which in turn enhances logistics service performance.

Keywords Organizational information processing theory, Logistics information integration, Collaborative decision-making, Container shipping firms, Logistics service performance

Paper type Research paper

1. Introduction

Globalization has forced firms to increasingly outsource their logistics activities to third-party logistics providers to decrease cost and improve quality. Apparently, multinational enterprises have expanded their supply chain networks to span the world. Organizations thus no longer compete as solely autonomous entities but as supply chains (Christopher, 1998). Facing this dynamic and complex environment of global competition, organizations should conceive methods of effectively controlling their supply chains. The concept of supply chain management (SCM) advocates the close collaboration of partners to provide superior services to the end customers at the lowest cost and also to build a long-term relationship with their partners. Thus, the new prospect of SCM entails the connection or integration of all members and activities within a supply chain, thereby enhancing the competitiveness of the entire supply chain.

Supply chain collaboration in the container shipping context can be defined as the extent to which container shipping firms and their partners jointly work to ensure service reliability, value-added service, productivity and superior logistics service performance (Seo *et al.*, 2016). Given that collaboration can positively lead to superior performance and competitiveness in maritime logistics (Seo *et al.*, 2016), logistics enterprises should endeavor not only to enhance their internal logistics operations but also to integrate the relative resources and capabilities held by all of the members of the supply chain, such as suppliers and customers, into a comprehensive value chain. Enterprises can thus create service value for their customers and enhance their competitiveness by integrating their supply chain activities. Specifically, the adoption of information and communication technologies has been proven to integrate and facilitate business processes and operations in the supply chain (Lee *et al.*, 2007). Thus, enterprises that use information technologies can effectively communicate, coordinate, collaborate and solve problems both intrinsically and extrinsically.

Given a dynamic marketplace, organizational information processing theory (OIPT) asserts that the possession of information processing capability could help organizations cope with environmental uncertainty. Thus, the sources of additional capacities rely on collaboration and establishment of linkages across internal and external functions to acquire and manage available internal as well as external resources (Galbraith, 1973; Fan *et al.*, 2016). Internal and external integration decrease information processing needs and increase information processing capacity by establishing electronic linkages and collaboration with upstream and downstream partners. Thus, information sharing has been suggested to be beneficial in supply chain decisions and firm success (Closs and Savitskie, 2003; Viet *et al.*, 2018), and the provision of real-time information promotes the successful completion of various activities within and between organizations.

In line with this theory, firms require integration among internal functions and with external partners to coordinate tasks in a supply chain. Accordingly, to manage complex business activities within supply chains, enterprises can effectively integrate supply chain information to stimulate information sharing between partners and reduce unnecessary expenditures. Moreover, information sharing and integration could help managers to effectively make decisions under environmental uncertainty, which in turn improves their

logistics and operations performance (Closs and Savitskie, 2003; Wong *et al.*, 2012; Raweewan and Ferrell, 2018; Viet *et al.*, 2018; Zhang and Cao, 2018).

Container shipping carries more than 90% of the world's goods and thus plays an important role in facilitating international trade (Lai *et al.*, 2013; Yang and Wei, 2013). It bridges the gap between shippers and consignees and connects all entities in the supply chain (Closs and McGarrell, 2004; Lee and Song, 2010) . With the increasing demand for one-stop shopping logistics services, it is imperative for container shipping firms to share information and collaborate with other supply chain members. Specifically, information integration and supply chain collaboration have been demonstrated to facilitate joint decision-making between firms and strategy formulation, which in turn leads to superior performance (Kim and Lee, 2010; Seo *et al.*, 2016).

Although the topic of collaboration has gained considerable attention in the fields of logistics and SCM, most of these studies have addressed the antecedents and advantages of collaboration and its impact on organizational performance (Cao and Zhang, 2010; Kim and Lee, 2010; Seo *et al.*, 2016; Zhang and Cao, 2018; Jimenez-Jimenez *et al.*, 2019). Moreover, to the best of our knowledge, with the exception of Wong *et al.*'s work (2015), few studies have examined the antecedent and impact of collaborative decision-making for container shipping firms. Thus, this study aims to empirically investigate the relationships among logistics information integration, collaborative decision-making and logistics service performance for container shipping firms based on OIPT.

There are five sections in this study. Section 1 introduces the research background, motivation and purposes. Section 2 reviews the literature on organizational information process theory, logistics information integration, collaborative decision-making and logistics service performance. A conceptual model and research hypotheses are subsequently proposed. Section 3 presents the methodology, including questionnaire design, measurements, sampling technique and research methods. The results of the analysis will be presented in Section 4, and conclusions and several managerial implications are discussed in Section 5.

2. Theoretical background and hypotheses development

2.1 Organizational information processing theory

A complex supply chain involves various parties and, hence, each partner is exposed to environmental uncertainties in an open logistics system. Such a dynamic and uncertain marketplace has led to complex decision-making. To respond to such uncertainties within a supply chain, all supply chain members have to be integrated into the whole with enhanced information sharing (Brush and Artz, 1999; Cegielski *et al.*, 2012). In particular, information has been proven to be a key driver in making supply chain decisions (Viet *et al.*, 2018). Thus, a firm's ability to effectively acquire and integrate supply chain information within a supply chain can reduce the costs of logistics operations and improve service performance.

Galbraith (1973) developed OIPT and argued that increasing information processing capability would help organizations cope with environmental uncertainty and thereby improve their decision-making ability. Ground in OIPT theory, Leuschner *et al.* (2013) also pointed out that when an organization increases flow and quantity of information, it could help decision-makers improve organizational performance as well as supply chain performance. An organization typically can enhance its information processing capability in several ways, namely, sharing information with supply chain partners, connecting and linking with supply chain partners through information technology (IT) infrastructure, collaborating with supply chain partners and providing a predictable business environment (Wong *et al.*, 2015). Hence, the OIPT can be used for explaining the relationship between a supply chain's information integration and its decision-making, positing that this

collaborative decision-making enables partners to make use of the information they collect from their activities to boost their logistics service performance.

2.2 Logistics information integration and collaborative decision-making

Organizations are open social systems and hence must process information to reduce uncertainty and equivocality. If logistics enterprises can effectively apply and integrate their IT to build a supply chain system, they can facilitate decision-making and strategy formulation to respond quickly to environmental changes (Closs and Savitskie, 2003; Seo *et al.*, 2016). Hence, information integration is a strategic action and is essential within business units and between organizations (Daft and Lengel, 1986; Lee *et al.*, 2007). Integration in the logistics context refers to a series of logistics processes that involve both internal and external collaborations (Mellat-Parast and Spillan, 2014). Information integration therefore can be defined as *the coordination of information sharing/transfer, collaborative communication and supporting technology across firms in a supply chain* (Leuschner *et al.*, 2013, p. 38). Thus, information related to logistics activities should be shared within and across organizational boundaries to facilitate decision-making with logistics partners (Kulp *et al.*, 2004).

Logistics information integration in general includes internal and external information integration (Closs and Savitskie, 2003; Zhao *et al.*, 2011). Internal information integration refers to spanning internal functional boundaries and sharing timely and accurate logistics activities information across the key functions within the business unit (Closs and Savitskie, 2003; Wong *et al.*, 2011). External information integration, on the other hand, is related to information sharing and communication beyond organizational boundaries (Closs and Savitskie, 2003; Wong *et al.*, 2015).

Information integration is characterized by building electronic linkages with other partners. Organizations need to invest in IT infrastructure and adopt technologies for facilitating interdepartmental communication and information exchange (Closs and Savitskie, 2003). Moreover, it connects and provides a platform in support of electronic linkages with supply chain partners (Wong *et al.*, 2015). Accordingly, prior studies have argued that internal information integration facilitates external information integration (Zhao *et al.*, 2011; Liu and Lee, 2018).

Given that enterprises cannot survive without collaboration along the supply chain, logistics information sharing and integration have been regarded as crucial drivers of joint decision-making, which in turn improves logistics service performance and organizational performance (Kim and Lee, 2010; Wong *et al.*, 2015; Raweewan and Ferrell, 2018; Viet *et al.*, 2018). Joint decision-making has been defined as the process by which supply chain partners coordinate activities in supply chain planning and operations to maximize supply chain performance. It generally refers to planning, integrating information, resolving problems and developing rules and regulations and procedures (Cao and Zhang, 2012; Shahbaz *et al.*, 2018).

Wong *et al.* (2015) found that the information integration for trading companies along the supply chain was positively related to collaborative decision-making in terms of procurement, market analysis, design of the distribution network, development of new products, controlling product quality and planning production. In particular, collaborative decision-making positively impacts customer service performance under a high level of IT infrastructure development. Zhang and Cao (2018) pointed out that collaborative culture could directly impact supply chain collaboration and be mediated by the use of interorganizational systems. Moreover, the value of information in supply chain decisions has been demonstrated in prior studies (Raweewan and Ferrell, 2018; Viet *et al.*, 2018). In summary, well-integrated logistics information can help supply chain partners provide timely, quality and accurate information

within departments and beyond organizations to facilitate decision-making (Closs and Savitskie, 2003; Bernstein and Hass, 2008). To successfully make joint decisions to reduce the occurrence of logistics service failures along the supply chain, all supply chain partners must share information through information integration channels.

2.3 Collaborative decision-making and logistics service performance

Collaboration is an important issue in the logistics and SCM research field. It refers to two or more parties working together by integrating and sharing information to conduct their business practices and further improve their joint performance (Ralston *et al.*, 2017). In general, supply chain collaborative activities include information sharing, joint activities, collaboration decision-making, risk and complementary resource sharing (Jap, 2001; Cao and Zhang, 2010; Um and Kim, 2019). Thus, decisions for SCM activities include demand forecasting, product design, production planning, distribution network design, transportation planning, site location and inventory control (Premkumar, 2000). Cao *et al.* (2010) noted that joint decision-making aimed to align supply chain partners and to jointly make decisions on order placement, inventory replenishment and order delivery. Viet *et al.* (2018) reviewed prior studies and classified supply chain decisions into five types, namely, facilities, inventory, transportation, sourcing and pricing. With respect to the container shipping context, the maritime supply chain is defined as the connected series of activities related to shipping services that is involved with planning, coordinating and controlling containerized cargoes from shippers to consignees (Lam, 2011). Thus, collaborative decision-making refers to jointly making logistics decisions pertaining to transportation, freight forwarding, warehousing, customs clearance, insurance and value-added services among maritime supply chain members.

A large number of prior studies have proven the effect of collaborative decision-making on performance (Cousins, 2005; Kim and Lee, 2010; Cao and Zhang, 2010; Wong *et al.*, 2015; Shahbaz *et al.*, 2018). Fugate *et al.* (2009) found that strategic relationships between shippers and carrier firms impact operational decisions. Kim and Lee (2010) classified supply chain collaboration into systems and strategic collaboration. Both systems collaboration and strategic collaboration were found to have positive impacts on supply chain responsiveness, whereas the impact of collaboration on market performance was mediated by supply chain responsiveness. Cao and Zhang (2010) pointed out that the advantages of supply chain collaboration include process efficiency, offering flexibility, business synergy, quality and innovation. These benefits may be achieved in the long term but are indeed a crucial driver of service performance and firm performance. Jimenze-Jimenze *et al.* (2019) also demonstrated that supply chain collaboration had a positive impact on innovation performance.

Wong *et al.* (2015) argued that IT-enabled collaborative decision-making was positively associated with trading companies' customer service performance, such as quick response, on-time delivery, flexibility and few errors in fulfilling customer orders. Seo *et al.* (2016) found that decision harmonization positively led to business synergy, quality, innovation and flexibility, which in turn improved port performance in maritime logistics. In summary, through collaborative decision-making, container shipping firms can decrease the probability of decision errors and the occurrence of logistics service failures to respond to this uncertain and dynamic marketplace, which in turn improves their service performance and organizational performance.

2.4 Logistics service performance

Container shipping firms can create value for shippers by providing a number of logistics service attributes, such as transportation, cargo tracking, storage, warehousing, customs

clearance, consolidation and so on (Lu and Yang, 2010). To measure the efficiency of resource allocation and logistics service quality, it is imperative for container shipping firms to assess the outcomes for logistics activities, thereby bridging the service gap and further increasing customer satisfaction and customer loyalty. Logistics is a time-based and customer-oriented activity along the supply chain (Yeung, 2006). A number of performance indicators, therefore, were used to measure container shipping firms' logistics service performance, such as service quality, flexibility, customer response, cost, delivery and effectiveness in solving problems (Stank *et al.*, 2001; Closs and Savitskie, 2003; Panayides, 2007; Wong *et al.*, 2011; Liu and Lee, 2018; Shou *et al.*, 2018). To comprehensively and accurately measure the logistics service performance for container shipping firms, a multidimensional model with five performance indicators and perceptual measures was used to measure logistics service performance in this study.

In summary, grounded in organizational information processing theory and based on the aforementioned discussions pertaining to logistics information integration, collaborative decision-making and logistics service performance, a conceptual framework portraying the network of relationships among the latent factors and the research hypotheses was proposed and illustrated in Figure 1. A number of research hypotheses were also formulated as follows:

H1. Internal information integration is positively associated with external information integration for container shipping firms.

H2. Internal information integration is positively associated with collaborative decision-making for container shipping firms.

H3. External information integration is positively associated with collaborative decision-making for container shipping firms.

H4. Collaborative decision-making is positively associated with logistics service performance for container shipping firms.

3. Methodology

3.1 Questionnaire design and measures

A questionnaire survey was used to collect the research data, and several ways were conducted to ensure the validity of the construct in this study. First, the process for questionnaire design was based on Churchill and Iacobucci's (2010) study. Specifically, all measures and questionnaire items were adapted from the literature review and can be seen
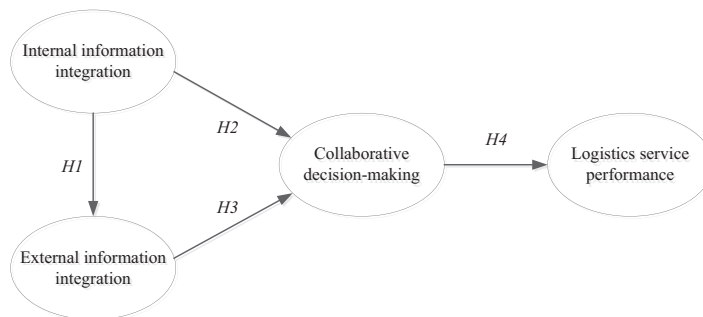

Figure 1.
Research framework

in Appendix. An instrument with eight items adopted from prior studies (Closs and Savitskie, 2003; Wong *et al.*, 2015) and five items adopted from Wong *et al.* (2015) was used to measure collaborative decision-making, and five items identified from prior studies (Closs and Savitskie, 2003; Panayides, 2007) were used to measure logistics service information. To ensure the content validity of the construct, an expert interview with five container shipping practitioners was conducted during the questionnaire design process. Second, pretesting was performed by distributing a draft questionnaire to five shipping and logistics experts who are studying the Executive Master of Business Administration program on Shipping and Transportation Management at National Kaohsiung University of Science and Technology. Finally, a pilot test with 20 shipping executives from container shipping firms in Kaohsiung, Taiwan, was conducted to improve the questionnaire. The results show that there was no particular confusion with respect to format or wording used in the questionnaire.

The final version of the questionnaire comprises five parts. Part 1 comprises the profiles of respondents and their companies. Part 2 is concerned with the internal and external information integration of container shipping firms. Part 3 is concerned with collaborative decision-making on logistics operations. The final part addresses the logistics service performance for container shipping firms. All question items in our survey were measured using a five-point Likert scale, where 1 corresponded to "strongly disagree" and 5 represented "strongly agree".

3.2 Sample techniques and non-response bias

This study evaluates the impact of collaborative decision-making on logistics service performance for container shipping service firms. Given that container shipping agencies and ocean freight forwarders provide logistics and transport services to shippers, these parties were therefore regarded as container shipping firms from a service provider's perspective in this study. The sample of container shipping firms was thus drawn from the *Directory of the National Association of Shipping Agencies and Companies* and the *Members of the International Ocean Freight Forwarders and Logistics Association* in Taiwan. The survey questionnaire with a cover letter and postage-paid return envelope was sent to 500 managers. The initial mailing elicited 102 responses. A follow-up mailing was sent one month after the initial mailing, and an additional 40 responses were returned. The total number of usable responses was therefore 142, yielding an overall response rate of 28.4%.

To address the potential problem of the non-response bias issue in the mail survey, the dataset was divided into two groups, namely, early ($n = 102$) and late ($n = 40$) respondents, based on their response wave, which was based on Armstrong and Overton's (1977) recommendation. Thus, a *t*-test was conducted to compare the difference between two groups' means for dependent and independent variables. The results showed that there were no significant differences between the two groups' perceptions of agreement with various items at the 5% significance level, suggesting that non-response bias was not a problem.

3.3 Research methods

Several multivariate data analysis techniques were conducted to test the research hypotheses in this study. First, descriptive analysis was used to evaluate respondents' perceptions on each dimension. Second, a reliability test with Cronbach's alpha and corrected item-total correlation (CITC) was conducted to assess the internal consistency and reliability of each dimension. Finally, a two-step structural equation modeling (SEM) approach suggested by Anderson and Gerbing (1988) was performed to examine the research hypotheses. A confirmatory factor analysis (CFA) was first conducted to assess the

validity of the proposed model. Once the proposed mode was purified, the SEM approach was subsequently performed to test the research hypotheses.

4. Results of empirical analysis

4.1 Characteristics of respondents and their companies

The profiles of respondents showed that a majority of the respondents (31.7%) were in the position of managers or assistant managers, and 18.3% were vice presidents or above, suggesting that approximately 50% of the respondents were in the position of managers or above. With respect to the respondents' work experiences, the results showed that 16.2% of the respondents had worked in the container shipping industry for more than 10 years, whereas 24.6% of the respondents had worked for between 6 and 10 years. As half of the respondents were managers or above – i.e. positions involved in decision-making in their companies – this shows that they had abundant practical experience with which to answer the questions regarding collaborative decision-making, which enhances the reliability of the survey findings.

The results also showed that 74.6% of the respondents were local firms, and the remaining were foreign-owned firms. Regarding the type of business, 55.6% of the respondents were from ocean freight forwarders, followed by liner shipping companies (22.5%), liner shipping agencies (16.2%) and other logistics-related firms (5.6%). In terms of the number of employees, 42.2% of the responding firms had between 101 and 500 employees, 15.5% had more than 1,001 employees, and only 9.2% had between 501 and 1,000 employees. The results also revealed that 38.3% of the respondents reported that their firms' annual revenue was between NT$101m and NT$1,000m, approximately 40% of the responding firms had an annual revenue of NT$1,001m or more, and 15% of the responding firms' annual revenue was NT$50m or less.

4.2 Descriptive statistics and reliability test

Table 1 shows the descriptive statistics for each factor. The results indicated that logistics service performance was perceived by the respondents as the highest agreement level of factor (mean = 4.113), followed by internal information integration (mean = 4.097), external information integration (mean = 3.782) and collaborative decision-making (mean = 3.739). The results showed that container shipping firms did not perform well in external information integration and collaborative decision-making.

This study further illustrates the agreement level about logistics decision-making perceived by respondents. The results indicated that jointly solving customs clearance problems (mean = 4.021) was perceived by the respondents as the highest agreement activity, followed by jointly coordinating the needs of cargo space (mean = 3.866), jointly planning delivery routes (mean = 3.648), jointly conducting market analysis (mean = 3.620) and jointly developing new logistics services (mean = 3.577). The results indicated that container shipping firms mainly focused on systems collaboration, which may be because of business secrets.

Dimensions	No. of items	Mean	SD	α	Range of CITC
Internal information integration	4	4.097	0.753	0.911	0.752–0.841
External information integration	4	3.782	0.942	0.936	0.744–0.899
Collaborative decision-making	5	3.739	0.847	0.941	0.817–0.881
Logistics service performance	5	4.113	0.643	0.863	0.572–0.748

Table 1.
Descriptive statistics and reliability test

4.3 Validity of the measurement model

Before testing the research hypotheses, it is important to ensure the validity of the measurement model. Following Anderson and Garbing's (1988) two-step SEM approach, a CFA was first conducted in this study to purify the validity of the measurement model. The CFA results, as shown in Table 2, showed that the χ^2 value (χ^2(129) = 221.815, p = 0.000) was statistically significant at the 0.05 level of significance, implying that the model was discredited. It is important to note that the significance level of chi-square statistics is very sensitive to sample size. Thus, other model-fit indices should also be considered in assessing model adequacy (Koufteros, 1999). Table 2 shows that the value of the ratio of chi-square to degrees of freedom (also called normed chi-square) was 1.719, below the threshold level of 2. In addition, other absolute fit indices, such as root mean square residual (RMR) and root mean square error of approximation (RMSEA) values, were also below the cutoff value of 0.08 (Hair *et al.*, 2010). With respect to incremental fit indices, the results indicated that comparative fit index (CFI), incremental fit index (IFI) and Tucker–Lewis index (TLI) values exceeded the recommended threshold of 0.9 (Hair *et al.*, 2010). In summary, the aforementioned goodness-of-fit indices for the model provided sufficient support for the results to be deemed an acceptable representation of the hypothesized constructs. Accordingly, the tests of unidimensionality, validity and reliability for the model were discussed as follows.

There were four constructs involved in the model, and the unidimensionality issue therefore should be considered. Unidimensionality refers to a set of indicators that could be explained by only one underlying construct (Hair *et al.*, 2010). The CFA results showed that the CFI, IFI, TLI and NFI values were well above the recommended cut-off value of 0.90, suggesting that all constructs were unidimensional (Hu and Bentler, 1999).

Latent variables	Factors	Factor loadings	Standardized factor loading	SD	CR	R^2	AVE
Internal information integration	II1	0.779	0.862	0.063	12.280	0.743	0.721
	II2	1.000	0.827	—[a]	—	0.684	
	II3	0.953	0.898	0.073	12.995	0.807	
	II4	0.808	0.806	0.073	11.131	0.649	
External information integration	EI1	0.728	0.754	0.059	12.396	0.569	0.792
	EI2	0.949	0.905	0.048	19.721	0.819	
	EI3	1.000	0.951	—	—	0.905	
	EI4	0.944	0.935	0.043	22.111	0.873	
Collaborative decision-making	CDM1	0.890	0.847	0.060	14.936	0.718	0.763
	CDM2	1.000	0.918	—	—	0.843	
	CDM3	0.987	0.910	0.055	17.868	0.828	
	CDM4	0.919	0.855	0.060	15.240	0.730	
	CDM5	0.735	0.833	0.051	14.391	0.695	
Logistics service performance	LSP1	0.836	0.740	0.086	9.751	0.548	0.564
	LSP2	0.795	0.605	0.106	7.523	0.366	
	LSP3	0.861	0.712	0.093	9.259	0.507	
	LSP4	1.000	0.856	—	—	0.733	
	LSP5	0.879	0.815	0.080	11.062	0.664	

Notes: [a]Indicates a parameter fixed at 1.0 in the original solution; Fit index: χ^2 = 221.815, df = 129, χ^2/df = 1.719, RMR = 0.033, RMSEA = 0.071, CFI = 0.954, IFI = 0.955, TLI = 0.946

Table 2.
Results of CFA analysis

Convergent validity refers to the items measuring a specific construct that should cover a high percentage of variance in common. Basically, it can be tested by factor loading, item reliability and average variance extracted (AVE) (Koufteros, 1999; Hair et al., 2010). Table 2 shows that all the critical ratio (CR) values were statistically significant for the factor loadings, and the standardized loading estimates were greater than 0.6, exceeding the 0.50 threshold. Moreover, Table 2 shows that all item reliability (R^2) values were above 0.3 and AVE values ranged from 0.564 to 0.792, exceeding the recommended cut-off value of 0.50 (Hair et al., 2010). In summary, all the above indices effectively provided evidence of convergent validity, implying that the measured variables represent the underlying constructs (Anderson and Gerbing, 1988; Hair et al., 2010).

Discriminant validity refers to the degree to which a construct is truly distinct from other constructs. One rigorous test is comparing the average variance extracted (AVE) values for any two constructs with the squared correlation between the constructs (Hair et al., 2010). Table 3 shows that the highest squared correlation was between the EI and CDM constructs at 0.317, which was lower than their individual AVE values of 0.792 and 0.763, respectively. The results demonstrated the evidence of discriminant validity for the study constructs. Finally, composite reliability was conducted to measure the internal consistency and homogeneity of the items comprising a scale. Table 4 shows that the reliability of all constructs was above 0.8, exceeding the recommended level of 0.7 (Bagozzi and Yi, 1988; Hair et al., 2010). To summarize, the overall results of the goodness-of-fit of the model and the assessment of the measurement model lent substantial support to confirming the proposed model.

Constructs	Composite reliability	II	EI	CDM	LSP
II	0.912	*0.721*			
EI	0.938	0.133	*0.792*		
CDM	0.941	0.022	0.317	*0.763*	
LSP	0.864	0.115	0.068	0.081	*0.564*

Notes: II: Internal information integration; EI: External information integration; CDM: Collaborative decision-making; LSP: Logistics service performance

Table 3.
Discriminant validity and composite reliability

Relationships	Estimate[a]	S.E.	C.R.	P	Supported
Internal information integration →External information integration	0.623	0.135	4.607	0.000**	Supported
Internal information integration → collaborative decision-making	−0.092	0.119	−0.777	0.437	Not supported
External information integration → collaborative decision-making	0.573	0.079	7.298	0.000**	Supported
collaborative decision-making → Logistics service performance	0.102	0.055	1.865	0.062*	Supported

Notes: [a]Unstandardized coefficient; **Significant at the 0.05 level of significance; *Significant at the 0.1 level of significance; Fit indices: χ^2 = 240.034, d.f = 131, P = 0.000, χ^2/df= 1.832, RMR = 0.047, GFI = 0.848, IFI = 0.945; CFI = 0.944, RMSEA = 0.077

Table 4.
Results of SEM

4.4 Hypotheses testing

As the validity tests ensured the fitness of the proposed model, this study proceeded to test the research hypotheses by performing SEM. The results, as shown in Table 4, show that internal information integration (estimate = 0.623, $p < 0.01$) was found to have a positive impact on external information integration, suggesting *H1* was supported in this study. External information integration (estimate = 0.573, $p < 0.01$) was also found to have a positive impact on collaborative decision-making, whereas collaborative decision-making (estimate = 0.102, $p < 0.1$) was positively related to logistics service performance, which lent support for *H3* and *H4*, respectively. However, the impact of internal information integration on collaborative decision-making was not found in this study.

5. Discussion and conclusions

Under this uncertain and dynamic logistics marketplace, it is important to share and integrate logistics information with supply chain partners for joint decision-making. This study evaluates the antecedent and effect of collaborative decision-making in the context of container shipping firms. The main findings can be summarized as follows.

The implementation of joint decision-making in the container shipping industry shows that container shipping firms mainly focus on systems collaborative activities such as customs clearance problems, cargo space and delivery routes. However, cooperation with partners in the areas of market analysis and development of new logistics services is seldom made by container shipping firms. The reason may be the consideration of business secrets. Accordingly, container shipping firms should build trust, commitment and long-term relationships with their partners. Moreover, information security should also be ensured for sharing and communicating logistics information with other parties in a supply chain.

Based on the results of SEM, the findings showed that internal information integration was positively associated with external information integration (*H1*), implying that a high level of internal information integration within business units can facilitate information integration beyond organizations in a maritime logistics system. This finding is consistent with those of prior studies (Zhao *et al.*, 2011; Liu and Lee, 2018). Thus, this study suggests that container shipping firms must put more effort into IT infrastructure and adopt technologies for facilitating interdepartmental communication and information exchange.

The results also indicated that external information integration was positively associated with collaborative decision-making for container shipping firms (*H3*), implying that a high level of information integration beyond organizations can facilitate logistics decision-making and strategy formulation. This finding is consistent with those of previous studies (Closs and Savitskie, 2003; Wong *et al.*, 2015; Raweewan and Ferrell, 2018; Viet *et al.*, 2018; Zhang and Cao, 2018). Container shipping firms therefore should share timely, quality and accurate logistics information across supply chain members to facilitate joint decision-making.

Supply chain collaboration has been proven to be a crucial driver of superior performance (Kim and Lee, 2010). Through joint decision-making, organizations can quickly respond to market changes and decrease decision-making errors. A significantly positive association was found between collaborative decision-making and logistics service performance (*H4*). This demonstrated the important role of collaborative decision-making in the maritime supply chain and implies that jointly making logistics decisions pertaining to transportation, warehousing, customs clearance, insurance, and value-added services among maritime supply chain members can enhance container shipping firms' logistics service performance. This finding is consistent with those of prior studies (Cousins, 2005; Kim and Lee, 2010; Cao and Zhang, 2010; Wong *et al.*, 2015; Shahbaz *et al.*, 2018).

Although the impact of internal information integration on collaborative decision-making was not found in this study, a significant relationship exists between the former and external information integration. As the maritime supply chain involves different service parties, there is a need for information sharing across organizations to move goods more smoothly. Hence, internal information integration may indirectly affect collaborative decision-making, suggesting that container shipping firms should build sound IT infrastructure and use IT applications to integrate and share information with their supply chain partners.

Several managerial implications were identified from this study. First, the possession of information processing capability could help organizations cope with environmental uncertainty. Container shipping companies should integrate and collaborate across functions and beyond organizations to acquire and manage additional resources (Galbraith, 1973; Fan *et al.*, 2016). Second, as digitalization was treated as a crucial capability for shipping firms to survive in this dynamic marketplace, a number of logistics platforms had been established for providing superior logistics services, such as Maersk Line's TradeLens platform. Thus, the findings suggest that container shipping firms should invest in the establishment of IT systems, databases and platforms for acquiring, processing, storing and sharing logistics information across different departments within an organization and different supply chain partners. Specifically, container shipping firms should share accurate and timely logistics information with their supply chain partners. Finally, our study shows that joint decision-making is positively related to logistics service performance. This suggests that container shipping firms should share and integrate logistics information among different partners to facilitate decision-making and, in turn, improve logistics service performance. To achieve superior logistics service performance, container shipping firms can jointly make logistics decisions pertaining to customs clearance, transportation, delivery, market analysis, and service development.

From a theoretical perspective, this study contributes to OIPT by demonstrating the value of collaborative decision-making for container shipping firms. Moreover, this study contributes theoretically by investigating the antecedents and outcome of collaborative decision-making from the view of OIPT. The results also demonstrate the important role of information integration to facilitate joint decision-making, which in turn improves logistics service performance.

This study mainly examines the collaborative decision-making issue from the view of container shipping firms. Future research could extend the scope to other supply chain members. Second, different factors such as relationship quality and culture may also influence joint decision-making and hence should be incorporated into the model. Finally, this study applies the OIPT to examine collaborative decision-making issues. Future research could apply the relational view or social exchange network theory to examine the impact of collaborative decision-making.

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Appendix. Questionnaire items

Item no.	Logistics information integration measures
1	Electronic information shared within our company is accurate
2	Electronic information shared within our company is timely
3	Our company's IT infrastructure is capable of meeting our current business needs
4	Our company has formal procedures to manage our IT infrastructure
5	Our company exchanges information with our partners electronically
6	Our company works with our partners electronically on cross-organizational business activities
7	Electronic information shared between our company and partners is accurate
8	Electronic information shared between our company and partners is timely

Table A1.
Logistics information integration

Notes: Please indicate how much you agree to the following statements relating to information integration practices in your company based on a five-point scale; $1 =$ strongly disagree to $5 =$ strongly agree
Source: Closs and Savitskie (2003), Wong *et al.* (2015)

Item no.	Collaborative decision-making measures
1	Our company jointly solves customs clearance problems with supply chain partners
2	Our company jointly coordinates the needs of cargo space with supply chain partners
3	Our company jointly plans and designs delivery routes with supply chain partners
4	Our company jointly undergoes market analysis with supply chain partners
5	Our company jointly develops new logistics services with supply chain partners

Table A2.
Collaborative decision-making

Notes: Please indicate how much you agree to the following statements relating to collaborative decision-making in your company based on a five-point scale; $1 =$ strongly disagree to $5 =$ strongly agree
Source: Wong *et al.* (2015)

Item no.	Logistics service performance measures
1	Logistics service reliability
2	Accuracy of documentation.
3	Quality of data transmission
4	Effectiveness of solving problem
5	Customer response speed

Table A3.
Logistics service performance

Notes: Compared to your company's major competitors, please indicate how much you agree to the following statements relating to logistics service performance in your company based on a five-point scale; $1 =$ strongly disagree to $5 =$ strongly agree
Source: Closs and Savitskie (2003), Panayides (2007)

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