The impact of total quality management and supply chain integration on firm performance of container shipping companies in Singapore

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Abstract

Purpose – The purpose of this paper is to investigate the influences of total quality management (TQM) and supply chain integration (SCI) practices on firm performance (FP) of container shipping industry in Singapore.
Design/methodology/approach – A survey was conducted with 159 container shipping companies in Singapore to examine the interrelationships between SCI and TQM practices and FP. A stepwise multiple regression analysis using SPSS version 14.0 was performed on the data.
Findings – Statistical results suggest that both TQM and SCI practices have positive effects on service quality and FP but at different extents, while TQM also contributes positively to SCI.
Research limitations/implications – The small sample is the main limitation. The findings bear important implications for further research as understanding these dimensions can help to position key changes and industry improvement that will increase revenue and reduce cost to the container shipping companies in Singapore.
Practical implications – This research provides guidelines for shipping managers on how to implement the SCI and TQM practices appropriately to boost their FP to the fullest extent.
Social implications – This study has unique implications for social sustainability especially the container shipping industry, which is hard pressed to combat the challenges within the logistics/transportation sector.
Originality/value – This is perhaps the first study that examines the influence of SCI and TQM practices on the performance of container shipping firms that helps them see beyond the silo mentality and focus on greater value addition in FP.

Keywords Firm performance, Service quality, Supply chain integration, Total quality management, Container shipping

Paper type Research paper

Introduction

With more than 90 percent of world trade by volume being transported by sea, shipping remains the backbone facilitator of international trade and globalization (International Maritime Organisation, 2014). It is the major transportation provider of large volume shipments over long distances at low costs. In recent years, container shipping has grown tremendously bringing with it an expanded network of suppliers, customers, and is being integrated more intensively into supply chains (Yang *et al.*, 2014). Unlike other types of cargo ships, containerships sail according to published schedules to named ports and require huge logistics support from a wide network of agents, ports and other suppliers, such as bunker and parts suppliers, and other immediate customers such as freight forwarders (Stopford, 2009). Regardless of whether or not there is a sufficient amount of cargo in the next port of call, the containership still has to follow its published schedule, and therefore it is essential to maintain a good plethora of interrelationships with both suppliers and customers to deliver a reliable service. All these players are intertwined in supply

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networks and are required for the effective performance of the container shipping industry. The importance of supply chain integration (SCI) in container shipping is highlighted by Frémont (2009) who argues that containerization prepares the ground for the full vertical and horizontal integration of transport chains. Integration is a central tenet in maritime logistics, particularly of the transportation modes and between organizations along the global supply chain (Panayides, 2006). In recent years, shipping companies have integrated horizontally through mergers, acquisitions, strategic alliances, and vertically through operating dedicated terminals and by providing integrated logistics and intermodal services (Gao and Yoshida, 2013; Merikas *et al.*, 2011; Agarwal and Ergun, 2010; Van De Voorde and Vanellander, 2008; Midoro *et al.,* 2005; Notteboom, 2004; Panayides and Cullinane, 2002).

Like other industries, service quality (SQ) plays a critical role in shipping, contributing to customer satisfaction and retention, leading to other business success (Thai, 2008; Thai *et al.*, 2014). Quality management is therefore essential to ensure that quality service and other business results are delivered to customers. This applies in many manufacturing and service sectors, and equally in the shipping industry, especially in container shipping. This is due to the characteristics of container shipping which are different from other sectors of the shipping industry. Specifically, containerships carry various types of cargo which are of high value but low volume, and the transport requirements are focused on timeliness, reliability, connectivity, etc. rather than the lowest freight rate. In other words, customers using container shipping are more concerned with the quality aspects of the service, and implementing quality management practices to meet customer expectations is essential. This is partly reflected through the existence of the International Organization for Standardization and other industry standards applicable to container shipping.

Although there has been much research on the influence of total quality management (TQM) and supply chain integration (SCI) practices on firm performance (FP), they were mostly conducted in isolation (e.g. see Chopra and Mendl, 2013; Huo, 2012; Agus and Hassan, 2011; Abdullah and Tari, 2012). In fact, it is possible that the implementation of some TQM practices would facilitate conducting specific aspects of SCI at the same time. For instance, if the firm implements supplier quality management practices such as seeking long-term relationships with their suppliers, it is likely that they would take actions to integrate further with their suppliers by sharing necessary information through information and communication technologies. In addition, studies on the impact of TQM and SCI practices on FP of container shipping lines are surprisingly scant, given the importance of the maritime supply chain in which container shipping companies are an integrated component. This paper addresses these research gaps. The paper is organized as follows. First, a literature review is provided, followed by the proposed conceptual model of TQM, SCI and FP. Methodologies are described next, followed by analyses and discussion of the study findings. Finally, concluding comments, including implications for academic research, management practice and future research directions are outlined.

Literature review

SCI and FP

In recent years, SCI has received much attention due to its key contribution toward firm's competitive advantage and performance (Li *et al.,* 2006). It is argued that the strongest association with improved performance is achieved by a high degree of integration (Frohlich and Westbrook, 2001). SCI refers to coordination mechanisms in the form of business processes that should be streamlined and interconnected both within and outside company boundaries (Romano, 2003; Pagell and Krause, 2004), and the strategic collaboration of both intra-organizational and inter-organizational processes (Flynn *et al.*, 2010). Supply chain management (SCM) philosophy emphasizes SCI that links a firm with its customers, suppliers and other channel members (Eng, 2006; Mason and Lalwani, 2006;

Sahin and Robinson, 2005; Watson and Zheng, 2005). Cohen *et al.* (2004) also emphasize the role of SCI among partners as an important determinant of value creation. In essence, SCI centers on coordination and requires all business processes to be streamlined internally within the firm and externally among firms (Cagliano *et al.*, 2006). In this respect, SCI is mainly conceptualized by two key dimensions; internal and external integration (Tessarolo, 2007). Internal integration refers to the coordination, communication, and cooperation among functional groups within the organization (Lin and Chen, 2008) which involves breaking down functional silos, reducing role conflicts among functions, facilitating teamwork and communications, and cohesive sharing of resources and information to maximize firm's performance (Gimenez and Ventura, 2005; Topolsek *et al.*, 2009). Meanwhile, external integration relates to any coordination mechanisms that aim at improving inter-firm communications, relationships, logistical activities, product design and development, and sharing of assets and resources to maximize overall supply chain value (Dröge *et al.*, 2000; Lee, 2000; Stock *et al.*, 1999).

The influence of SCI practices on FP has been researched in many previous studies. It is widely known that conflicting objectives of functional departments or business units within the same firm may hinder organizational performance (Simchi-Levi *et al.*, 2003). Efforts have been taken by firms to integrate internally as internal integration and customer integration have been found to have a greater effect on FP than supplier integration (Flynn *et al.*, 2010). Stevens (1989) argues that the concept of internal integration requires a radical shift from being functional to being process-oriented, and this shift in perspective has a positive effect on firm's performance through the elimination of functional barriers. This is because being functional-oriented creates barriers within the organization where functions are oblivious to each other's objectives. This reduces the ability of the organization to fulfill customer requirements effectively since the completion of customer requirements often necessitates the joint effort of several departments (Huo, 2012). Second, being functional-oriented increases intra-firm conflicts since overlapping activities or responsibilities are shown to exist between key functions of an organization (i.e. production, logistics and marketing) (Casanovas and Arbós, 2001). Such an integration within the firm would eliminate functional objectives and therefore reduce transaction cost (Zajac and Olsen, 1993) and improve productivity. Greater customer satisfaction and larger profits would also be generated since strategic goals, supply chain goals, and supply chain drivers are aligned (Chopra and Mendl, 2013). The emphasis on integrated information systems, information sharing, goal alignment through the implementation of customer-centric performance metrics and incentives, further boosts firm's operational and financial performance (Lee, *et al.*, 2007).

Apart from internal integration, how firms within the same supply chain eliminate or reduce external barriers between them and integrate with each other also contributes to their performance. This is evidenced in recent studies in the literature (e.g. Prajogo *et al.*, 2016; Chang *et al.*, 2016; Stevens and Johnson, 2016). In essence, the positive effects that external integration has on performance can be analyzed from the strategic and tactical level. At the strategic level, external integration involves the full cooperation of all supply chain members to structure their processes to achieve the desired level of efficiency or responsiveness, which is determined by their end customers. Proper configuration of the supply chain drivers and structures provides maximum value for customers and hence, maximizes profits (Beamon, 1998; Prajogo *et al.*, 2016). From the resource-based-view perspective (Thompson *et al.*, 2012), the ability of the supply chain to coordinate and to look beyond individual's profits is a valuable competitive advantage since competition today is between supply chains and not between firms (Christopher, 2000; Stevens and Johnson, 2016). Previous studies also confirm the positive influence of SCI on delivery performance (Heskett, 1977; Birou *et al.*, 1998; Bowersox *et al.*, 1999; Stank *et al.*, 1999; Iyer *et al.*, 2004; Germain and Iyer, 2006).

At the tactical level, logistics initiatives such as vendor-managed inventory, just-in-time inventory, postponement and cross-docking are concepts of external integration that require the joint effort of more than one member of the supply chain (Wong *et al.*, 2005). These initiatives are commonly linked with improving product flow and cost efficiency when successfully implemented (Giunipero *et al.*, 2008). External integration is also associated with improving information flow (Lee, 2002), which is primarily achieved from integrating information systems and sharing of demand information with upstream and downstream partners (Gunasekaran and Ngai, 2004). Attaining full visibility of the supply chain signifies a reduction in cost due to improved accuracy in demand forecasting (Småros *et al.*, 2003). Gaining access to end customer's demands mitigates the bullwhip effect (Lee *et al.*, 2004) which reduces product availability and ultimately, the profitability of the firm.

TQM and FP

TQM is said to help improve customer satisfaction, quality of goods and services, productivity, reduce waste, cost, time, and inventory level, among others (e.g. see Fuzi and Gibson, 2013; Oprescu, 2012; Valmohannadi, 2011; Pakdil, 2010; Besterfield *et al.*, 2003; Goetsch and Davis, 2006). Research on the relationship between TQM practices and FP began in the 1990s and is established in the literature through continuing investigations on critical factors of TQM and their impact on FP (e.g. see Saraph *et al.*, 1989; Flynn *et al.*, 1994; Powell, 1995; Ahire *et al.*, 1996; Black and Porter, 1996; Madhu *et al.*, 1996). On this note, previous studies give mixed results about the relationship between TQM practices and FP (e.g. Kaynak, 2003; Nair, 2006; York and Miree, 2004; Sadikoglu, 2004; Prajogo and Sohal, 2001, 2006; Rahman and Bullock, 2005; Fuentes-Fuentes *et al.*, 2004; Chong and Rundus, 2004; Kannan and Tan, 2005; Douglas and Judge, 2001). For example, it was found that the relationship between the "hard practices" of TQM – technical tools and techniques used in quality management, and performance is not significant (Ho *et al.*, 2001), while others showed that some "soft practices" – those dealing with people and relationships, and hard quality management practices are either directly or indirectly related to performance (Rahman and Bullock, 2005). The relationship between TQM practices and FP was also suggested to be either direct or indirect (e.g. Kaynak, 2003, Rahman and Bullock, 2005). Meanwhile, Sila (2007) concluded that TQM and TQM – performance relationships are not context-dependent.

The relationship between TQM practices and FP has been continuously researched in recent years. Examining this relationship from the country-specific perspective, for example, Prajogo and Hong (2008) found that TQM contributed significantly to research and development performance of Korean firms and that TQM as a set of generic principles can be adapted in environments other than manufacturing or production. Meanwhile, TQM and its adoptions were found to have significant correlations with production performance and customer-related performance in Malaysian manufacturing firms (Agus and Hassan, 2011). However, the research by Abdullah and Tari (2012) also revealed that soft quality management factors have a positive influence on hard quality management, and soft quality management factors have direct and indirect effects on performance of electrical firms in Malaysia. Industry-specific studies on the influence of quality management practices on performance have also been conducted recently in the petroleum industry by Parast *et al.* (2011) who found that top management support, employee training, and employee involvement are significant variables explaining the variability of operational performance. In line with these findings, all four quality management practices, i.e. top management commitment and participation, quality information and performance measurement, employee training and empowerment, and customer focus, are positively associated with operational performance, financial performance and customer satisfaction in the shipping industry (Cheng and Choi, 2013).

In spite of the comprehensive research on the relationship between TQM and SCI on FP, the majority of these studies have considered these concepts in isolation scholars have noticed the

similarities and differences between TQM and SCM practices and have identified integration as a common area. Specifically, Vanichchinchai and Igel (2009) found that TQM focuses more on internal participation, whereas SCM places more emphasis on external partnerships. Meanwhile, management support and commitment, customer focus, and supplier partnership are the most common practices found in both TQM and SCM literature (Talib *et al.*, 2011). The linkage between TQM and SCI is still unclear and deserves further research. This study addresses this gap in the context of Singapore-based container shipping companies.

Research methodology

Measurement of constructs

Given that TQM and SCI are established research constructs in the literature, it is envisaged that items validated in previous studies and used to measure these constructs in other sectors could be adopted in the shipping industry. In this respect, popular variables measuring TQM include management leadership (e.g. Saraph *et al.*, 1989), training (e.g. Vanichchinchai and Igel, 2009), customer focus (e.g. Kaynak and Hartley, 2008), supplier quality management (e.g. Saraph *et al.*, 1989; Kaynak, 2003; Anderson *et al.*, 1998), process management (e.g. Wang *et al.*, 2012) and employee involvement (e.g. Saravanan and Rao, 2006). SCI is most frequently represented by internal integration (e.g. Flynn *et al.*, 2010; Wong *et al.*, 2011), supplier integration (e.g. Flynn *et al.*, 2010) and customer integration (Flynn *et al.*, 2010). Meanwhile, FP can be measured by SQ (e.g. Thai, 2008) and other performance indicators (e.g. Flynn *et al.* 2010). Table I provides a summary of research constructs, variables, measurement items and the literature sources adopted for this study.

FP is categorized into three types: operational, financial, and strategic performance (Fabbe-Costes and Jahre, 2008). Operational performance has long been recognized as a complex, multidimensional, hierarchical construct that involves the improvement of supply chain-related organizational measures including logistics cost reduction, on-time delivery, inventory turnover and cycle time reduction. Financial performance is the improvement of economic goals based on revenue minus cost-based measures such as profitability, return-on-investment, and return-on-sales. Based on types of FP identified in the strategic management and marketing literature (e.g., Chenhall and Langfield-Smith, 2007; Morgan, 2012; Vorhies and Morgan, 2003), we further distinguish between relational and strategic performance. Relational performance is the improvement of customer-oriented measures such as customer satisfaction, customer loyalty, and customer retention. Strategic performance is the improvement of market goals that is assessed with purely revenue-based measures such as sales, market share, and growth in sales and market share.

Conceptual framework

To address the research issues in this study, it is hypothesized that both TQM and SCI variables would have positive influences on FP variables, while TQM variables also positively influence SCI. Figure 1 shows the conceptual framework (the influence of TQM and SCI practices on SQ and other performance indicators).

Thus, specific hypotheses in this research are stated as follows:

H1. TQM practices positively influence SQ in container shipping.

H2. TQM practices positively influence other performance indicators in container shipping.

H3. SCI practices positively influence SQ in container shipping.

H4. SCI practices positively influence other performance indicators in container shipping.

H5. TQM practices positively influence SCI in container shipping.

Construct	Variables	Items	Sources
TQM	Management leadership	1. Degree to which organization top management (top organization executive and major department heads) is evaluated for quality performance 2. Degree of participation by major department heads in the quality improvement process 3. Extent to which the organizational top management has objectives for quality performance 4. Degree to which the organizational top management considers quality improvement as a way to increase profits	Saraph *et al.* (1989)
	Training	1. Quality-related training given to hourly employees throughout the organization 2. Quality-related training given to managers and supervisors throughout the organization 3. Quality-related training is encouraged for active improvement teamwork 4. All employees are encouraged to attend quality-related training programs	Vanichchinchai and Igel (2009)
	Customer focus	1. Extent to which customer satisfaction surveys are used in determining/identifying customers' requirements 2. Extent to which managers have access to a summary of customer complaints 3. Extent to which the organization actively seeks ways to improve the primary service in order to achieve greater satisfaction 4. Extent to which customer satisfaction surveys are used in determining/identifying customers' requirements	Kaynak and Hartley (2008)
	Supplier quality management	1. Extent to which long-term relationships are offered to suppliers 2. Extent to which suppliers are evaluated according to quality, delivery performance, and price, in that order 3. Extent to which suppliers are selected based on quality rather than price or delivery schedule 4. The thoroughness of the supplier rating system	Saraph *et al.* (1989), Kaynak (2003), Anderson *et al.* (1998)
	Process management	1. Extent to which services disruption prevented from occurring is a strong attitude 2. Extent to which the processes include in-process measures of quality 3. Extent to which the explanation of the variation in processes is used as an analysis technique 4. Extent to which managers and supervisors continuously monitor and identify variation in work processes	Wang *et al.* (2012)
	Employee involvement	1. Extent to which employees are involved in quality management programs 2. Effectiveness of Cross Functional Teams with respect to solutions to problems related to quality 3. Degree of importance given to employee suggestions and innovations 4. Extent to which employees are encouraged to identify loopholes in their work	Saravanan and Rao (2006)
SCI	Internal integration	1. Degree of responsiveness within the company to meet other department's needs 2. Degree of having an integrated system across functional areas under company control 3. Degree of emphasis on information flows among functional departments	Flynn *et al.* (2010), Wong *et al.* (2011)

Table I.
Research constructs, variables and measurement items

(*continued*)

Construct	Variables	Items	Sources
		4. Degree of utilization of periodic interdepartmental meetings among internal functions	
	Supplier integration	1. Degree of sharing information to major suppliers through information technologies	Flynn *et al.* (2010)
		2 Degree of strategic partnership with suppliers	
		3. Degree of joint planning with suppliers to maintain rapid response ordering process	
		4. Degree of suppliers' involvement in work planning and development of services	
	Customer integration	1. Degree of sharing with major customers about market updates	Flynn *et al.* (2010)
		2. Degree of sharing information to major customers through information technologies	
		3. Degree of joint planning and design of work process with major customers	
		4. Degree of customers' involvement in work planning and service development	
FP	Service quality	1. Timeliness (on-time delivery)	Thai (2008)
		2. Quick response time in case of emergency, problem or special request	
		3. Speed of order handling	
		4. Accuracy of shipment documentation	
		5. Shipment safety and security	
	Other performance indicators	1. Growth in profit	Chenhall and Langfield-Smith (2007), Morgan (2012), Vorhies and Morgan (2003), Flynn *et al.* (2010)
		2. Growth in market share	
		3. Growth in sales	
		4. Overall firm performance	

Table I.

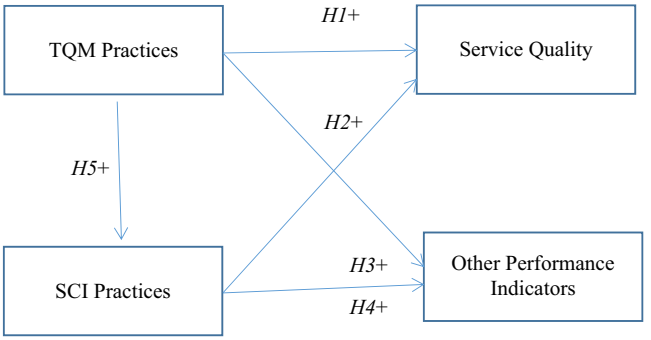

Figure 1.
The conceptual framework

Data collection, population and sampling

A survey method was selected for data collection in this study. This research involves the population of container shipping lines with registered offices in Singapore. The member directory of Singapore Shipping Association and Singapore Maritime Directory contains information on container shipping organizations. A mailing list of 159 container shipping organizations was constructed from the directory. Given the small number of samples, total population sampling was adopted for this study. The survey questionnaire, which is

preceded by a cover letter using the letterhead of the authors' institution, employs both fixed-alternative and open-ended response question. It consists of two sections. In the first section, respondents were asked to indicate their attitude toward statements describing the TQM and SCI variables in their organizations. Respondent's attitude is measured using the five-point Likert scale, ranging from 1 as "strongly disagree" to 5 being "strongly agree." The other questions in this section explored respondents' evaluation of their organizations' performance relative to the industry's average in terms of SQ and other performance indicators on the five-point categorical scale, ranging from 1 as "worst" to 5 being "best."

The second section asked demographic questions such as the types of company ownership of the respondents, their designation and work experience. Upon completion, the questionnaire was pre-tested with a small group of academics and container shipping professionals to ensure the language clarity and face validity of the measurement constructs. The questionnaire survey was then administered by post with a follow-up mailing two weeks after the first wave of postage. By the cut-off date, a total of 55 usable questionnaires were returned, yielding a response rate of 35 percent. The majority of respondents (98 percent) hold middle and senior managerial positions and 40 percent of them have more than ten years of work experience in the shipping industry. It can be concluded, therefore, that the respondents are appropriate for this study given the strategic nature of TQM, SCI and FP. Table II provides a summary of demographic statistics.

Analysis and findings

The influence of TQM on FP

We adopted the suggestion of Armstrong and Overton (1977) to test for non-response bias. For internal consistency, the results of the Cronbach's α yielded values of 0.60-0.87. As this study is exploratory, the value range of 0.50-0.60 is considered sufficient (Nunnally, 1978). Since the research constructs, variables and measurement items in this study were adopted from previous well-established studies and had been checked for content validity with container shipping professionals, they were used as is in the statistical analyses in this study. In addition, the pre-test confirmed that a group of industry experts viewed the scales used as acceptable. Discriminant and convergent validity was assessed satisfactorily. Finally, stepwise multiple regression at 95 percent confidence level using SPSS version 14.0 was performed on the model. To examine the causal relationship between TQM variables and FP, regression analyses were used with SQ and other performance indicators as the

	%
Types of company ownership	
Local owned firm	60
Joint-venture firms	15
Foreign-owned firm	25
Designation	
Senior management	53
Middle management	45
Lower management	2
Work experience (years)	
1-5	51
6-10	9
11-15	2
16-20	18
> 20	20

Table II.
Summary of demographic statistics

dependent variables and TQM variables as predictors. First, the influence of TQM variables on SQ of container shipping lines is examined. The results of this analysis are summarized in Tables III and IV. The first observation is that all six TQM variables met the entry requirements to be included in the regression equation. The multiple R ($R = 0.747$) shows that there is a substantial correlation between the dependent variable (SQ) and six predictors mentioned earlier, and this is statistically significant ($p = 0.0000$). In this respect, about 50 percent of the variance in SQ is explained by the six predictor variables (adjusted $R^2 = 0.502$). Among the six predictors, two have statistically significant positive influence on SQ; specifically, employee involvement has the greatest positive influence on SQ ($\beta = 0.391$), followed by customer focus ($\beta = 0.274$). Hence, *H1* is partly accepted.

The hypothesis results reveal that the standardized coefficient (β-value) for employee involvement is the highest compared to others related to SQ. This suggests that it is worthwhile for the industry to focus closely on employee involvement as one of innovative TQM practices to influence SQ. This finding is consistent with the popular service-profit chain concept where the key driver of service industry performance is employee involvement (loyalty) (Heskett and Schlesinger, 1994). In addition, this finding is in line with social exchange theory. The norm of reciprocity in social exchange theory states that an action by one party leads to a response by another party. A positive reciprocity orientation involves the tendency to return positive treatment for positive treatment (Uhl-Bien and Maslyn, 2003). In the context of the social exchange theory, the employer is devoted to building a relationship of long-term employment with his employees by fulfilling their needs through offering them favorable working conditions; in return, employees will be loyal to their employer by being committed to making extra efforts to offer services with a high level of quality as a means of reciprocity to their employing organizations (Flynn, 2005; Wayne *et al.*, 1997; Yee *et al.*, 2008). The employer's willingness to build a relationship with his employees and the employee's commitment to delivering high-quality services are key characteristics of a social exchange (Yee *et al.*, 2008; Blau, 1964). Loyal employees who are involved and satisfied with their job demonstrate their loyalty to the employing organization by working hard and being committed to delivering services with a high level of quality to customers. Loveman (1998) demonstrated that employee loyalty is positively correlated with SQ. It is expected that an increase in employee loyalty and involvement triggers a corresponding change in customer satisfaction; in turn, this would lead to an increase in shipping industry profitability.

Table III. Coefficient of determination – TQM influence on service quality

Model	R^2	F	Sig.
1	0.558	10.082	0.000

Table IV. Predictors: (Constant), employee, leadership, SupQ, Cusfo, process, training

	Unstandardized coefficients			
Model 1	B	SE	t	Sig.
(Constant)	0.886	0.490	1.808	0.077
leadership	0.071	0.095	0.746	0.459
training	−0.052	0.109	−0.475	0.637
Cusfo	0.294	0.129	2.284	0.027
SupQ	0.006	0.098	0.061	0.951
Process	0.175	0.092	1.893	0.064
Employee	0.278	0.090	3.104	0.003

Meanwhile, Tables V and VI summarize the regression analysis on the influence of TQM variables (predictors) on other performance indicators (dependent variable) of container shipping lines. The results show that there is a strong correlation between TQM variables and other performance indicators of container shipping lines in that about 60 percent of variance of the latter can be explained by those of the former (adjusted $R^2 = 0.595$). Among the six predictors, two of them have statistically significant positive influence on other performance indicators (training, $\beta = 0.310$; supplier quality management, $\beta = 0.281$). Therefore, *H2* is partly accepted.

The hypothesis results reveal that the standardized coefficient (β-value) for training is the highest compared to others related to other performance indicators. This suggests that it is worthwhile for the industry to focus closely on training as one of innovative TQM practices to improve FP. Training requirements include technical skills (statistical process/quality control methods, design tools, and quality function deployment), supervision skills (managerial problem-solving tools), communication, new work procedures (teamwork) and customer relations (Flynn *et al.*, 2010; Goetsch and Davis, 2006). Those are also applicable in shipping as an important service industry. Employees are given training based on their needs to improve their skills and knowledge and help them do their jobs as well (Goetsch and Davis, 2006). Training is essential to facilitate the organization's human resource training and development system which is a key mechanism in ensuring the knowledge, skills and attitudes necessary to achieve organizational goals and create competitive advantage (Peteraf, 1993; Apospori *et al.*, 2008).

The finding that supplier quality management has positive impact on FP is also in line with other earlier research in the literature, for example in small-scale manufacturing firms (Vivek and Ravindran, 2009), information-related industries (Ou *et al.*, 2010), pork-processing firms (Han *et al.*, 2010), automotive industry (Quesada *et al.*, 2006), to name just a few. This finding is particularly relevant to the shipping industry. In recent years, many shipping companies provide their customers with one-stop shopping (integrated logistics) services. However, as many of them only focus their resources on providing the core shipping services, they rely on performance of their suppliers such as other logistics service providers to meet customers' requirements and expectation. Hence, managing supplier quality is essential in ensuring a positive customers' experience on the overall SQ which leads to other FP indicators.

Table V.
Coefficient of determination – TQM influence on other performance indicators

Model	R^2	F	Sig.
1	0.640	14.246	0.000

Table VI.
Regression coefficients – TQM influence on other performance indicators

	Unstandardized coefficients			
Model 1	B	SE	t	Sig.
(Constant)	−0.133	0.528	−0.252	0.802
leadership	0.109	0.102	1.059	0.295
training	0.270	0.117	2.309	0.025
Cusfo	0.268	0.139	1.928	0.060
SupQ	0.284	0.106	2.690	0.010
Process	0.009	0.100	0.088	0.930
Employee	0.109	0.096	1.134	0.262

The influence of SCI on FP

As indicated in the literature review, the influence of SCI practices on FP has been intensively examined with mixed results. In this research, the causal relationship between SCI practices as predictors and FP in terms of SQ and other performance indicators as the dependent variable is examined through regression analysis. The results are summarized in Tables VII and VIII for the analysis of SCI influence on SQ of container shipping companies. In line with earlier regression analyses, there is a substantial causal correlation between SCI practices and SQ (adjusted $R^2 = 0.809$). Specifically, two among three SCI variables have statistically significant positive influence on SQ, in which the strongest impact is from internal integration ($\beta = 0.475$), followed by supplier integration ($\beta = 0.460$). Hence, *H3* is partly accepted.

The hypothesis results reveal that the standardized coefficient (β-value) for internal integration is the highest compared to others related to SQ. It is therefore worthwhile for the shipping industry to focus closely on internal integration as one of innovative SC integration practices to improve SQ. It was found in the literature that internal integration will contribute to customer delivery performance (Stank *et al.*, 1999; Zailani and Rajagopal, 2005) and this is applicable in the shipping industry as well. It is recommended that shipping industry practice internal integration (from materials management to distribution/delivery) in order to fulfill customer requirements at the lowest total system cost (Morash and Clinton, 1998) by having full systems visibility across functions such as procurement, production, logistics, marketing and distribution (Stevens, 1989; Morash and Clinton, 1998; Birou *et al.*, 1998). In addition, they should practice sharing reliable and real time data both within and across firms in the supply chain in order to improve delivery performance (Daugherty *et al.*, 1999; Stank *et al.*, 1999; Waller *et al.*, 1999; Sohal *et al.*, 2001; Frohlich and Westbrook, 2002). Companies with a high level of internal integration to joint efforts in problem solving (stock out/quality problems), product development to achieve desirable time to market and cycle time performance and collaborative planning can achieve delivery performance (Morash *et al.*, 1996; Stank *et al.*, 2001; Swink *et al.*, 2007; Flynn *et al.*, 2010; Rosenzweig *et al.*, 2003).

Meanwhile, SCI practices as predictors also have a positive influence on other performance indicators of container shipping lines as the dependent variable as reflected in Tables IX and X. Specifically, more than 70 percent variance of the latter can be explained by those of the former (adjusted $R^2 = 0.728$). However, among the three SCI variables, only supplier integration has the statistically significant positive influence on other performance indicators of container shipping lines ($\beta = 0.738$). Therefore, *H4* is partly accepted.

Table VII. Coefficient of determination – SCI influence on service quality

Model	R^2	F	Sig.
1	0.820	77.326	0.000

Table VIII. Regression coefficients – SCI influence on service quality

	Unstandardized Coefficients			
Model 1	*B*	SE	*t*	Sig.
(Constant)	0.246	0.253	0.973	0.335
InIntegration	0.429	0.133	3.217	0.002
SupIntegration	0.444	0.076	5.843	0.000
CusIntegration	0.063	0.082	0.766	0.447

Based on previous literature studies, there are three different dimensions of SCI, e.g. internal integration, supplier integration, and customer integration which could contribute to delivery performance (Handfield, 1993; Choi and Hartley, 1996; Morash *et al.*, 1996; Fawcett *et al.*, 1997; Birou *et al.*, 1998; Bozarth *et al.*, 1998; Daugherty *et al.*, 1999; Waller *et al.*, 1999; Stank *et al.*, 2001). Findings from Tables IX and XI suggest that it is worthwhile for the shipping industry to focus closely on supplier integration as one of innovative SC integration practices that influences other performance indicators. Supplier integration is achieved through alignment, information sharing, interactions between firms and their suppliers (Ragatz *et al.*, 2002). The mutual and timely sharing of market and operational information allows firms to be agile to respond to any changes of customer needs (Stank *et al.*, 1999; Zailani and Rajagopal, 2005). In addition, this is applicable in the shipping industry as a shipping firm, as a matter of fact, needs to collaborate with many external partners in order to provide their customers with the all-rounded customer experience. With supplier integration in the shipping industry, there are three other performance indicators to be considered such as quality, on-time delivery and cost (Handfield, 1993). Direct supplier development and supplier's strategic objective alignment are significant to improve other supply chain performance indicators such as on-time delivery and quality (Li *et al.*, 2006). In addition, firms in the shipping industry should have strategic long-term relationships with other supply chain trading partners (Narasimhan and Carter, 1998) in order to improve other performance indicators (i.e. delivery capability especially in multimodal transport).

The influence of TQM on SCI

One of the objectives of this paper is to examine whether the implementation of TQM practices has a positive connection with SCI, especially in the context of container shipping industry. This is based on the observation from the literature that the connection between TQM practices and FP may not be so evident compared with that between SCI and FP, and thus TQM may influence FP through SCI should there is a connection between TQM and SCI. To examine this, a regression analysis was conducted with SCI as the dependent variable and TQM variables as predictors. Tables XI and XII present a summary

Table IX.
Coefficient of determination – SCI influence on other performance indicators

Model	R^2	F	Sig.
1	0.743	49.229	0.000

Table X.
Regression coefficients – SCI influence on other performance indicators

	Unstandardized coefficients			
Model 1	B	SE	t	Sig.
(Constant)	−0.022	0.361	−0.060	0.952
InIntegration	0.141	0.190	0.741	0.462
SupIntegration	0.851	0.108	7.857	0.000
CusIntegration	0.061	0.118	0.516	0.608

Table XI.
Coefficient of determination – TQM influence on SCI

Model	R^2	F	Sig.
1	0.864	50.805	0.000

of this analysis. In this respect, there is a strong causal positive relationship between TQM variables and SCI (adjusted $R^2 = 0.847$) in container shipping companies. However, among the six TQM variables, only process management ($\beta = 0.256$) and employee involvement ($\beta = 0.625$) have a statistically positive influence on SCI. Hence, *H5* is partly accepted.

The combined influence of TQM and SCI on FP

To have an overall view of the influence of TQM and SCI as a whole on FP, it is necessary to conduct a regression analysis in which all TQM and SCI variables are treated as predictors and FP constructs of SQ and other performance indicators are dependent variables. Table XIII summarizes the results of TQM and SCI impact on SQ of container shipping companies. It is interesting to note that there is a strong positive causal relationship between TQM and SCI practices and SQ, in that more than 90 percent variance of the latter can be explained by those of the formers (adjusted $R^2 = 0.924$). This adjusted R^2 is higher than those of the influence of TQM and SCI on SQ when they are examined separately (adjusted $R^2 = 0.502$ and 0.809, respectively). Together with the earlier finding that TQM has a positive influence on SCI, this result implies that SQ can be positively enhanced when TQM and SCI practices are implemented in synergy.

Findings from Table XIII suggest that it is essential for companies in the shipping industry to focus closely on the implementation of TQM and SCI practices to improve SQ. One of the most important aspects of SQ that can be enhanced by the implementation of TQM and SCI in synergy is customer service delivery performance. Based on previous literature studies, the service delivery performance of a logistics and supply chain systems can be measured in terms of on-time delivery, delivery lead-time and delivery reliability (Fawcett and Closs, 1993; Noble, 1997). Owing to the importance of the time element, customer delivery performance is often regarded as time-based performance (Iyer *et al.*, 2004). Indeed, this performance indicator can be greatly enhanced with the implementation of TQM and SCI thanks to the coordinated effects between these practices. For example, supplier quality management as a variable of TQM and supplier integration as a SCI variable all ensure that a firm and its suppliers march to the same drum beats. This is especially important when it comes to customer service delivery performance in the shipping industry, because many shipping companies reply on other transport logistics service providers such as 3PLs to complete their service performance to customers. It is

Model 1	Unstandardized Coefficients *B*	SE	*t*	Sig.
(Constant)	0.193	0.290	0.663	0.510
leadership	0.076	0.056	1.353	0.183
training	0.004	0.064	0.055	0.956
Cusfo	0.142	0.076	1.859	0.069
SupQ	0.071	0.058	1.231	0.224
Process	0.179	0.055	3.267	0.002
Employee	0.475	0.053	8.954	0.000

Table XII. Regression coefficients – TQM influence on SCI

Model	R^2	*F*	Sig.
1	0.558	10.082	0.000
2	0.937	73.990	0.000

Notes: Coefficient of determination – TQM and SCI influence on service quality

Table XIII. Coefficient of determination – TQM and SCI influence on service quality

therefore highlighted that TQM and SCI practices are recognized as strategic process management that can be instrumental for creating positional advantages associated with SQ improvement in the shipping industry. Table XIV presents the summary of regression analysis on the impact of TQM and SCI variables on other performance indicators of container shipping companies. Similar to the relationship between TQM and SCI and SQ, there is also a strong positive causal link between TQM and SCI practices and other performance indicators of container shipping lines with adjusted $R^2 = 0.767$. In line with the previous observation, this adjusted R^2 is higher than those of the relationship between TQM and SCI on other performance indicators when they are examined in separation ($R^2 = 0.595$ and 0.728, respectively). It is evident that, with the positive influence of TQM on SCI, the implementation of these practices as a whole would render stronger positive impact on other performance indicators of container shipping lines.

Interestingly, the hypothesis results reveal that the standardized coefficient (β-value) for SCI is the highest compared to others related to other performance indicators. This suggests that it is worthwhile for companies in the shipping industry to focus closely on SCI practices to improve other performance indicators, i.e. quality and operating performance (Armistead and Mapes, 1993), profit (Chen and Paulraj, 2004). This result is in line with the previous studies Frohlich and Westbrook (2001) and Flynn *et al.* (2010) which showed that operating and business performance are two of the most frequently used measurements for assessing the relationship of FP with SCI. In addition, Rosenzweig (2009) emphasized the role of exploration operations and business performance in SCI; while FP was also found relating to a company's external supply chain partners, internal functions and processes, and all external and internal connections (Huo, 2012). Previous studies also confirmed that SCI is a concept concerning the improvement of SCM performance and the creation of value (Frohlich and Westbrook, 2001; Corsten and Felde, 2005; Fabbe-Costes and Jahre, 2008; Krause *et al.*, 2007). In this respect, Prajogo and Olhager (2012) also indicated that SCI (integration of information sharing and supply chain partnerships) has contributed substantially to the practical and academic aspects of supply chain performance.

Conclusion

Although there have been studies which examined the impact of TQM and SCI practices on FP, they often focus on only one of these practices and few are related to the shipping industry. This paper addresses these gaps in the literature. This research has generated some interesting findings. First, it was found that TQM has a positive influence on both SQ and other performance indicators of container shipping companies, especially those practices of employee involvement, customer focus, training and supplier quality management. This is in line with many earlier studies in the literature. The same pattern was also observed about the relationship between SCI and FP, in that practices such as internal integration and supplier integration also have positive impact on SQ and other performance indicators of container shipping lines. This study is also one of the first researches which found that TQM practices have a positive impact on SCI, and the implementation of TQM and SCI practices as a whole would produce stronger positive influence on both SQ and other performance indicators of container shipping companies. This research therefore contributes to enrich the contemporary literature on TQM and SCI

Table XIV.
Coefficient of determination – TQM and SCI influence on other performance indicators

Model	R^2	F	Sig.
1	0.640	14.246	0.000
2	0.806	20.801	0.000

and provides a more rounded understanding on how the performance of container shipping lines can be enhanced by the combined implementation of quality management and SCI practices. This in turns provides guidelines for shipping managers on how to implement these practices appropriately to boost their FP to the fullest extent.

As TQM, SCI and FP in shipping industry is complex and diverse, understanding those dimensions would be a challenging task both to the academic, practitioners and industry. The findings bear important implications for further research as understanding these dimensions can help to position key changes and industry improvement that will lead to both greater consumer satisfaction and higher profitability both by increasing revenues and reducing costs of firms in the container shipping companies in Singapore. There are two managerial implications on this study. This research provides guidelines for shipping managers on how to apply the SCI and TQM practices appropriately to boost their FP to the fullest extent. This study has unique implications for social sustainability especially the container shipping industry, which is hard pressed to combat the challenges within the logistics/transportation sector.

Despite the interesting findings of this research and its academic and managerial implications, the generalization from this research should be done with caution. The major limitation of this research lies with its small sample size, which prevents the deployment of structural equation modelling (SEM) as a more comprehensive data analysis technique for the purpose of this research. Hence, future research should employ SEM as well as apply the research model in other shipping sectors to validate the reliability and generalization of this research. This research was carried out in the context of the Singapore shipping industry but additional insights could be obtained by replicating the study in other geographic and context-specific domains.

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