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Cooperative and Collaborative Spirit Indices Between Supply Chain Members

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Abstract

This paper aims to evaluate the extent of supply chain collaboration and cooperation between shipping companies as logistics service providers and shippers as consumers. Bespoke cooperative and collaborative spirit indices (CCSIs) reflect the conceptual differentiation of cooperation from collaboration and more comprehensive conceptualization. Based on existing literature, expertise, content analysis, Q-sorting, and pilot testing a survey instrument was developed. Shipping companies registered in South Korea yielded 167 usable responses which were analysed using factor analysis and multivariate analysis of variance. Collaboration in supply chain members comprises cooperation including transparency, fairness and mutuality, and relationship strength comprised of trust and sustainability. CCSIs revealed modest cooperation and collaboration between supply chain members but statistically significant differences between differing vessel types and contract periods. The CCSIs provide grounds and interpretation for the application of relevant theories to cooperative and collaborative relationships between the supply chain members. CCSIs revealed that powerful supply chain members resist two-way communication, mutuality, distributive fairness, and long-term relationships. Management initiatives and policy are discussed to reduce barriers to interaction. More comprehensive definitions of cooperation and collaboration emerged and cooperation was nested within the collaboration. CCSIs reveal the degree of cooperation and collaboration between supply chain members and indicate the competitive advantages of a supply chain.

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1. Introduction

Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 10 pt. Here follows further instructions for authors.

Supply chain management (SCM) facilitates improved customer service and competitiveness by combining major business processes through inter-firm cooperation and inter-functional coordination (Min and Mentzer, 2004). Supply chain collaboration (SCC) predicates supply chain (SC) competitiveness but despite numerous definitions, cooperation is rarely differentiated from collaboration (Hudnurkar et al., 2014; Soosay and Hyland, 2015; Thomson et al., 2009). Piecemeal research has hampered comprehensive conceptualisation, precise understanding, and measurement of the extent of cooperation and collaboration (Cao et al., 2010; Barratt, 2004; Simatupang and Sridharan, 2005).

Relationships between suppliers and manufacturers or retailers typically highlight consumer goods retailing, computer assembling and automobile manufacturing (Hudnurkar et al., 2014) and occasionally shippers and logistics companies (Fugate et al., 2009; Gardner et al., 1994; Golicic, 2007; Zsidisin et al., 2007). After applying SCM principles, carriers were transformed from product distributors into SC integrators, disseminators of information and transport service advisers, essential to SC service performance (Wagner and Frankel, 2000). Supplier-customer relationships depend on shipper-carrier relationships which are often reported anecdotally (Golicic, 2007; Zsidisin et al., 2007). However, reliable and accepted SCC measurement instruments are rare in maritime logistics (Seo et al., 2015).

Exhaustive analysis of each instance of cooperation and collaboration in complex multiple inter-firm relationships in SC goods movements is infeasible. However, most SC members who need shipping logistics services can function as shippers (Frémont, 2009; Fransoo and Lee, 2013). Accordingly, this case study highlighted shippers and shipping logistics companies.

Typically, because shipping companies offer easily duplicated services and are revenue-reliant on powerful shippers, adversarial relationships attain (Heaver, 2015; Golicic, 2007). However, where shippers predominate, logistics companies must create and maintain cooperative and collaborative relationships with shippers to survive. Shipping company survival in a languishing economy plagued by overcapacity may depend on shippers' willingness to guarantee reasonable profits, share additional benefits and costs, and long-term contracts. Conversely, as consumers of logistics services dependant on carriers' tariffs, a cooperative and collaborative spirit benefits shippers as more carriers offer high-quality, cost-effective delivery systems (Talley and Ng, 2013). Because dominant partners must balance self-interests with interdependency to ameliorate overall performance, corporate responses to unfettered competition, risks and uncertainties caused by globalisation have included better visibility, reliability, agility, and collaboration (Heaver, 2015; Richey et al., 2010).

This study aims to reveal the extent of SC cooperation and collaboration using cooperative and collaborative spirit indices (CCSIs) and to assist policy analysis and public communication. Heeding the research gap concerning SC cooperation and collaboration, this case study in South Korea presents CCSIs to quantify relationships between shipping companies and shippers.

2. Literature Review

2.1. Theories underlying cooperation and collaboration

Transaction cost theory (TCT) argues that transaction cost shapes governance structures, market and hierarchy although when markets fail, researchers focus on relational governance and alliances rather than hierarchy (Geyskens et al., 2006). Recent theoretical extensions predict cooperation and collaboration as a necessary alternative to transactions (Kim et al., 2010). Transactions governance spans spot markets, hierarchies and long-term hybrid contracts which are relevant to SCM (Williamson, 2008). TCT "explains that inter-firm cooperation can overcome the limitations of restricted rationality, secure economic efficiency with reduced transaction costs, and realise transaction stability from opportunistic threats" (Kim et al., 2010, p.864).

Resource based theory (RBT) characterises a firm as a collection of different resources or resources bundle, and their impact on performance (Barney, 1991; Huo et al., 2016). RBT focused on intrafirm resources and capabilities as

a source of competitive advantage (Dyer and Singh, 1998). Assembling, cooperation and resource coordination, including inter-firm resources, signify capabilities which produce more productivity and performance and operational efficiency concerns have driven external information integration (Huo et al. 2016). Relational theory (RT) complements RBT (Dyer and Singh, 1998) as "the application of RBT to inter-organisational relations" (Acedo et al., 2006). RBT traces the origin of competitive advantage from intrafirm resources whereas RT stresses that competitive advantage can be acquired through inter-firm dyads or networks (Dyer and Singh, 1998). If resources, especially intangible resources or capabilities could extend to include a cooperative and collaborative relationship network with other firms, RBT could offer a theoretical basis for cooperation and collaboration. Arguably, RBT might assist in framing complex dimensions of SC relationships involving new product development and process issues (Ahmed et al., 2017).

Attempts to secure necessary resources from the market arise because attempts to obtain all resources intrafirm fail, thereby necessitating bilateral relationships (Reid et al., 2001). As with RBT, resource dependence theory (RDT) advocates SCC to raise performance but RDT proposes that cooperation and support from partners is required for SCs to respond to market demand (Ramanathan and Gunasekaran, 2014; Hillman et al., 2009). However, gaining access to inter-firm resources involves loss of autonomy, and dependency should be avoided if possible.

Social exchange theory (SET) explores how actors' interactions in an exchange process are influenced by rewards and costs and the difference determines attitudes and behaviours (Griffith et al., 2006; Narasimhan et al., 2009). As actors compare the rewards and costs of an exchange, they decide to participate and make relationships which can maximise benefits and minimise costs (Nunkoo and Ramkissoon, 2012). Trust, commitment, justice, and power are crucial (Morgan and Hunt, 1994).

Social capital theory (SCT) concerns the "goodwill" which others have towards us that encourages cooperative behaviour and develops new forms of association and organisation (Adler and Kwon, 2002; Putnam, 1993). High levels of trust particularly in networks, reduce economic transaction costs and scope for opportunism and expensive monitoring processes (Putnam, 1993). Actors can utilise social capital as a resource, which offers competitive advantages (Adler and Kwon, 2002).

2.2. Cooperation and collaboration in SCM and logistics

Cooperation between distributors and manufacturers sometimes precedes trust (Anderson and Narus, 1990) but Ganesan (1994) revealed that long-term relationships between retail buyers and vendors built on trust and dependence. Morgan and Hunt (1994) investigated the antecedents and consequences of trust and commitment between tire retailers and suppliers. Bove and Johnson (2001) argued that trust and commitment between customer/buyer and service personnel/provider/seller represent "relationship strength", with information and cooperation as antecedents. Barratt (2004) identified a collaborative culture composed of trust, mutuality, information exchange, and openness/communication as a component of collaboration. Simatupang and Sridharan (2005) measured SCC through information sharing, decision synchronisation, and incentive alignment, proposing a collaboration index between retailers and their suppliers. Min et al. (2005) characterized SCC involving information sharing, joint planning, joint problem solving, joint performance measurement, and leveraging resources and skills. Griffith et al. (2006) showed that procedural and distributive justice positively impacted long-term SC orientation between suppliers and distributors. Kim et al. (2010) identified determinants of cooperation including technical uncertainty, reciprocity and trust in relationships between telecommunication service providers and suppliers. Cao and Zhang (2011) identified components of SCC including information sharing, collaborative communication and joint knowledge creation. Chen et al. (2011) identified information sharing, quality and availability as antecedents of trust and commitment. Ramanathan and Gunasekaran (2014) linked SCC with collaborative planning, decisions making and execution. Kumar and Nath Banerjee (2014) identified six dimensions in an SCC index using partial least squares analysis. Finally and out-with intra-organisational motives, Pradabwong et al (2017) identified sharing of common goals, incentive alignment, joint activities and information sharing and communication as inter-organisational antecedents of SCC to enhance marketplace competitiveness.

Components of win/win partnerships include "relationship extendedness" as loyalty and long-term expectations and sharing of benefits and burdens between shippers and carriers/ warehousers (Gardner et al., 1994). Zsidisin et al. (2007) found that communication, trust and mutual dependence influence the willingness of carriers to commit assets

to shippers. Using SEM to test "relationship strength", Golicic (2007) found a significant difference between shippers and carriers regarding trust and commitment. Fugate et al. (2009) found that environmental changes and capacity constraints such as driver-hours regulations triggered more balanced power between shippers and inland carriers culminating in collaborative relationships. Nassirnia and Robinson's (2013) case study of maritime coal SCs found that cooperation and integration maximised benefits and SC value increments. Within maritime logistics, Seo et al. (2015) measured SCC based on information sharing, knowledge creation, goal similarity, decision harmonisation and joint SC performance measurement. Within ports, competition and globalisation fostered widespread collaboration to raise efficiency which supersedes traditional hostility (Heaver, 2015; Seo et al., 2015).

Examples of published indices include a Logistics Performance Index (LPI) to assist countries to identify challenges and opportunities to ameliorate performance. The LPI synthesises Likert scale evaluations of system characteristics by global freight forwarders and express carriers (World Bank, 2014). Simatupang and Sridharan (2005) applied collaboration index to measure collaborative practices based on information sharing, decision-synchronisation, and incentive alignment used Likert scales to estimate mean scores for each dimension. Finally, a customer satisfaction index incorporated six dimensions such as joint planning, information sharing and collaborative culture with weights estimated using Analytical Hierarchy Process methods (Kumar and Nath Banerjee, 2014).

3. Conceptual Framework

3.1. Cooperation and collaboration

Differences between collaboration and cooperation relate to the extent of trust, commitment, and mutual dependence; cooperation is lacking in trust and less active than collaboration (Golicic et al., 2003). Cooperation is an incipient relationship involving limited information exchange, or some advertising of long-term contracts. Collaboration, the highest level of the relationship, involves higher levels of trust and commitment than cooperation (Spekman et al., 1998). Cooperation can be incorporated within collaboration and the extent of trust and commitment typically discriminates between concepts. This study differentiates cooperation from collaboration based on trust and sustainability. Sustainability is postulated to include commitment and long-term orientation. Coordination is not differentiated from cooperation and collaboration because coordination implies cooperation (Morgan and Hunt, 1994).

Cooperation is a transparent business partnership process where partners work together treating each partner justly and equally, based on mutuality, for common goals and benefits. Collaboration refers to a business partnership process where partners aim to sustain long-term cooperative relationship based on trust between them.

Diverse representations of collaboration prompted reorganisation of constructs, whereby each sub-construct was derived by integrating multiple concepts with similar meanings or explaining the same construct. For example, information sharing, communication, and formalisation were merged into transparency and sub-constructs of collaboration were identified to involve transparency, fairness, mutuality, trust and sustainability. Cooperation is postulated as a subset of collaboration comprised of transparency, fairness, and mutuality. Given that the "strength of a relationship" can be measured by trust and commitment (Bove and Johnson, 2001), collaboration can be considered to consist of cooperation and "relationship strength".

3.2. Components of cooperation and collaboration and their operational definitions

Transparency

Transparency implies the extent to which a partner has an open and transparent relationship based on smooth communication, information sharing, and clear setting-up of the relationship through prior agreement. Transparency involves concepts of information sharing, communication, and formalization.

A critical component of cooperation in SCM is information sharing, a primary form of collaboration. Exchange of private data among partners is required to establish an efficient SC (Kumar and Nath Banerjee, 2014). A lack of willingness to share appropriate information can make it difficult to establish   SC relationships based on shared risks and rewards (Richey et al., 2010). Detailed information exchange can lead to better decision-making and SC efficiency and can provide SC visibility (Min et al., 2005).

The purpose of communication is to find opportunities and areas for improvement (Min et al., 2005). Collaborative communication is "the contact and message transmission process among SC partners regarding frequency, direction, mode, and influence strategy" (Cao et al., 2010, p.6620). Collaborative communication is more frequent, more bidirectional, and uses better information modes, and enhanced indirect influences (Mohr and Nevin, 1990).

Formalization is "the extent to which decision making is regulated by explicit rules and procedures" (Dwyer and Oh, 1987, p.349). High formalization implies formal rules and standardised policies affect decisions and working relationship for an extended period. Formalization shapes expectations of what should be done and standard practices established through eliminating ambiguity and clarifying priorities thereby enhancing transparency (Daugherty et al., 2006).

Fairness

Fairness signifies the extent to which a partner treats the partner company fairly and justly with no discrimination, observation of regulations and laws, and guarantee of reasonable and just profits. Related terminology involves justice (Konovsky, 2000) and reciprocity (Bensaou, 1997). The level of cooperation could be affected by reciprocity (fairness) between partners (Kim et al., 2010). Fairness in a buyer-supplier relationship can be conceptualised within collaborative and long-term SC relationships (Hornibrook et al., 2009).

Fairness includes procedural justice and distributive justice (incentive alignment) (Kumar et al., 1995a; Griffith et al., 2006) where distributive fairness is based on reseller outcomes and procedural fairness on supplier behaviour (Kumar et al., 1995a). Procedural justice implies how fairly a firm and its personnel deal with its partner firm (Griffith et al., 2006). It concentrates on the fairness of procedures by which decisions are made and on the attitudes of people affected by those decisions (Korsgaard et al., 1995). Distributive justice is sometimes interchanged with incentive-alignment involving sharing costs, risks, and benefits among SC members (Griffith et al., 2006, Simatupang and Sridharan, 2005). Successful partnerships depend on whether participants share gains and losses equitably and fairly (Cao et al., 2010). Effective SCM implies mutual sharing of risks and rewards and unless the benefits of cooperation exceed the costs, a firm will not cooperate (Nassirnia and Robinson, 2013). Distributive justice, the incentive alignment, ensures satisfactory levels of cooperation (Harland et al., 2004).

Mutuality

Based on interdependence and RDT, mutuality refers to exchange relationships between organisations, involving the extent to which one partner treats another equally and is willing to support the other based on mutual understanding (Thomson et al., 2009). Mutuality spans goal congruence, decision synchronisation, resource sharing, joint problem solving, joint performance measurement and joint knowledge creation. Goal congruence applies when objectives are accomplished and satisfied by SC partners and congruence signifies mutual understanding and agreement across firm attributes, values, beliefs, and practices required for SCC (Cao et al., 2010). Decision synchronisation involves joint decision making at planning and operational levels (Simatupang and Sridharan, 2005). Resource sharing is the process of leveraging and investing capabilities and assets with SC partners (Cao et al., 2010). Sustainable collaborations require considerable mutual resource investments including both financial and non-financial investments such as time, money, training, and technology. Sufficient commitment of management time is required for collaborative relationships (Min et al., 2005).

Problem-solving implies that disagreements and conflicts between partners are solved amicably (Kumar and Nath Banerjee, 2014). Mutually advanced process improvement can be achieved through joint problem-solving. Building cross-functional, cross-original teams and co-locating each other's personnel to solve issues may progress into a virtual integration of SC process and monitoring and measurement of performance can assure the success of collaborative efforts (Min et al., 2005). Joint knowledge creation can promote better understanding and reaction to changing markets and environments (Malhotra et al., 2005).

Trust

Trust defines the extent to which a partner can be trusted in terms of trustworthiness, good faith and fulfilment of obligations and how far partners consider each other to be believable (Ganesan, 1994). Credibility and honesty are components of trust (Eyuboglu et al., 2003) as are credibility and benevolence (Wang et al., 2008). Credibility is a firm's belief about sincerity and the fulfilment of promise and obligation of its partner (Anderson and Narus, 1990).

Trust can result in reduced costs related to ex-ante negotiation and conclusion of a contract as well as ex-post transactions (Ryu et al., 2007). Trust can contribute to decreasing anxiety and uncertainty and reduced transaction costs (Ganesan, 1994; Wang et al., 2008).

Trust may restrain a partner's opportunistic behaviour and deter dominant partners from exerting power over weaker partners (Ganesan, 1994; Mei and Dinwoodie, 2005). Trust also makes partners believe that long-run idiosyncratic investments can be feasible with minimal risks (Ganesan, 1994). If a powerful partner trusts a weaker partner the former is less likely to seek alternative suppliers and be more tolerant towards short-term inequities (Kumar, 1995a). To establish trust is difficult and the other party must prove its abilities to solve problems, and its loyalty (Min et al., 2005). The extent of trust depends on relative power; shippers may trust carriers but not be committed to them because alternatives are available (Golicic, 2007).

Sustainability

Sustainability continuously strengthens a cooperative relationship with another partner, embedding concepts of commitment and long-term orientation that extend relationships, indicating loyalty and long-term expectations (Gardner et al., 1994). A high level of trust and commitment is required for successful SC performance.

Commitment is an implicit or explicit pledge of continuing a relationship between exchange partners that allows them to tolerate each other's deficiencies (within reason) and to cooperate rather than acting opportunistically (Dwyer and Oh, 1987; Min et al., 2005). Organisational commitment within SCs is akin to the weaker party being willing to commit to a long-term relationship, and quality increases with the level of commitment (Hornibrook et al., 2009; Nyaga and Whipple, 2011).

Long-term orientation implies the desire of a partner toward having a long-term relationship (Ganesan, 1994). Construction, maintenance and enhancement of long-term relationships with SC partners is required for effective SCM. As partners start to trust each other because of the success of their collaborative arrangements, collaborative relationship and cooperation are likely to be enhanced. (Min et al., 2005).

3.3. Concept construction

Error! Reference source not found. represents the composition of the grounds for cooperation and collaboration of this research. Given that the "relationship strength" between a customer/buyer and service personnel/provider/seller can be indicated by trust and commitment (Bove and Johnson, 2001), this study postulates that collaboration is comprised of components representing cooperation and another components representative of "relationship strength" such as trust and sustainability.
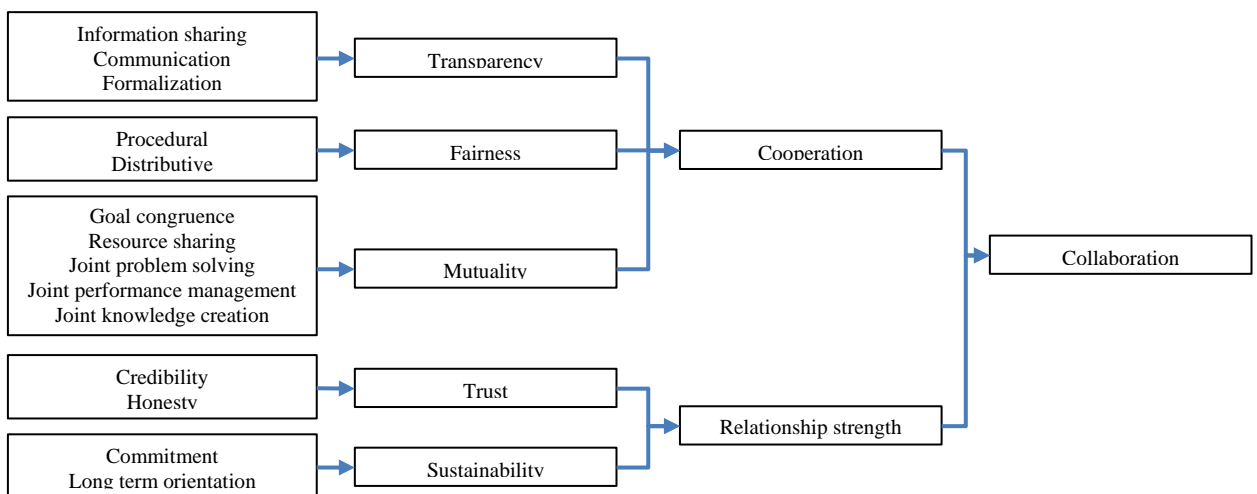

Fig. 1. Construction of cooperation and collaboration.

3.4. Hypothesis development

The average gross shipping tonnage (GT = 3,550) and average number of vessels (n = 2.9) of coastal shipping companies is dwarfed by seagoing companies (GT = 288,922; n = 7.3) (MOF, 2016). Coastal shipping delivers logistics services between domestic ports whereas ocean-going shipping delivers commodities between domestic and foreign ports or between foreign ports. Differing business scope and sizes imply different kinds of shippers, cooperation and collaborations suggesting a hypothesis that:

H_1. The extent to which shippers in ocean-going and coastal shipping cooperate and collaborate with their shipping companies will differ.

Over time shippers handled different types of cargoes and variegated vessels evolved. Eventually, shippers contracted with shipping companies who possessed specialist vessels. Accordingly, different types of vessels have their own shippers and different shippers have different characteristics towards shipping companies regarding cooperation and collaboration. Hypothesis two posits that:

H_2. The extent to which shippers of different types of vessels cooperate and collaborate with their shipping companies will differ.

Similarly, contract periods with shippers may vary with vessel-type. In liner shipping, direct shippers' purchase freight services from container shipping companies typically on one-year contracts, but freight forwarders and shipping companies contract for <3 months (Frémont, 2009; Fransoo and Lee, 2013). Long-term contracts between shippers and shipping companies underpin tramp shipping of iron ore, forest products and motor cars and oil and LPG tanker transport (Stopford, 2009) implying that:

H_3. Different contract periods will show different levels of cooperation and collaboration between shippers and shipping companies.

H_4. Different types of vessels combined with different contract periods will show different levels of cooperation and collaboration between shippers and shipping companies.

These hypotheses are tested by comparing CCSIs between different shipping types, vessel types and contract periods.

4. Methods

4.1. Measurement instrument development

76 initial items relevant sub-constructs were compiled through literature review, generated indicating a cooperative and collaboration spirit. Item listings were emailed to 11 shipping experts in South Korea. Coastal shipping experts managing bulkers, tankers, and other ships included two directors, a general manager, a deputy general manager and two managers. Experts managing ocean-going container and bulk shipping included a director, a general manager, a manager and two assistant managers. To develop industrially bespoke measures, experts were requested to sort and discard items that were inappropriate or irrelevant to SCs. Following sorting, 40 items remained. Finally, following content analysis to delete redundant items and merge similar items into a new item with a common meaning, 24 items remained.

A qualitative Q-sort technique was selected to ensure transparency, mutuality and sustainability in finding concepts which have not been firmly established (Boon-itt and Paul, 2005) and to develop new scales. Two-rounds of Q-sorting

of the 24 items and five sub-constructs engaged 25 experts in spring 2016. The second-round demonstrated a solid overall agreement rate of 97% verifying existence of the research sub-constructs.

Following Q-sorting, pilot testing engaged three academics and 31 practitioners in spring 2016, representing coastal and ocean-going shipping; container, bulk, tank, and other ships, and different sized organisations. Experts were invited to complete all questions to test their reliability and internal consistency. All scale scores exceeded 0.900 ranging from fairness (= 0.919) to mutuality (= 0.972).

4.2. Data collection

In summer 2016, 183 ocean-going and 241 coastal shipping companies were contacted via the Korea Ship-owners' Association. Two email and two telephone reminders produced responses of 89 ocean-going and 85 coastal companies, 167 (39.0 per cent) were usable. Based on posits that non-respondents' views probably mimic those of late-respondents, independent samples t-tests for non-response bias compared the central tendency of 30 early and 30 late responses (Armstrong and Overton, 1977). Non-response bias is unlikely because outcomes for 24 item variables showed no significant differences at $p < 0.05$.

Respondents represent varied types of shipping, vessels, work experience, roles and contract period and job titles affirm sufficient knowledge to ensure authoritative responses (Table 1).

Table 1. Demographic data for 167 responses.

Variables		Frequency	Percentage
Shipping registered			
	Coastal shipping	78	46.7
	Ocean-going shipping	89	53.3
Vessel type			
	Container	16	9.6
	Bulk carrier	66	39.5
	Tanker	51	30.5
	Others	34	20.4
Work experience			
	Less than five years	18	10.8
	5-9 years	28	16.8
	10-19 years	90	53.8
	Over 20 years	31	18.6
Job title			
	Staff/Assistant manager	19	11.4
	Manager/Deputy department manager	54	32.3
	Department manager	58	34.7
	(Senior) Director/CEO	36	21.6
Employee			
	Fewer than 10	18	10.8
	10-49	60	35.9
	50-99	43	25.7
	100-199	21	12.6
	More than 200	25	15.0
Contract period			
	Less than 1 year	55	32.9
	1-2 years	56	33.5
	3-9 years	28	16.8
	More than 10 years	28	16.8

4.3. Exploratory factor analysis

Following Wieland et al.'s (2017) suggestions, after the initial judgemental Q-sorting, exploratory factor analysis (EFA) was conducted on items for further purification using with maximum likelihood (ML) and Direct Oblimin (DO). PCA delivers data reduction but fails to distinguish between shared and unique variance, and may inflate estimates of the variance explained by factors, frustrating generalisation. ML is less problematic and maintains consistency with

CFA tested by AMOS. Oblique rotation was selected because some factor inter-correlation is usual in the social sciences (Osborne and Costello, 2009; Pedhazur and Schmelkin, 2013).

EFA on 16 items presumed to represent cooperation detected no cross-loadings but one free-standing indicator variable (Table 2: MUT2) was deleted. The ratio of observations to variables (167:16) is acceptable. Bartlett's test results were highly significant ($\chi^2 = 2868.796$, df = 105, $p = 0.000$) and Kaiser-Meyer-Olkin (KMO) Measure of Sampling Accuracy scores (0.945) indicated that EFA is appropriate. Variables with factor loadings exceeding 0.45 were selected given the sample size and communalities of all variables exceeded 0.5 (Hair et al., 2014). Three factors were selected for analysis, each with eigenvalues exceeding 0.7 (Jolliffe, 2002), and together explained 82.5% of total variance. Variables MUT1 to MUT8 load highly on factor 1 and factor 2, characterised by variables FAI1 to FAI4 and factor 3 has four distinctive characteristics (TRA1 to TRA 4). Items with sufficient factor loadings on the same factor suggest that factor one represents mutuality, factor two fairness, and factor three transparency.

Table 2. EFA result for cooperation

Item	Factor			Communality
	1	2	3	
MUT6	.958			.902
MUT3	.882			.657
MUT7	.829			.759
MUT4	.806			.732
MUT5	.803			.889
MUT8	.762			.822
MUT1	.566			.767
FAI3		-.874		.937
FAI4		-.760		.839
FAI1		-.699		.571
FAI2		-.687		.670
TRA3			.827	.879
TRA2			.819	.644
TRA1			.653	.720
TRA4			.627	.818
Eigenvalues	10.422	1.081	0.872	
% of Variance	69.477	7.205	5.811	
Cumulative %	69.477	76.683	82.494	

Extraction Method: ML.
Rotation Method: Oblimin with Kaiser normalization
Factor 1 – Mutuality, Factor 2 – Fairness, Factor 3 – Transparency

EFA on 24 items initially representing collaboration yielded no cross-loadings but two free-standing items (Table 3: MUT2 and SUS1) were eliminated. A 7:1 ratio of observations to variables was acceptable (Hair et al., 2014). For the remaining 22 items, the adequacy of EFA was identified by Kaiser-Meyer-Olkin (KMO) (0.944) and Bartlett's test ($\chi^2 = 4195.77$, df = 231, $p = 0.000$). Five common factors with initial eigenvalues exceeding 0.7 explained 83.3% of total variance. Twenty-two items with factor loadings exceeding 0.45 were retained and factor correlations from +0.435 to +0.695 and -0.543 to -0.690 indicate that oblique rotation is preferred (Pedhazur and Schmelkin, 2013). Items with sufficient factor loadings on the same factor suggest that factor one represents fairness, factor two fairness, factor three mutuality, factor four transparency, and factor five trust.

Table 3. EFA result for collaboration

Item	Factor					Communality
	1	2	3	4	5	
FAI3	.703					.942
FAI4	.576					.837
FAI1	.523					.577
FAI2	.496					.675
SUS3		.861				.923
SUS4		.774				.879

SUS2		.541				.722
MUT6			-.969			.907
MUT5			-.848			.901
MUT3			-.787			.658
MUT7			-.785			.765
MTU4			-.717			.742
MUT8			-.683			.830
MUT1			-.585			.772
TRA3				-.841		.890
TRA2				-.777		.648
TRA4				-.646		.819
TRA1				-.641		.718
TRU3					.858	.686
TRU2					.834	.873
TRU1					.733	.742
TRU4					.672	.656
Eigenvalues	14.263	1.354	1.10	.877	.725	
% of Variance	64.83	6.154	5.024	3.987	3.296	
Cumulative %	64.83	70.985	76.009	79.996	83.291	

Extraction Method: ML.
Rotation Method: Oblimin with Kaiser normalization.
Factor 1 – Fairness, Factor 2 – Sustainability, Factor 3 – Mutuality, Factor 4 – Transparency, Factor 5 - Trust

4.4. Confirmatory factor analysis

Using a two-step SEM procedure, the measurement accuracy of constructs was tested for construct validity and reliability (Hair et al., 2014). For cooperation, overall model $\chi^2 = 273.066$ with 87 degrees of freedom (*df*) (*p* = 0.000), indicated good fit. Given that n = 167, standardized root mean squared residual (SRMR) = 0.0395 is an appropriate absolute fit index significantly <0.05, a conservative threshold (Byrne, 2010). Comparative Fit Index (CFI) = 0.935 and Tucker-Lewis Index (TLI) = 0.922 both exceeded critical values (>0.90) (Baumgartner and Homburg, 1996). Regarding convergent validity, all standardised factor loadings were >0.7 and corresponding squared factor loadings >0.5 (Garver and Mentzer, 1999; Hair et al., 2014). TRA2 has the lowest factor loading of 0.752 and its squared factor loading is 0.566. The values and statistical significance of the critical ratio imply that all factor loadings are reasonable and statistically significant (*p* < 0.01). The average variance extracted (AVE) estimates ranged from 0.745 (transparency) to 0.779 (mutuality), exceeding critical thresholds of 0.5 (Hair et al., 2014). Composite reliabilities (CR) between 0.921 (transparency) and 0.961 (mutuality) indicate adequate reliability (>0.7) (Hair et al., 2014). In all cases Cronbach's α exceeds 0.7 (Garver and Mentzer, 1999). Overall model fit indices for the cooperation measurement model support convergent validity and discriminant validity, given that all square roots of AVE estimates exceed corresponding pairwise correlation estimates among sub-constructs.

The measurement model for collaboration includes 22 measured indicator variables and five latent variables, with sub-constructs of trust represented by four items and sustainability by three. Overall model fit is good ($\chi^2 = 507.879$; df = 199; RMR= 0.0426 (*p* < 0.05); TLI = 0.914; CFI= 0.926). Regarding convergent validity, all standardised factor loadings are >0.7 and corresponding squared multiple correlations are >0.5. Item TRA2 has the lowest factor loading (0.754) and squared multiple correlation (0.568). All factor loadings are reasonable and statistically significant (*p* < 0.01). All AVE estimates (0.746 to 0.814) are >0.5. CRs from 0.914 to 0.961 and Cronbach's α s from 0.914 to 0.960 exceed the minimum criterion (0.7). Measures taken overall strongly support convergent validity of the measurement model for collaboration and discriminant validity, where all correlations among sub-constructs representing collaboration are significant (*p* < 0.01), and all values of square roots of AVEs exceed the corresponding pairwise correlations among sub-constructs.

The efficiency of a second-order factor model is assessed by the target coefficient (*T*-coefficient), the relative ratio of χ^2 in the first-order and second-order models. Where $T \geq 0.8$ a second-order construct exists and the second-order structure is efficient (Cao and Zhang, 2010). Cooperation is measured indirectly by indicators of first-order factors which load on the second-order factor. Standardised factor loadings of measurement items on respective first-order factors (0.75 to 0.96) are all significant (p < 0.01). Standardised factor loadings of first-order factors on second-order

factors (0.90 to 0.93) and strong paths indicate statistical significance ($p < 0.01$). The second-order construct explains 81%, 87% and 81% respectively in variation of transparency, fairness, and mutuality. Between the first and second-order factor model T=1, providing good evidence of the existence of a higher-order construct, cooperation.

In testing the existence and efficiency of the second-order factor model for collaboration, estimates are strong and significant ($p < 0.01$). The second-order factor explains 76% of variation in the first-order factor transparency, 86% for fairness, 85% for mutuality, 72% for trust, and 68% for sustainability. Model fit indices (χ^2 = 525.284, df = 204, SRMR = 0.0471, TLI = 0.913, CFI = 0.923) satisfy recommended thresholds. The *T*-coefficient (0.967) indicates an efficient and valid second factor model and first-order factors are sufficiently explained by the second-order construct, collaboration.

Comparison of three models identifies the possibility of common method bias, convergent validity and discriminant validity (Iverson and Maguire, 2000). Significant $\Delta\chi^2$ statistics (regarding collaboration, $\Delta\chi^2$ (22) = 3184.7, $p < 0.01$ between null and one-factor models, $\Delta\chi^2$ (5) = 702.9, $p < 0.01$ between one-factor and second-order factor models) and improved model fit indices from the null model to the second-order factor model, indicate that the possibility of common method bias is minimised and of limited concern (Table 4).

Table 4. Comparison of three models' fit

		Null (M0)	One factor (M1)	Second order factor (M2)	M0-M1	M1-M2
Cooperation	χ^2	2973.2	633.0	273.0	2340.2***	360.0***
	DF	105	90	87	15	3
	SRMR	0.6335	0.0679	0.0395	SI	SI
	TLI	0	0.779	0.922	SI	SI
	CFI	0	0.811	0.935	SI	SI
Collaboration	χ^2	4412.8	1228.1	525.2	3184.7***	702.9***
	DF	231	209	204	22	5
	SRMR	0.6077	0.0695	0.0471	SI	SI
	TLI	0	0.731	0.913	SI	SI
	CFI	0	0.756	0.923	SI	SI

Note. ***: significant at the 0.001 significance level, SI: Significantly Improved

4.5. Profiles of CCSIs

Weighted averages of indicators and factors are used to calculate CCSIs (OECD, 2008). Following EFA, items with high loadings on each factor are weight averaged to calculate each factor's index (Osborne and Costello, 2009; Pedhazur and Schmelkin, 2013; Hair et al., 2014). **Error! Reference source not found.**5 shows the computed weights of items and factors. For each item the squared factor loading indicates the variance explained by each factor. An item weight is the squared factor loading, divided by the variance explained by a factor (OECD, 2008). A factor weight shows the proportion of the variance explained for that factor, divided by the sum of variances explained for all factors. Taking MUT6 as an example for cooperation, the squared factor loading (= 0.918) divided by the variance explained by factor 1 (= 9.318) generates item weight 0.1000. The weight of factor 1 (0.366) represents the percentage of variance that it explains (9.138), divided by the summed variance explained by all three factors (9.138+8.196+7.666). Factor weights vary from 30.7% (*transparency*) to 36.6% (*mutuality*). The weights of 22 items and five sub-constructs of collaboration were treated similarly (Table 6).

Table 5. Weights of 22 indicators and five sub-constructs of cooperation

Item	Squared factor loading			Weight of item		
	1	2	3	1	2	3
MUT6	0.918			0.100		
MUT3	0.778			0.085		
MUT7	0.687			0.075		
MUT4	0.650			0.071		
MUT5	0.645			0.071		
MUT8	0.581			0.064		

Item	1	2	3	1	2	3
MUT1	0.321			0.035		
FAI3		0.763			0.093	
FAI4		0.578			0.070	
FAI1		0.488			0.060	
FAI2		0.472			0.058	
TRA3			0.683			0.089
TRA2			0.671			0.088
TRA1			0.427			0.056
TRA4			0.393			0.051
EV*	9.138	8.196	7.666			
WF**	0.366	0.328	0.307			

* Explained Variance implies the variance which the factor explains

** Weight of factor: the proportion of the variance of a factor divided by the sum of the variances explained by the five factors

Factor 1 – Mutuality, Factor 2 – Fairness, Factor 3 – Transparency

Table 6. Weights of 22 indicators and five sub-constructs of collaboration

Item	Squared factor loading					Weight of item				
	1	2	3	4	5	1	2	3	4	5
FAI3	0.515					0.059				
FAI4	0.394					0.040				
FAI1	0.288					0.033				
FAI2	0.253					0.029				
SUS3		0.744					0.086			
SUS4		0.597					0.069			
SUS2		0.294					0.034			
MUT6			0.937					0.078		
MUT5			0.721					0.060		
MUT3			0.624					0.052		
MUT7			0.612					0.051		
MTU4			0.516					0.043		
MUT8			0.468					0.039		
MUT1			0.336					0.028		
TRA3				0.706					0.074	
TRA2				0.601					0.063	
TRA4				0.420					0.044	
TRA1				0.410					0.043	
TRU3					0.736					0.073
TRU2					0.696					0.069
TRU1					0.534					0.053
TRU4					0.454					0.045
EV*	8.734	8.650	12.008	9.534	10.079					
WF**	0.178	0.177	0.247	0.196	0.207					

* Explained Variance implies the variance which the factor explains

** Weight of factor: the proportion of the variance of a factor divided by the sum of the variances explained by the five factors

Factor 1 – Fairness, Factor 2 – Sustainability, Factor 3 – Mutuality, Factor 4 – Transparency, Factor 5 - Trust

A factor score is computed as the weighted average of items:

$$\text{Factor score} = \frac{\sum x_i w_i}{\sum w_i}$$

$\sum w_i$ = the summed weights of item i.

$\sum x_i w_i$ = the summation of each item's average score (x_i) multiplied by its weight (w_i).

CCSIs are calculated using the weighted average of factors:

$$\text{CCSIs} = \frac{\sum f w_f}{\sum w_f}$$

$\sum w_f$ = the weights of each factor, sum to unity.

$\sum f \, w_f$ = the summation of each factor score multiplied by its factor weight. Finally, the index is scaled 0-100 allowing computation of a cooperative spirit index (CSI1 = 55.0) and collaborative spirit index (CSI2 = 57.0).

Table 7 shows CCSIs computed by shipping registered, vessel types and contract period. Indices for coastal shipping exceed those for ocean-going shipping. By vessel type, indices for "other" ships exceed those for tankers, bulkers and containers. By contract period, longer contracts record higher CCSIs.

Table 7. CCSI profiles and the results of hypothesis tests.

	CSI1	CSI2	Hypothesis	Reject/Accept
The SC	55	57	-	-
Shipping types registered				
Coastal	57	58	H_1	Rejected
Ocean-going	53	55		
Vessel types				
Container	47	51		
Bulk	54	55	H_2	Accepted
Tanker	55	57		
Others	61	61		
Contract period				
Less than 1	49	51		
1-2	53	55	H_3	Accepted
3-9	61	62		
More than 10	64	66		

4.6. Comparison of differences of cooperative and collaborative spirit indices

MANOVA was deployed to examine differences in groupings of CCSIs. To test H_1 cursory inspection revealed higher CCSIs for coastal shipping. Assumptions of independence between observations underpinning MANOVA were met through saturation sampling. Multivariate normality attained because no higher-order moments of dependent variables differed significantly from normality at $p < 0.05$ identified by z values $< |1.96|$ for skewness (CSI1 = 0.665; CSI2 = 1.16) and kurtosis (CSI1 = -.909; CSI2 = -1.168). CCSIs separately and collectively met homoscedasticity assumptions, as both Levene's test (CSI1, $p = 0.534$; CSI2, $p = 0.140$) and Box's test ($p = 0.158$) were insignificant at $p < 0.05$. Bartlett's test for sphericity indicated significant inter-correlation (p = 0.000) between dependent variables (Hair et al., 2014). No multivariate test statistic indicated a significant difference ($p < 0.05$) between coastal and seagoing shipping companies. Main effects and power statistics for Pillas's trace (PT) were V (value) = 0.027, F (2, 164) = 2.245, p (0.109) > 0.1, η2 = 0.027, P (power) = 0.452. Univariate tests for each dependent variable indicated no significant difference ($p = 0.117$ for cooperation, $p = 0.240$ for collaboration) and with only two groups a post hoc test was inappropriate (Hair et al., 2014). Consequently, H_1 was rejected.

The possibility of joint effects and main effects of vessel types and contract periods on CCSIs were examined. Following Box's test (significance = 0.120), a null hypothesis of equality of variance-covariance matrices was accepted (p < 0.05). Levene's test for CCSIs showed non-significant values (cooperation = 0.815; collaboration = 0.974). Multivariate and univariate tests indicated compliance with assumptions of homoscedasticity. Multivariate statistics indicated an insignificant interaction effect between vessel types and contract periods (PT V = 0.065, F (14, 306) = 0.735, p = 0.738, η2 = 0.33, P (power) = 0.469), implying rejection of H_4. Hence, the direct effects were examined without adjustment. Multivariate testing with different group sizes using PT demonstrated significant effects of contract periods and vessel types on CCSIs (Hair et al., 2014). For contract period, V = 0.129, F (6, 306) = 3.512, p (0.002) < 0.01, η2 = 0.64, P (power) = 0.948; for vessel types, V = 0.081, F (6, 306) = 2.166, p (0.046) < 0.05, η2 = 0.41, P (power) = 0.767. Power measures were good for contract periods and acceptable for vessel types, supporting

H_2 and H_3. Values of η^2 imply that contact periods have more effect on CCSIs than vessel types. Follow-up univariate ANOVAs on dependent variables likewise revealed significant effects of contract periods and vessel types on CCSIs. CSI1 results were: contract periods, $F (13, 153) = 6.234$, $p < 0.01$; vessel types, $F (13, 153) = 2.880$, $p < 0.05$. For CSI2: contract periods with $F (13, 153) = 6.872$, $p < 0.01$ and vessel types: $F (13, 153) = 2.839$; $p < 0.05$. Tests of "between-subjects effects" generated p-values indicating significant differences between groups regarding contract periods and vessel types, implying that CCSIs are significantly affected.

Post hoc tests compared CCSIs grouped by contract period and vessel type (Table 8). By contract period, Tukey's LSD test on both CSI1 and CSI2 revealed highly significant differences at $p < 0.01$ between short/ longer periods, and short / long periods. For both CSI1 and CSI2, long contracts differed from medium periods, at $p < 0.01$. By vessel type, only containers compared to other vessels differed significantly at $p < 0.05$, for CSI1.

Table 8. Post hoc pairwise comparison with Turkey LSD.

Dependent variables	Comparison among contract period groups		p	Comparison among vessel type groups		p
CSI1	< 1	1-2	-	Container	Bulk	-
		3-9	***		Tanker	-
		10 ≤	***		others	**
	1-2	< 1	-	Bulk	Container	-
		3-9	*		Tanker	-
		10 ≤	**		Others	*
	3-9	< 1	***	Tanker	Container	-
		1-2	*		Bulk	-
		10 ≤	-		Others	-
	10 ≤	< 1	***	Others	Container	**
		1-2	**		Bulk	*
		3-9	-		tanker	-
CSI2	< 1	1-2	-	Container	Bulk	-
		3-9	***		Tanker	-
		10 ≤	***		others	*
	1-2	< 1	-	Bulk	Container	-
		3-9	*		Tanker	-
		10 ≤	***		Others	*
	3-9	< 1	***	Tanker	Container	-
		1-2	*		Bulk	-
		10 ≤	-		Others	-
	10 ≤	< 1	***	Others	Container	*
		1-2	***		Bulk	*
		3-9	-		tanker	-

Note: ***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$

5. Research findings

5.1. Components of cooperation and collaboration

In this study cooperation comprised transparency, fairness, and mutuality and collaboration consisted of cooperation, trust, and sustainability. Fairness has the highest variation explained by cooperation (87%) and collaboration (86%) in each corresponding measurement model, implying that shipping companies most value fairness. Transparency comprised exchange of relevant and timely information, smooth communication through various channels, open and two-way communication, and previously and clearly setting-up of the relationship by prior agreement. Fairness is akin to justice (Konovsky, 2000) or reciprocity (Bensaou, 1997) and consists of procedural and distributive justice with no discrimination, observation of fair trade laws, guarantees of reasonable and just profits,

and reasonable and just bearing of burdens. Mutuality represented exchange relationships including understanding of partner's services, common implementation plans and objectives, common identification of customer's needs, common performance measurement and providing adequate assistance to overcome difficulties, including financial support. Trust can be measured by trustworthiness and good faith of the other party, fulfilment of obligation and benevolence. Finally, sustainability mirrors "relationship extendedness" (Gardner et al., 1994), represented by belief in the continuity of relationships and partner willingness to maintain and enhance the relationship.

5.2. The cooperative and collaborative spirit indices

CCSIs quantify the state of SC cooperation and collaboration and suggest improvement strategies. On both CSI1 and CSI2, mutuality (50) and fairness (56) components recorded lower factor scores than transparency (58), although trust (65) and sustainability (56) increased CSI2's overall score to 57, two points above CSI1 (Table 9). Low mutuality scores reveal that shipping companies perceive little financial support or assistance from shippers to overcome difficulties and common implementation planning and performance reviews rarely succeeded, implying fundamentally weak exchange relationships in SCs. Distributive fairness was deemed less applicable than procedural fairness as shipping companies regarded the reasonable and just guaranteeing of profits and additional burdens on powerful SC members as insufficient. Low attitude scores amongst dominant partners towards sharing gains and costs decrease satisfaction amongst shipping companies (Harland et al., 2004) and hinder the building of trust and true cooperation. Low sustainability scores imply that influential members belittle "relationship extendedness" involving joint development of new business plans or expanding new markets. Transparency was highly rated, but limited open and two-way communication reflects the superior power of shippers. Despite relatively low CCSIs, weaker SC members showed relatively strong trust towards superior partners as shipping companies believed firmly in the fulfilment of contractual obligations of shippers with regulations concerning business transactions and laws governing fair trade relatively well observed by powerful members.

Table 9. Overall CCSIs and factor score.

		Transparency	Fairness	Mutuality	Trust	Sustainability
CSI1	55	58	56	50	-	-
CSI2	57	58	56	50	65	56

6. Discussion and conclusion

6.1. Contributions to theories

This research supports findings from TCT that benign and credible transactions are realistic (Heaver, 2015) as inter-firm cooperation decreases transaction costs and realises mutual gains. Shipper superiority coupled with modest CCSIs imply that market or "muscular" transactions predominate, but long-term contracts and correspondingly higher CCSIs indicate "benign" and "credible" transactions as hybrid forms of transactional governance.

From an RBT perspective SC cooperation and collaboration is an intangible resource and capability which builds sustainable competitive advantage. Shipping companies with higher CCSIs gained a competitive advantage because weaker members were revenue-dependent on shippers, and cooperation and collaboration benefits accumulate over time.

Within RDT, resource exchanges shape inter-firm relationships driven by power relations (Ulrich and Barney, 1984). Organisations capable of reducing others' power over themselves, in turn increase their own power over others (Hillman et al., 2009). This perspective of RDT may partially explain the attitudes of dominant SC members because shippers need to cooperate and collaborate resources and services with shipping companies to simultaneously switch carriers in a competitive industry (Golicic, 2007). CCSI scores by vessel type highlight shippers' ability to exert power efficiently over weaker SC members. Low CCSIs for containers indicate that shippers have effectively reduced shipping lines' power over them and their dependence on shipping lines, partially indicating the degree of dependence of shippers on shipping companies and power over them.

SET informed the research conceptual model concerning fairness, commitment (Korsgaard et al., 1995) and long-term orientation (Griffith et al., 2006). A highly significant path coefficient for fairness indicated that weaker SC

members regard fairness as the pivotal antecedent of trust and SEM supported the proposition that trust has a direct and positive effect on sustainability which contains the concepts of commitment and long-term orientation. Essential conceptions of SET within the context of maritime logistics and relationships between concepts were strongly supported.

CCSIs provide a criterion to define the type of relations in SCs and the extent of goodwill. Low CCSIs in container shipping imply widespread market or hierarchical relations and insufficient or unsatisfactory goodwill from shippers towards shipping.

This research assists operationalisation of key concepts. Spekman et al. (1998) and Golicic et al.'s (2003) differentiation of cooperation from collaboration is crystallised in that collaboration consists of cooperation and "relationship strength" such as trust and sustainability. Further, first-order factors consisting of a few concepts are utilised to measure cooperation and collaboration. Despite representing composite constructs, first-order factors clearly represent and measure higher-order factors and parsimony avoids overload on respondents resulting from lengthy survey questionnaires (Hair et al., 2014). As a component of cooperation and collaboration, fairness extends beyond "incentive alignment" which represents distributive fairness. If indeed procedural fairness surpasses distributive justice in building cooperative relationships (Kumar et al., 1995b), both were adopted simultaneously. Weaker SC members perceived fairness as fundamental to cooperation, the most influential component for building trust.

6.2. Managerial implications

CCSIs revealed that indifference towards mutuality, distributive fairness, "relationship extendedness", and two-way communication hamper cooperative and collaborative SCs. Shipping company failure damages SC members as evidenced by Hanjin Shipping Company's bankruptcy in 2016 when 329 shippers lost USD120M and suffered delivery delays, dishonoured contracts, resources squandered in finding capable transport service providers and rising freight rates (KITA, 2017). Ordered maintenance of cooperation and collaboration with weaker SC members serves the long-run self-interests of powerful SC members, and emergency financial support to hard-pressed shipping companies preserves service provision.

Two-way communication between influential and weaker SC members is needed to settle common cooperative and collaborative implementation plans and to review performance. Shippers' endeavours to ensure rationalised and justified contact enhance SC exchange relationships but must avoid burdensome overly frequent contact (Min et al., 2005).

Shipping companies value fairness most highly in building trust but weaker SC members expect greater distributive fairness from influential SC members. Stable, effective channel partnerships with unfair suppliers are unlikely (Kumar et al., 1995a).

Shipper-shipping company relationships illustrate SC relationships effectively. Mutual sharing of profits and burdens between stronger and weaker members develops effective, high-quality relationships and mutual trust which precedes partnership building. Expectations of reciprocal provision pre-dispose partners to accept short-term hardships as long-run attitudes of sharing benefits and burdens benefit both partners (Gardner et al., 1994). Distributive fairness was crucial following Hanjin's collapse. Long-term SC relationships generate improved quality and reduced costs. Reinforcing of long-term relationships with superior members may ensure survival for weaker parties or stable foundations for long-term growth, perhaps through joint expansion of new markets and joint development of new business plans.

To establish trust requires sufficient collaboration and weaker members must develop and implement complex and time-consuming methods to earn and build trust from influential SC partners (Min et al., 2005; Daugherty et al., 2006). Shipping companies must continually keep delivery promises and satisfy shippers' expectations. Ship owners must empathise with shippers by offering flexible and responsive innovative value-added services including integrated logistics services. To build "brand loyalty" shipping companies must continuously superior partners' needs.

6.3. Policy implications

Power imbalances coupled with adversarial relationships, perhaps between shippers and carriers, invite government intervention to foster inter-organisational cooperation involving public governance of an association (Fugate et al., 2009). Shipping operates within complex patterns of agreements involving shipping companies, shippers and government policies, mediation and "order-preserving mechanisms" to maintain cooperation as contracts are enacted (Williamson, 2008).

Sporadic two-way communication within SCs and shippers' dominance may necessitate government intervention to form consultative stakeholder groups to foster cooperative relationships. In 2010 the Federal Maritime Commission organised voluntary committees to address commercial practices, capacity forecasting and enhanced collaborative relationships, between shippers and carriers (Heaver, 2015). Low CCSIs make liner shipping a prime initial candidate. In parallel, government action to collate, provide and disseminate best practices of cooperation and collaboration is urgent to raise process efficiency, flexibility, business synergy, quality, and innovation (Cao et al., 2010; Cao and Zhang, 2010; 2011) where firms misunderstand collaboration and shun formal arrangements (Barratt, 2004; Ramanathan and Gunasekaran, 2014). Low maritime SCC evidences ineffective operational processes in building mutuality, trust, commitment for collaboration, and requires attitudinal and behavioural change (Fugate et al., 2009). However, good practice is evident where "other vessels" (tugs, barges and reefers) record high CCSIs and two-fifths of bulk and tanker sector contract periods exceed 3 years allowing sufficient time to develop good practice. Exemplar practice of mutuality and sustainability relates to how common plans are established, joint performance is measured and assistance offered. "Relationship extendedness" by jointly developing new business models and expanding new markets is instructive, as are long-term contract periods which signify close relationships. Detailed execution plans to enhance CCSIs will impact logistics network design and strategic plans to generate mutual benefits (Stank and Goldsby, 2000).

To enhance CCSIs, government should consider institutional strategies to promote fairness as the key component of cooperation and essential antecedent of trust. Under global competition and heightened uncertainties, government policies and regulatory regimes have encouraged new collaborative relationships among international logistics parties to improve efficiency (Heaver, 2015). Interventions to reinforce distribution fairness such as limiting driver working hours, muffle opportunistic tendencies by shippers and provoke more collaborative attitudes towards inland carriers (Fugate et al., 2009).

6.4. Policy implications Limitation and recommendation for future research

CCSIs diagnosed, compared and evaluated the current state of cooperation and collaboration between SC members but because the composite indicator is exploratory, its limitations generate recommendations for future research (OECD, 2008). A detailed taxonomy of shippers as suppliers, manufacturers, distributors, large retailers and freight forwarders may facilitate more accurate evaluations of CCSIs by shipper type. In this study, CCSI reporting by vessel type assumed that shippers are differentiated within each type, denying direct linking of CCSIs to shippers. More detailed categorisation would enable linking.

This study highlighted the shipping firm perspective and using a single informant design, common methods variance can arise (Griffith et al., 2006). Influential SC members' views differ from those of weaker partners, and future research needs to consider both sides.

Can CCSIs be generalized to embrace other SC relationships? The research methods presented are transferable to test other relationships spanning combinations of SC members but each is distinctive and research requires advice from expert commentators regarding relevant items. In this research joint demand forecasts and inventory management between shippers and shipping companies were eschewed, but suppliers and manufactures, or manufacturers and distributors may embrace them. International comparison of CCSIs is desirable but social, cultural and legal variations occur. Where regulations and contract forms concerning business transactions vary, interviews with shipping experts are required to propose comparable international measurement items and where comparability attains, each country can identify strengths, weaknesses and remedial measures to enhance its performance.

Appendices

Table A. Description of the item codes

Item code	Item descriptor
FAI3	Shippers make an effort to guarantee reasonable and just profits for our firm
FAI4	Shippers make an effort to bear reasonably and justly any additional risks, burden, and costs related to delivery with our firm
FAI1	Shippers do not discriminate our firm against other shipping companies
FAI2	Shippers try to comply with the regulations related to business transactions
SUS3	Shippers make communication with our firm open and two-way
SUS4	The relationship between shippers and our firm is understood clearly and transparently through prior agreements
SUS2	Shippers and our firm communicate smoothly with each other
SUS1	Shippers exchange relevant and timely information with our firm
MUT6	Shippers and our firm, as equal business partners, decide together the availability level of our facilities and equipment
MUT5	Shippers and our firm agree common implementation plans and objectives
MUT3	Shippers are willing to provide financial support for our firm
MUT7	Shippers and our firm identify together customer needs related to delivery
MTU4	Shippers are willing to assist our firm in overcoming any difficulties we face
MUT8	Shippers and our firm identify together customer needs related to delivery
MUT1	Shippers understand our firm's services well and are willing to assist us
MUT2	Shippers are willing to provide their facilities and equipment for our firm
TRA3	Shippers try to develop new business plans or ideas together with us
TRA2	The relationship between shippers and our firm will last and strengthen
TRA4	Shippers enhance their relationship with our firm by expanding markets jointly
TRA1	The relationship between shippers and our firm is stable
TRU3	We believe that shippers fulfil their contractual obligations
TRU2	We believe the good faith offered by shippers
TRU1	Overall, shippers are trustworthy
TRU4	We believe that shippers benefit our firm
EV	Explained Variance: variance that the factor explains
FW	Factor Weight: proportion of the variance of a factor divided by the sum of the variances explained by all factors

References

Acedo, F.J., Barroso, C. and Galan, J.L. (2006), "The resource-based theory: Dissemination and main trends", *Strategic Management Journal*, Vol. 27 No. 7, pp. 621-636.

Adler, P.S. and Kwon, S-W. (2002), "Social capital: Prospects for a new concept. *Academy of Management Review"*, Vol. 27 No. 1, pp. 17-40.

Ahmed, M.U., Kristal, M.M., Pagell, M. and Gattiker, T.F. (2017) "Towards a classification of supply chain relationships: a routine based perspective", *Supply Chain Management: An International Journal,* 22(4), pp. 341-374

Anderson, J.C. and Narus, J.A. (1990), "A model of distributor firm and manufacturer firm working partnerships", *Journal of Marketing*, Vol. 54 No. 1, pp. 42-58.

Armstrong, J.S. and Overton, T.S. (1977), "Estimating nonresponse bias in mail surveys", *Journal of Marketing Research*, Vol. 14 No. 3, pp. 396-402.

Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.

Barratt, M. (2004), "Understanding the meaning of collaboration in the supply chain". *Supply Chain Management: An International Journal*, Vol. 9 No. 1, pp 30-42.

Baumgartner, H. and Homburg, C. (1996), "Applications of structural equation modeling in marketing and consumer research: A review", *International Journal of Research in Marketing*, Vol. 13 No. 2, pp. 139-161.

Bensaou, M. (1997), "Interorganisational cooperation: The role of information technology an empirical comparison of US and Japanese supplier relations", *Information Systems Research*, Vol. 8 No. 2, pp. 107-124.

Boon-itt, S. and Paul, H. (2005), "Measuring supply chain integration - Using the Q-sort technique". In Kotzab, H., Seuring, S., Müller, M. and Reiner, G (Eds.), *Research Methodologies in Supply Chain Management,* Physica-Verlag, Heidelberg, pp. 47-58.

Bove, L.L. and Johnson, L.W. (2001), "Customer relationships with service personnel: Do we measure closeness, quality or strength?", *Journal of Business Research*, Vol. 54 No. 3, pp. 189-197.

Byrne, B.M. (2010), *Structural Equation Modelling With AMOS: Basic Concepts, Applications, and Programming,* 2nd ed., Routledge, London.

Cao, M., Vonderembse, M.A., Zhang, Q. and Ragu-Nathan, T.S. (2010), "Supply chain collaboration: Conceptualisation and instrument development", *International Journal of Production Research*, Vol. 48 No. 22, pp. 6613-6635.

Cao, M. and Zhang, Q. (2010), "Supply chain collaborative advantage: A firm's perspective". *International Journal of Production Economics*, Vol.128 No.1, pp 358-367.

Cao, M. and Zhang, Q. (2011), "Supply chain collaboration: Impact on collaborative advantage and firm performance", *Journal of Operations Management*, Vol. 29 No. 3, pp. 163-180.

Chen, J.V., Yen, D.C., Rajkumar, T. and Tomochko, N.A. (2011), "The antecedent factors on trust and commitment in supply chain relationships", *Computer Standards and Interfaces*, Vol. 33 No. 3, pp. 262-270.

Daugherty, P.J., Richey, R.G., Roath, A.S., Min, S., Chen, H., Arndt, A.D. and Genchev, S.E. (2006), "Is collaboration paying off for firms?", *Business Horizons*, Vol. 49 No. 1, pp. 61-70.

Dwyer, F.R. and Oh, S. (1987), "Output sector munificence effects on the internal political economy of marketing channels", *Journal of Marketing Research*, Vol. 24 No. 4, pp. 347-358.

Dyer, J.H. and Singh, H. (1998), "The relational view: Cooperative strategy and sources of interorganisational competitive advantage", *Academy of Management Review*, Vol. 23 No. 4, pp. 660-679.

Eyuboglu, N., Ryu, S. and Tellefsen, T. (2003), "Current and future interdependence". *Journal of Marketing Channels*, Vol. 11 No. 1, pp. 3-26.

Fransoo, J.C. and Lee, C.Y. (2013), "The critical role of ocean container transport in global supply chain performance", *Production and Operations Management*, Vol. 22 No. 2, pp. 253-268.

Frémont, A. (2009), "Shipping lines and logistics", *Transport Reviews*, Vol. 29 No. 4, pp. 537-554.

Fugate, B.S., Davis-Sramek, B. and Goldsby, T.J. (2009), "Operational collaboration between shippers and carriers in the transportation industry", *International Journal of Logistics Management*, Vol. 20 No. 3, pp. 425-447.

Ganesan, S. (1994), "Determinants of long-term orientation in buyer-seller relationships", *Journal of Marketing*, Vol. 58 No. 2, pp. 1-19.

Gardner, J.T., Cooper, M.C. and Noordewier, T.G. (1994), "Understanding shipper-carrier and shipper-warehouser relationships: Partnerships revisited", *Journal of Business Logistics*, Vol. 15 No. 2, pp. 121-143.

Garver, M.S. and Mentzer, J.T. (1999), "Logistics research methods: Employing structural equation modeling to test for construct validity", *Journal of Business Logistics*, Vol. 20 No. 1, pp. 33-57.

Geyskens, I., Steenkamp, J.-B.E.M. and Kumar, N. (2006), "Make, buy, or ally: A transaction cost theory meta-analysis", *Academy of Management Journal*, Vol. 49 No. 3, pp. 519-543.

Golicic, S.L. (2007), "A comparison of shipper and carrier relationship strength". *International Journal of Physical Distribution and Logistics Management*, Vol. 37 No. 9, pp. 719-739

Golicic, S. L., Foggin, J. H. and Mentzer, J.T. (2003), "Relationship magnitude and its role in interorganisational relationship structure", *Journal of Business Logistics*, Vol. 24 No. 1, pp. 57-75.

Griffith, D.A., Harvey, M.G. and Lusch, R.F. (2006), "Social exchange in supply chain relationships: The resulting benefits of procedural and distributive justice", *Journal of Operations Management*, Vol. 24 No. 2, pp. 85-98.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2014), *Multivariate Data Analysis, Pearson,* Essex.

Harland, C., Zheng, J., Johnsen, T. and Lamming, R. (2004), "A conceptual model for researching the creation and operation of supply networks", *British Journal of Management*, Vol. 15 No. 1, pp. 1-21.

Heaver, T.D. (2015), "Increased collaborative relationships in international logistics: Canadian and other national and corporate examples", *Maritime Policy and Management*, Vol. 42 No. 3, pp. 278-292.

Hillman, A.J., Withers, M.C. and Collins, B.J. (2009), "Resource dependence theory: A review", *Journal of Management*, Vol. 35 No. 6, pp. 1404-1427.

Hornibrook, S., Fearne, A. and Lazzarin, M. (2009), "Exploring the association between fairness and organisational outcomes in supply chain relationships", *International Journal of Retail and Distribution Management*, Vol. 37 No. 9, pp. 790-803.

Hudnurkar, M., Jakhar, S. and Rathod, U. (2014), "Factors affecting collaboration in supply chain: A literature review", *Procedia-Social and Behavioral Sciences*, Vol. 133 No. 1, pp. 189-202.

Huo, B., Han, Z. and Prajogo, D. (2016), "Antecedents and consequences of supply chain information integration: a resource-based view", *Supply Chain Management: An International Journal*, Vol. 21 No. 6, pp. 661-677.

Iverson, R.D. and Maguire, C. (2000), "The relationship between job and life satisfaction: Evidence from a remote mining community", *Human Relations*, Vol. 53 No. 6, pp. 807-839.

Jolliffe, I.T. (2002) Principal component analysis. 2nd ed. New York: Springer.

Kim, K.K., Park, S.-H., Ryoo, S.Y. and Park, S.K. (2010), "Inter-organisational cooperation in buyer–supplier relationships: Both perspectives", *Journal of Business Research*, Vol. 63 No. 8, pp. 863-869.

KITA, (2017), *The damage of shippers from Hanjin collapse,* Korea International Trade Association,Seoul.

Konovsky, M.A. (2000), "Understanding procedural justice and its impact on business organisations", *Journal of Management*, Vol. 26 No. 3, pp. 489-511.

Korsgaard, M.A., Schweiger, D.M. and Sapienza, H.J. (1995), "Building commitment, attachment, and trust in strategic decision-making teams: The role of procedural justice", *Academy of Management Journal*, Vol. 38 No. 1, pp. 60-84.

Kumar, G. and Nath Banerjee, R. (2014), "Supply chain collaboration index: An instrument to measure the depth of collaboration", *Benchmarking: An International Journal*, Vol. 21 No. 2, pp.184-204.

Kumar, N., Scheer, L.K. and Steenkamp, J.-B.E. (1995a), "The effects of supplier fairness on vulnerable resellers", *Journal of Marketing Research*, Vol. 32 No. 1, pp. 54-65.

Kumar, N., Scheer, L.K. and Steenkamp, J.-B.E. (1995b), "The effects of perceived interdependence on dealer attitudes", *Journal of Marketing Research*, Vol. 32 No. 3, pp. 348-356.

Kwon, I.W.G. and Suh, T. (2005), "Trust, commitment and relationships in supply chain management: A path analysis", *Supply Chain Management: An International Journal*, Vol. 10 No. 1, pp. 26-33.

Malhotra, A., Gosain, S. and Sawy, O.A.E. (2005), "Absorptive capacity configurations in supply chains: Gearing for partner-enabled market knowledge creation", *Management Information Systems Quarterly*, Vol. 29 No. 1, pp. 145-187.

Mei, Z. and Dinwoodie, J. (2005), "Electronic shipping documentation in China's international supply chains", *Supply Chain Management: An International Journal,* Vol. 10, No. 3, pp. 198-205.

Min, S. and Mentzer, J.T. (2004), "Developing and measuring supply chain management concepts", *Journal of Business Logistics*, Vol. 25 No. 1, pp. 63-99.

Min, S., Roath, A.S., Daugherty, P.J., Genchev, S.E., Chen, H., Arndt, A.D. and Richey, R.G. (2005), "Supply chain collaboration: What's happening?", *International Journal of Logistics Management*, Vol, 16 No. 2, pp. 237-256.

MOF, (2016), Internal data, Ministry of Oceans and Fisheries, Sejong, South Korea.

Mohr, J. and Nevin, J.R. (1990), "Communication strategies in marketing channels: A theoretical perspective", *Journal of Marketing*, Vol. 54 No. 4, pp. 36-51.

Morgan, R.M. and Hunt, S.D. (1994), "The commitment-trust theory of relationship marketing", *Journal of Marketing*, Vol. 58 No. 3, pp. 20-38.

Narasimhan, R., Nair, A., Griffith, D.A., Arlbjørn, J.S. and Bendoly, E. (2009), "Lock-in situations in supply chains: A social exchange theoretic study of sourcing arrangements in buyer-supplier relationships", *Journal of Operations Management*, Vol. 27 No. 5, pp. 374-389.

Nassirnia, P. and Robinson, R. (2013), "Supply chain integration and chain efficiency: The importance of changing perspective toward whole chain integration", *Journal of Applied Sciences and Engineering Management*, Vol. 1 No. 1, pp. 13-23.

Nunkoo, R. and Ramkissoon, H. (2012), "Power, trust, social exchange and community support", *Annals of Tourism Research*, Vol. 39 No. 2, pp. 997-1023.

Nyaga, G.N. and Whipple, J.M. (2011), "Relationship quality and performance outcomes: Achieving a sustainable competitive advantage", *Journal of Business Logistics*, Vol. 32 No. 4, pp. 345-360.

OECD., (2008), *Handbook On Constructing Composite Indicators: Methodology and User Guide,* Organisation for Economic Co-operation and Development, Paris.

Osborne, J.W. and Costello, A.B. (2009), "Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis", *Pan-Pacific Management Review*, Vol. 12 No. 2, pp. 131-146.

Pedhazur, E.J. and Schmelkin, L.P. (2013), *Measurement, Design, and Analysis: An Integrated Approach,* Psychology Press, New York.

Pradabwong,J., Braziotis, C., Tannock, J.D.T and Pawar, K.S. (2017), "Business process management and supply chain collaboration: effects on performance and competitiveness", *Supply Chain Management: An International Journal*, Vol. 22 No. 2, pp. 107-121

Putnam, R.D. (1993), "The prosperous community", *American Prospect*, Vol. 4 No. 13, pp. 35-42.

Ramanathan, U. and Gunasekaran, A. (2014), "Supply chain collaboration: Impact of success in long-term partnerships", *International Journal of Production Economics*, Vol. 147 Part B, pp. 252-259.

Reid, D., Bussiere, D. and Greenaway, K. (2001), "Alliance formation issues for knowledge-based enterprises", *International Journal of Management Reviews*, Vol. 3 No. 1, pp. 79-100.

Richey, R.G., Roath, A.S., Whipple, J.M. and Fawcett, S.E. (2010), "Exploring a governance theory of supply chain management: Barriers and facilitators to integration", *Journal of Business Logistics*, Vol. 31 No. 1, pp. 237-256.

Ryu, S., Park, J.E. and Min, S. (2007), "Factors of determining long-term orientation in interfirm relationships", *Journal of Business Research*, Vol. 60 No. 12, pp. 1225-1233.

Seo, Y.J., Dinwoodie, J. and Roe, M. (2015), "Measures of supply chain collaboration in container logistics". *Maritime Economics and Logistics*, Vol. 17 No. 3, pp. 292-314.

Simatupang, T.M. and Sridharan, R. (2005), "The collaboration index: A measure for supply chain collaboration", *International Journal of Physical Distribution and Logistics Management*, Vol. 35 No. 1, pp. 44-62.

Soosay, C.A. and Hyland, P. (2015), "A decade of supply chain collaboration and directions for future research", *Supply Chain Management: An International Journal,* Vol. 20. No. 6, pp. 613–630.

Spekman, R.E., Jr, J.W.K. and Myhr, N. (1998), "An empirical investigation into supply chain management", *International Journal of Physical Distribution and Logistics Management*, Vol. 28 No. 8, pp. 630-650.

Stank, T.P. and Goldsby, T.J. (2000), "A framework for transportation decision making in an integrated supply chain", *Supply Chain Management: An International Journal*, Vol. 5 No. 2, pp. 71-78.

Stopford, M. (2009), *Maritime Economics*, 3rd ed. Routledge, New York.

Talley, W.K. and Ng, M. (2013), "Maritime transport chain choice by carriers, ports and shippers", *International Journal of Production Economics*, Vol. 142 No. 2., pp. 311-316.

Thomson, A.M., Perry, J.L. and Miller, T.K. (2009), "Conceptualizing and measuring collaboration", *Journal of Public Administration Research and Theory*, Vol. 19 No. 1, pp. 23-56.

Ulrich, D. and Barney, J.B. (1984), "Perspectives in organisations: Resource dependence, efficiency, and population", *Academy of Management Review*, Vol. 9 No. 3, pp. 471-481.

Wang, C.L., Siu, N.Y.M. and Barnes, B.R. (2008), "The significance of trust and renqing in the long-term orientation of Chinese business-to-business relationships", *Industrial Marketing Management*, Vol. 37 No. 7, pp. 819-824.

Wieland, A., Durach, C.F., Kembro, J. and Treiblmaier, H. (2017), "Statistical and judgmental criteria for scale purification", *Supply Chain Management: An International Journal*, Vol. 22 No. 4, pp.321-328.

Williamson, O. E. (2008), "Outsourcing: Transaction cost economics and supply chain management", *Journal of Supply Chain Management*, Vol. 44 No. 2, pp. 5-16.

World Bank (2014), *Connecting to Compete 2014. Trade Logistics in the Global Economy,* The World Bank, Washington.

Zsidisin, G.A., Voss, M.D. and Schlosser, M. (2007), "Shipper-carrier relationships and their effect on carrier performance", *Transportation Journal*, Vol. 46 No. 2, pp. 5-18.