An empirical investigation of how information sharing affects cash flow performance through competitive capability

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Abstract

Purpose – This paper aims to examine how information sharing affects cash flow performance through the competitive capabilities of low cost or product quality.

Design/methodology/approach – In total, 159 survey responses were collected from Norwegian manufacturing firms in 2018. Structural equation modelling (SEM) was used to analyse the data collected.

Findings – The low-cost competitive capability was found to positively mediate the effect of information sharing on cash flow performance. However, product quality competitive capability did not have a significant mediating effect between information sharing and cash flow performance. Rather, customer satisfaction fully mediated the relationship between product quality, capability and cash flow performance. The empirical results not only support how the competitive capabilities can be developed through information sharing but also illustrate that the competitive capabilities affect cash flow performance through different mediating routes.

Originality/value – While information sharing and competitive capabilities have been studied previously with regard to financial performance, less emphasis has been placed on how customer satisfaction might explain the mediated relationship between product quality, competitive capability and financial performance. In addition, financial performance is measured by the proxy of cash flow. The use of cash flow as a performance measure leads to a more forward-looking financial performance measure. This is especially appropriate for non-listed firms.

Keywords Quality management, Financial performance, Structural equation model, Information flow, Cost management, Transactions costs

Paper type Research paper

1. Introduction

The competitive market is ever-changing. Rapid changes in technology (Kapoor and Adner, 2012), customer preferences (Jansen *et al.*, 2006), as well as domestic and international market dynamics (Birkinshaw *et al.*, 1998) have forced firms to integrate more closely with suppliers to increase own competitiveness.

An important dimension of supplier integration is information sharing. Information sharing can be used as a "competitive weapon" according to Olorunniwo and Li (2010, p. 456). Information sharing may lead to an agile and aligned supply chain, thus, positively affecting performance (Lee, 2004; Narasimhan and Nair, 2005; Carr and Kaynak, 2007; Sahin and Robinson, 2002; Lee *et al.*, 1997).

Information sharing between the buying firm and the suppliers is not necessarily easy. For instance, at the beginning of the 2000s, Nike blamed its supply chain management system – and more indirectly its vendor – after suffering excessive inventory and order delays due to failures in its demand planning system. When the news hit the market, the financial consequences were almost 20 per cent decline in Nike share value[1]. Nike is not alone, Apple experienced in 2016 a failure to meet the demand for iPhones due to supposed delivery problems from its supplier. Fitbit failed and they did not receive sufficient quality components from its suppliers, resulting in a high proportion of scrapped products[2]. Although this is anecdotal evidence, it might illustrate how information sharing between supply chains can have severe financial consequences when it fails to meet customer expectations.

However, if managed properly, tighter supplier integration may lead to increased competitiveness. This is achieved by reduced production costs and/or value creation for customers (Cooper *et al.*, 1997). Competitiveness stems from the capabilities that firms develop over time. Teece and Leih (2016, pp. 6-7) conceptualised capability as "a set of activities that performs the firm in a semi-routinised fashion to enable a particular set of task to be accomplished in a manner that allows – against the opposition of circumstance – products and services to be made and delivered and profits to be generated".

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A transition from capabilities to competitive capabilities occurs when the firm is able to match customer expectations to a competitor's ability to do the same on products or services (Koufteros et al., 2002, p. 259).

Low-cost or product quality competitive capabilities are the two competitive capabilities that have been shown to have the strongest effect on firm performance (Jitpaiboon et al., 2016). Based on trade-off theory logic, a firm primarily focusses on developing one capability at time (Boyer and Lewis, 2002; Leong et al., 1990; Vickery et al., 1993) or at least, the firm does not gain any significant improvement in performance by simultaneously pursuing the development of several capabilities (Corbett and Claridge, 2002). This may be explained by how different competitive capabilities require different types of investment (Safizadeh et al., 2000), and being used to target different customer groups (Miller and Roth, 1994).

However, several meta-analyses have illustrated a degree of ambiguity regarding whether supplier integration, in general, leads to improve financial performance through competitive capabilities. The results are highly contingent on what, who and by whom the integration is studied (Chang et al., 2016; Leuschner et al., 2013; Mackelprang et al., 2014). When considering information sharing more specifically (being one aspect of supplier integration), both contextual and structural (Vanpoucke et al., 2009; Barratt, 2004) cultural factors may explain the relationship (or lack of) between information sharing and competitive capabilities (Jungbae Roh et al., 2008).

There are two different aspects regarding competitive capabilities that may explain the lack of consistent findings, thus, representing the motivation for this study. First, Chang et al. (2016) argues that inconsistent findings may owe to not including more complex mediating routes between supplier integration and financial performance. Consequently, information sharing must be translated into competitive capabilities before it leads to increased financial performance. Here, low-cost and product quality competitive capabilities will be explained as potential mediating routes between information sharing and financial performance.

Product quality is especially interesting to study as it can be conceptualised in two different ways. This is either as:

1 quality conformance to specifications (Kristal et al., 2010) or
2 perceived production quality as reflected through customer satisfaction (Zeithaml, 1988; Anderson et al., 1994).

Quality conformance to specifications is the degree to which a product or service functions as expected. This can be determined by *ex ante* sale (Anderson et al., 1994). For the purpose of this study, quality conformance to specifications is conceptualised as product quality competitive capability. Customer satisfaction is about how a customer perceives the product's quality. This can be determined *ex post* sale (Anderson et al., 1994). While, Yu et al. (2013) suggest that customer satisfaction is the missing variable in explaining the relationship between supplier integration and financial performance, this study suggests that both product quality conformance and customer satisfaction should be added as explanatory variables, as they are two separate aspects of product quality (Forza and Filippini, 1998). This creates more complex mediation routes and may facilitate a deeper understanding of how information sharing contributes to financial performance through product quality competitive capabilities.

Second, both the choice of competitive capabilities and selected financial performance indicators have an effect on the obtained results. For instance, Rosenzweig et al. (2003) found that the effect (or lack of) from competitive capabilities was contingent on the individual business performance measure used. Swink et al. (2007) discovered that the relationship between competitive capabilities and business performance was also dependent on the type of competitive capabilities one are studying. In other words, different competitive capabilities have different effects on financial performance and various operationalisation of financial performance yields different results. For instance, Cho and Pucik (2005) have shown how the relationship between product quality competitive capability and financial performance is dependent on whether one uses using growth or profitability as indicators of financial performance. This study takes a novel turn by suggesting cash flow as an alternative and unidimensional measure for financial performance. This is based on the managerial; investor; and methodological benefits from using cash flow as a measure of financial performance.

Managers need to be forward-thinking rather than backward-looking. Cash flows enable managers to be forward-thinking, as they indicate the future need for liquidity and the ability to achieve the projected profitability (Shi and Yu, 2013). Past cash flows have also been shown to have greater predictive ability for future cash flows compared to other measures, such as earnings or accruals (Krishnan and Largay Iii, 2000). They additionally mitigate criticisms of financial performance measures being too aggregated and backward-looking, such as return on assets or return on equity (ROE) (Chenhall and Langfield-Smith, 2007; Shi and Yu, 2013).

From an investor perspective, most manufacturing firms are not listed. This makes valuation difficult, as common valuation measures cannot be used (such as Tobin's Q). As the discounted cash flow method is one way for valuation (Koller et al., 2005), the cash flow measure may be one indication (all else being equal) of changes in firm value.

From a methodological perspective, it may seem more reasonable to use various and related financial performance indicators. This is particularly pertinent when conducting a covariance-based (such as maximum likelihood estimation procedure) structural equation modelling (SEM) (Edwards, 2011). Nevertheless, three concerns lead to suggesting cash flow as the sole financial performance variable. The first is that financial performance indicators may have an ambiguous relationship with one another, yielding inconsistent findings across studies. For instance, assume that the latent financial performance variable consists of (among several others) cash flow and ROE. While both may be viewed as reflecting financial performance, they may yield different results, dependent on how the indicators affect each other. Firms experiencing high growth may lead to higher scores on cash flow indicators. However, to enable such growth there are substantial investments with high leverage. This may relatively lead to a decline in ROE. The tendency of a negative relationship between cash flow and ROE is not necessarily always the case.

If the firm experiences increased productivity (output) with the same amount of resources (input), its profit margins increases. This leads to (all else being equal) both improved cash flow and ROE. In other words, the cause-and-effect relationship between cash flow and other financial performance indicators makes it unclear whether variation in the latent variable causes all indicators simultaneously, solely or in some combinations to change and in which direction (Edwards, 2011).

Second, and in relation to the first concern, factor analysis does not distinguish between the relationships of the indicators. This may create goodness of fit statistics that seem equivalent regardless of how the indicators are defined (causal, effect or both) (Fayers *et al.*, 1997, p. 396). For instance, there may be equivalent goodness of fit statistics by suggesting that cash flow leads to ROE or by combining them into one measure. However, interpretations differ greatly based on the specified relationship between these financial indicators. For instance, Kroes and Manikas (2014)[3] have used cash flow as an independent variable and financial performance as a dependent variable, while Wu *et al.* (2006) have used cash flow as one of several indicators in the same financial performance variable. This result in different understandings of financial performance, as the first states a cause-and-effect relationship, whereas the second presents them as simply reflecting the same latent variable.

Third, how indicators interact with one another may differ from study to study, thus, leading to unstable factor solutions (Fayers and Hand, 1997; Costa, 2015). This can lead studies to use different financial indicator combinations to achieve a valid factor solution and fit statistics. The consequence is that it is difficult to compare studies in contrast to using the same set of financial performance indicators across various studies.

The aim of this paper is to explain how supplier integration by information sharing may lead to improved cash flow performance, through the development of low-cost or product quality competitive capability. By explaining this relationship, the paper offers two contributions to existing literature. First, it shows how low-cost competitive capability and product quality competitive capability may mediate the effect of information sharing on cash flow performance. The novelty lies in adding customer satisfaction in addition to quality conformance. This illustrates that while the direct and indirect effects of low-cost competitive capabilities on cash flow performance are rather clear-cut, a more complex relationship exists for product quality. This may explain to at least some degree the earlier mixed results regarding the link between supplier integration and financial performance (Chang *et al.*, 2016), and suggest that product quality competitive capability must be distinguished into direct and indirect effects on financial performance (Ebrahimi and Sadeghi, 2013).

Second, cash flow performance is developed and used as a unidimensional financial performance measure. This makes it easier to interpret the relationships, as it avoids the conceptual ambiguity concerning the relationship between other financial performance indicators (Edwards, 2011).

This paper uses a web survey completed by 159 Norwegian manufacturing firms to uncover the potential direct and indirect effects of information sharing on cash flow performance. From a supplier integration perspective, Norwegian manufacturing firms are interesting to study for two reasons. First, the manufacturing sector itself is capital intensive, adding pressure to achieve and maintain a sufficient cash flow (Kroes and Manikas, 2014). Second, Norwegian manufacturing firms have a high-cost base. Compared to other nations, they are in the bottom quarter of manufacturing value-added as a percentage of a nation gross domestic product (Kearney, 2018). Nevertheless, Norway was defined as a "high potential" country in the World Economic Forum's 2018 report in collaboration with Kearney (2018). The reason is that although Norway has a high-cost base, they are well-developed and has the potential for increased productivity. This presents the Norwegian manufacturing sector with untapped potential to drive financial performance through supplier integration.

Using a SEM-based approach, the results indicate that low-cost competitive capability acts as a positive mediator between information sharing and cash flow performance. Product quality competitive capability is not found to be a significant mediator between information sharing and cash flow performance. However, customer satisfaction is found to fully mediate the positive effect between product quality competitive capability and cash flow performance.

The remainder of the paper is organised as follows. In Section 2, the theory and hypotheses are outlined, followed by a description of the research methodology in Section 3 and the presentation of the results in Section 4. Discussion, limitations and further research are presented in Section 5.

2. Theory and hypotheses development

2.1 Transaction cost economics
Transaction cost economic theory (TCE) has often been used as a theoretical lens to understand supplier integration (Soosay and Hyland, 2015; Rindfleisch and Heide, 1997; Williamson, 2008; Grover and Malhotra, 2003; Hobbs, 1996), and more specifically to explain information sharing as part of supplier integrative efforts (Kembro *et al.*, 2014).

Following a TCE-based reasoning, information sharing represents a source to competitive capabilities (Porter and Millar, 1985), as it can lead to decreased supply chain costs (Huang *et al.*, 2003). This can be explained by how information sharing leads to improved forecasting and reduced inventory levels (Lee *et al.*, 2000), enhanced planning and operational decision making processes (Mohr and Spekman, 1994; Yigitbasioglu, 2010), and strategic decision making processes (Li *et al.*, 2006b). In addition, information sharing may create a more transparent buyer–supplier relationship, thus, mitigating the possibility of opportunistic behaviour from one or both of the parties (Williamson, 1977, 2008, 1979; Hennart, 1988, 1991).

Transaction costs occur either before a supplier contract is signed (*ex ante*) or afterwards (*ex post*). The supplier contract has the primary function of decreasing information asymmetry between the supplier and buyer (Grover and Malhotra, 2003; Williamson, 2008; Zhao *et al.*, 2008; Benaroch *et al.*, 2016; Milgrom and Roberts, 1990). This is because a lack of contracts or contract incompleteness can increase the potential for opportunism (Clemons *et al.*, 1993; Yan and Kull, 2015; Wacker *et al.*, 2016; Schloetze, 2012).

Ex ante transaction costs may include searching for new suppliers, specifying needs, drafting contracts and negotiating terms (Benaroch *et al.*, 2016; Milgrom and Roberts, 1990).

Other *ex ante* post costs may include costs such as monitoring, compliance and coordinating activities (i.e. ordering, procurement, inventory management, production, development, replenishment, forecasting and distribution), maladaptation costs (such as redefinition, renegotiation and re-specification), contracting non-compliance costs (such as misappropriation and supplier shirking) and non-performance costs (such as technical defects, performance shortfalls and poor upgradeability) (Benaroch *et al.*, 2016; Milgrom and Roberts, 1990).

2.2 Mediating role of low-cost competitive capability on cash flow performance

Low-cost competitive capability can be defined as "a manufacturer's capability to compete on cost" (Kristal *et al.*, 2010, p. 426). Krause *et al.* (2007) argue that cost is pivotal to measurement because all manufacturers must take (at least to some degree) cost into consideration in their business operations. Vanpoucke *et al.* (2014) have demonstrated how increased cost-performance leads to both increased market and financial performance.

Information sharing is important for developing low-cost competitive capability at the *ex ante* stage. This is because knowledge regarding the buying firms' needs and specifications and design of orders may provide a foundation for future transactions. For instance, poorly written material specifications may lead to misunderstandings or wrong orders that later exacerbate non-performance and maladaptation costs (Benaroch *et al.*, 2016).

Supplier trust may increase as well. This is achieved by meeting expectations and requirements derived from the ex-ante stage, such as delivering materials at the correct time and with the correct quantity and quality. This leads the buying firm to use fewer resources for monitoring and safeguarding transactions (Rosenzweig *et al.*, 2003; Lumineau and Henderson, 2012; Bharadwaj and Matsuno, 2006).

Better inventory management may be achieved through more information sharing, for instance, by implementing information technology (IT) software. This may be explained by Seggie *et al.* (2006) how the coordination costs decreases. This may provide the buying firm with a cost-benefit through factors such as mitigation of the bullwhip effect (Hosoda *et al.*, 2015; Pastore *et al.*, 2017), better material flow and reduced order cycle time (Bharadwaj and Matsuno, 2006). Contrarily, a lack of information sharing may result in the accumulation of non-value added activities that increase production costs (Frohlich and Westbrook, 2001; Lee *et al.*, 2000).

Even though the supplier complies with initial contracts and agreements, there will be most likely a need for renegotiation and re-specification over time (maladaptation costs). The reason is contingencies in the market and environment (Rosenzweig *et al.*, 2003; Williamson, 1999). However, lengthy and costly renegotiation process may be avoided through information sharing, as the supplier and buyer may more easily find a settlement (Rosenzweig *et al.*, 2003). However, in more severe cases, the buying firm may need to terminate supplier engagement if there appears to be a high degree of non-compliance, inflicting switching costs from one supplier to another (Chen and Bharadwaj, 2009; Crook *et al.*, 2013).

Information sharing may have a direct effect on low-cost competitive capability as it decreases both *ex ante* and *ex post*

transaction costs. This may then lead to improved cash flow performance in two ways. First, low-cost competitive capability reduces the overall product costs, thereby increasing cash flow as much as the decreased production cost (all else being equal). Um and Kim (2018) have illustrated how both supplier integration and competitive capabilities may lead to a transaction cost advantage, which may explain the improved financial performance. Second, a higher sales volume may be achieved through the improved ability to compete on cost (Porter, 1985). Although higher sales volume increases product costs, the marginal cash flow effect is positive (assuming positive operating margins).

However, information sharing may fail to deliver low-cost benefits due to three reasons. First, as Lechner *et al.* (2010) argue, over-embeddedness may arise as a result of too much integration. The cost of obtaining information in terms of people and technology may exceed the value of the acquired information. In other words, the low-cost competitive capability may increase, but at a cost that exceeds the marginal cash flow performance gains. This especially holds true for technical information that may be both costly and difficult to obtain (e.g. "sticky information") (von Hippel, 1994). Second, excessive reliance on information from one source may lead to collective blindness/myopia. In other words, it does not promote continuous learning or critical examination of the information sources (Nahapiet and Ghoshal, 1998). Third, while monitoring costs may decrease as a result of trusting information from a supplier, overreliance from one information source may lead to trusting wrong or outdated information (Koka and Prescott, 2002; Villena *et al.*, 2011; Zhou *et al.*, 2014a). The consequence may be bad decision making, ultimately negatively affecting cash flow performance.

The ambiguous direction of the relationship leads to the expected hypotheses of:

H1a. There is a relationship between information sharing and low-cost competitive capability.

H1b. There is a relationship between low-cost capability and cash flow performance.

When combined, hypotheses *H1a* and *H1b* suggest a mediated relationship between information sharing and cash flow performance through low-cost competitive capability.

2.3 Mediating role of product quality competitive capability on cash flow performance

This study defines product quality competitive capability as "a manufacturer's capability to consistently achieve conformance to specifications, [and] fitness for use" (Kristal *et al.*, 2010, p. 426). This suggests that information sharing primarily affects product quality conformance. Customers' expectations may be met or even exceeded by achieving this competitive capability (i.e. customer satisfaction) (Zeithaml, 1988).

Information sharing may affect two types of product quality costs:

1 cost of good quality; and/or
2 cost of poor quality (Sahay, 2016; Crosby, 1996, 1979).

Cost of good quality can be distinguished further into appraisal and prevention costs. Appraisal costs concern measuring and

monitoring activities related to product quality, while prevention costs are those associated with developing, implementing and sustaining quality management systems that prevent poor quality from ever occurring (Sahay, 2016; Crosby, 1996, 1979). Here, information sharing is a vital part of such quality management systems (Flynn *et al.*, 2010; Malmi, 2001). Appraisal and prevention costs will often be negatively related. For instance, the decreased variance may reduce the need for extensive measuring and monitoring activities, while it may increase the prevention costs because it requires a comprehensive quality management system (Crosby, 1979, 1996; Sahay, 2016). In other words, the cost of good quality must be balanced, as otherwise, the costs will exceed the benefits.

The cost of poor quality can be split into internal failure and external failure costs. They may be both explained by high process variation (Sahay, 2016; Crosby, 1996, 1979). Internal failure costs are non-performance costs discovered internally, and may lead to more scrap, reworking or repairing and retesting. External failure costs are discovered by the customer and may result in returned products, complaints and warranty claims. (Sahay, 2016; Crosby, 1996, 1979).

However, the literature on the relationship between product quality and firm performance offers mixed results (Ebrahimi and Sadeghi, 2013). Some studies have failed to establish such a relationship (Prajogo and Sohal, 2003; Yunis *et al.*, 2013; Samson and Terziovski, 1999; Fawcett *et al.*, 2000). Others have found that product quality is positively related to firm performance (Sila, 2007; Martínez-Costa *et al.*, 2008; Hendricks and Singhal, 2001; Kaynak, 2003; Sila and Ebrahimpour, 2005; Douglas and Judge, 2001; Nair, 2006; Benner and Veloso, 2008; Kaynak and Hartley, 2008; Song *et al.*, 2017).

The ambiguity may stem from how various costs of quality are affected, as they may affect to various degree the bottom line in the financial statement (Malmi *et al.*, 2004; Williams *et al.*, 1999; McNair *et al.*, 2001). If the buying firm achieves a product quality competitive capability, it may improve cash flow performance because higher product quality may increase customer profitability. However, customer profitability increases only if the costs of poor quality decreases relative to a positive net cost-benefit from good quality.

This leads to the expected hypotheses of:

H2a. There is a positive relationship between information sharing and product quality competitive capability.

H2b. There is a relationship between product quality competitive capability and cash flow performance.

Combined, *H2a* and *H2b* suggest a mediated relationship between information sharing and cash flow performance through product quality competitive capability.

2.4 Mediating role of customer satisfaction on cash flow performance

There is empirical support for product quality being an antecedent to customer satisfaction (Anderson and Sullivan, 1993; Das *et al.*, 2000; Ahire and Dreyfus, 2000; Choi and Eboch, 1998; Anderson *et al.*, 1995; Rungtusanatham *et al.*, 1998). In addition, customer satisfaction is found to be positively related to financial performance (Yeung, 2008; Ou *et al.*, 2010; Yu *et al.*, 2013; Das *et al.*, 2000; Song *et al.*, 2017). This implies that customer satisfaction should act as a mediator between product quality competitive capability and cash flow performance.

This might be explained by the way in which customer satisfaction decreases information asymmetry between the firm and customer regarding product quality (Bharadwaj and Matsuno, 2006). This may be especially true as modern IT solutions offer transparency (for instance, through buying patterns and reviews), decreasing customer transaction costs (Houman Andersen, 2005). This may result in two sources of increased cash flow performance. First, higher product quality reduces demand elasticity, which, in turn, enables the firm to charge an extra premium, thereby increasing the cash flow (Shetty, 1988). Second, higher product quality acts as a type of differentiator from competitors, which may increase sales volume (Buzzell *et al.*, 1975; Jacobson and Aaker, 1987; Porter, 1985).

This leads to the expected hypotheses of:

H3a. There is a positive relationship between product quality competitive capability and customer satisfaction.

H3b. There is a positive relationship between customer satisfaction and cash flow performance.

Combined, *H3a* and *H3b* suggest a mediated relationship between information sharing and cash flow performance through product quality competitive capability.

2.5 Control variables

Two types of control variables are included in this study, namely, firm- and industry-related characteristics. Firm size and age are assumed to be relevant control variables based on two arguments. First, larger and older firms may have more resources and history available internally to identify, evaluate and initiate activities. This may lead to improved financial performance compared to smaller and younger firms (Subramani, 2004; Wu *et al.*, 2014; Wu and Chang, 2012; Sinkula, 1994; Hult *et al.*, 2007). Second, size and age are also related to the power dependency in the relationship between buyer and supplier, which may explain other key relationship characteristics that affect performance (commitment, cooperation, trust and conflict) (Benton and Maloni, 2005, p. 5).

The second type of control variable is at the industry level because manufacturing firms often operate in a volatile business environment, with fluctuations in raw materials, sales volumes and competitive forces (Ward and Duray, 2000; Jin *et al.*, 2014; Hult *et al.*, 2007).

Figure 1 illustrates the assumed relationships derived from the hypotheses. Section 3 will describe the research methodology and empirically test the assumed relationships.

3. Research methodology

This section contains a description of the survey instrument development, data collection and descriptive statistics and evaluation of potential non-response bias.

Figure 1 Structural model
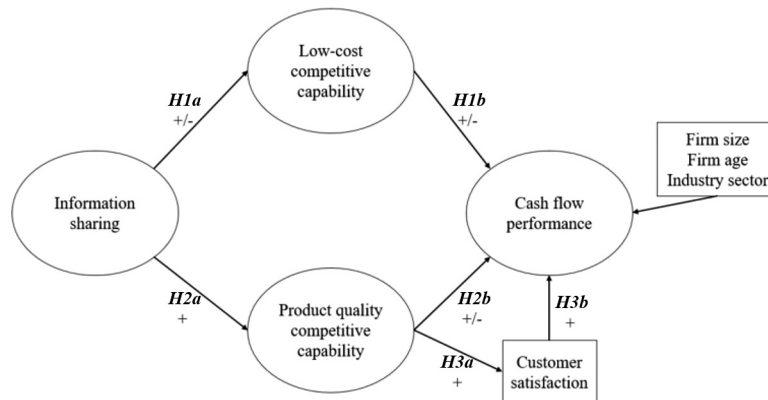
3.1 Survey instrument development and data collection

A three-step approach similar to that used by Cao and Zhang (2011) was followed in the development of survey instruments and data collection by conducting: item generation; structured interviews; and sample design and large-scale data collection.

3.1.1 Item generation

When generating survey items, it is important to ensure the content validity of constructs (Brown, 2015). To this end, a literature review was conducted along the same lines through Wong *et al.* (2012) as:

- question formulation;
- locating studies;
- study selection and evaluation;
- analysis and synthesis; and
- using the results.

The question formulation was as follows: how does supplier integration drive performance? To locate studies, top-tier journals (levels 3 and above) according to the *Academic Journal Guide* were used. The journals were primarily selected from the domains of operations and technology; management accounting; ethics, CSR and management; and marketing. They were obtained from databases such as Elsevier, Emerald, ScienceDirect, Sage and JSTOR. Different journals were chosen to encompass the multi-disciplinary nature of supply chain research. The review period for articles was set as 2000 to 2018 to ensure a contemporary update on the various concepts and operationalisations. However, these articles also provided relevant references prior to 2000. Only peer-reviewed articles were selected. Titles and abstracts were first screened and checked for relevance. More than 100 articles constituted the shortlist following the initial screening.

The articles were then categorised under the main key constructs of supplier integration (information sharing), competitive capabilities[4] and performance. Several sub-concepts were developed to further refine categorisation. For instance, the performance was categorised into the sub-concepts of financial, market and firm value. This was done to identify research opportunities in the existing literature at a preliminary stage of the study, and obtaining conceptualisations and identifying relevant survey items/indicators.

3.1.2 Structured interviews

Reliability and validity of the survey items were assessed through structured interviews (Brown, 2015). The survey items were reviewed and evaluated by four practitioners with relevant and extensive work experience within the field of supply chain management, and six academic researchers. The main changes after this review were to focus on one key supplier important for the supply chain (i.e. not selecting suppliers for support functions).

The survey was then translated into Norwegian, with three rounds of review to ensure that the Norwegian version was equivalent to the original English version. The English version was held constant, only altering the wording in Norwegian to make it as equivalent as possible. Two academic researchers, both native Norwegian speakers, conducted the review. The survey items used for the large-scale survey are reported in Appendix.

3.1.3 Sample design and large-scale data collection

To refine, evaluate and analyse the measurement properties, a large-scale web survey was conducted using Qualtrics survey software. An initial email list of 1,480 firms was purchased from Norfakta AS, a company that specialises in survey research and market analysis. The established criteria for selecting firms were: manufacturing firms with industry NACE code (Rev.2) 10-32[5] with a minimum of 10 employees[6]. Furthermore, the targeted respondents were mainly CEOs, CFOs, directors and managers within the firm. This was done because the analytical focus was at the firm level, and such role functions are believed to be knowledgeable about integrative efforts with suppliers.

Prior to the large-scale data collection, Norfakta AS targeted and contacted (primarily by telephone) the CEO, CFO or a manager in each firm, encouraging them to participate before the survey was distributed. This accorded with an endorsement strategy to increase response rate (Young, 2005)[7]. There existed some duplicate names within firms, and some emails bounced. Therefore, the sample contained 1,369 unique firms. The web survey instructed the respondents to answer the survey questionnaire based on one key supplier in the past three years that they considered important for daily production processes. A seven-point Likert scale for all key latent variables was used, ranging from 1 (strongly disagree) to 7 (strongly

agree). Financial statements for the fiscal year of 2015 were used to estimate the natural logarithm of firm size and firm age (Subramani, 2004; Wu *et al.*, 2014; Wu and Chang, 2012; Sinkula, 1994). The main industrial grouping (MIG) was added as an industry control variable[8]. All key latent variables were measured through self-reporting. Appendix summarises the survey items, definitions and references.

To improve the response rate, two waves of emails were sent one week apart from the initial survey invitation in spring 2018. Out of the 189 responses received, 159 were usable (30 incomplete or failing to meet the selection criteria's), resulting in a response rate of 11.6 per cent. Web surveys are challenging to conduct because they are often met with a lack of interest and low prioritisation. This leads regularly in a response rate below 10 per cent (Grandcolas *et al.*, 2003). Looking at similar web surveys, Cao and Zhang (2011) achieved a response rate of approximately 6 per cent, while Narayanan *et al.* (2015) achieved approximately 7 per cent. Hence, this study appears to be within an acceptable response range.

3.2 Descriptive statistics
Table I describes the respondents using various descriptive characteristics, such as the respondent's job titles, industry grouping (MIG) and the type of supplier on which they based their response. In general, CEOs (41.5 per cent) or managers

Table I Descriptive statistics

Job title	Frequency	% of sample
CEO	66	41.5
CFO	14	8.8
Director, other (IT, strategy, operations, research and development, sales, etc.)	6	3.8
Manager (production, purchase, logistics, sales and marketing, materials, etc.)	61	38.4
Controller	3	1.9
Other (purchaser, agent, etc.)	9	5.6
Total	159	100
MIGs		
Intermediate goods	76	47.8
Consumer goods	53	33.3
Capital goods	30	18.9
Total	159	100
Type of supplier		
Manufacturing firms	101	63.5
Service firms	11	6.9
Wholesale/distributor	39	24.5
Retailer	5	3.1
Other	3	2.0
Total	159	100
Business history with key supplier		
<1 year	3	1.9
1-5 years	28	17.6
5-10 years	48	30.2
10-20 years	56	35.2
>20 years	24	15.1
Total	159	100

(38.4 per cent) answered the survey. This was as expected because they are most likely to be involved in integrative efforts with key suppliers, and hence, have the necessary information to answer the survey. About half of the firms are manufacturers of intermediate goods (47.8 per cent), and the rest are either manufacturers of consumer goods (33.3 per cent) or capital goods (18.9 per cent). Unsurprisingly, given that the firms are from the industrial sector, most of the key suppliers chosen for the survey response are themselves manufacturing firms (63.5 per cent) or wholesale/distributors (24.5 per cent). The length of business relationships with key suppliers seemed to be long and stable, with the majority having a relationship for more than five years (80.5 per cent).

3.3 Non-response bias
Non-response bias can exist within survey research, diminishing the representativeness of the obtained results. Non-response bias is evaluated by comparing the answers of early survey respondents to those of late respondents, with the assumption that late respondents are more similar to non-respondents than early respondents (Armstrong and Overton, 1977; Lambert and Harrington, 1990).

To evaluate the potential non-response bias, independent sample *t*-tests of key firm characteristics between early (first wave) and late respondents (second and third waves) were conducted. The key firm characteristics were not significant ($p > 0.01$) between early and late respondents with regard to firm size (lnassets) ($p = 0.168$), firm age (lnage) ($p = 0.514$), number of employees (lnemployees) ($p = 0.659$), type of supplier ($p = 0.622$) and MIG ($p = 0.472$).

4. Results

The study used confirmatory factor analysis (CFA) as part of the SEM analysis. This combination has often been used in previous supply chain research (for instance, Cao and Zhang, 2011; Ou *et al.*, 2010; Seggie *et al.*, 2006; Vanpoucke *et al.*, 2014; Vickery *et al.*, 2003; Ahire and Dreyfus, 2000; Yunis *et al.*, 2013; Kaynak, 2003; Jin *et al.*, 2014; Forza and Filippini, 1998). The use of CFA can be justified as it enables the identification of latent constructs, while SEM offers a flexible examination of complex causal and potentially endogenous relationships (Mehmetoglu and Jakobsen, 2016; Hair *et al.*, 2013).

The remainder of this section will first describe the large-scale measurement results from the CFA, followed by the hypotheses testing results, and then testing for the effect size of mediation. The analysis was conducted using the data software programme Stata 15.1.

4.1 Large-scale measurement results
This paper followed the same approach as outlined by Cao and Zhang (2011), assessing the CFA's:
- unidimensionality and convergent validity;
- reliability;
- discriminant validity; and
- factor structure used for further SEM analysis.

Unidimensionality is measured by the respective factor loadings and fit indices from each indicator on the latent variable. A general rule of thumb is that factor loading should

be at least between 0.3-0.4 (Brown, 2015). This is, however, a liberal interpretation and must be viewed against other fit statistics as well (Brown, 2015).

Each latent variable is assessed by its fit indices before the fit indices for the whole measurement model are measured. The fit measures may be distinguished between absolute, parsimony and incremental/relative fit. Absolute fit is measured by the chi-square (χ^2) distribution and normed χ^2 (χ^2 divided by degrees of freedom), with a normed χ^2 of $\chi^2 < 3.0$ indicating a reasonable fit, whereas $\chi^2 < 2.0$ indicates a good fit (Segars and Grover, 1998). The parsimony fit is measured by the root mean square error of approximation (RMSEA), with a suggested threshold of <0.10 (Brown, 2015). The incremental/relative fit is measured by the comparative fit index (CFI) and Tucker–Lewis index (TLI)[9], with an acceptable level when both CFI and TLI are >0.90 (Brown, 2015).

Convergent validity is assessed by the significance of z-values of each measurement indicator and the average variance extracted (AVE). The z-values should be significant (with a threshold of 0.05) and AVE > 0.5, meaning that variance in the indicators explained by the latent variable is higher than the indicators' error variance (Brown, 2015).

Furthermore, the factor/scale reliability was measured using Raykov's (1997) factor reliability coefficient (RRC). A rule of thumb is that the reliability coefficient should be >0.70 (Brown, 2015).

Discriminant validity is verified by comparing the correlation between the latent variable and its indicators with other indicators in the model. AVE may also be used for assessing discriminant validity because it should be higher than the squared correlations between latent variables (Fornell and Larcker, 1981).

Following Hair *et al.* (2013), iterative modifications were made by evaluating the modification index (MI), correlated errors and factor loadings to improve key model fit statistics. After modifications, the survey items IS1, CP1 and QP2 were removed from their latent constructs. IS5 was borderline but was included because it was believed to represent an important aspect of information sharing that is not represented in the other indicators.

In Table II, the results from the CFA and fit indices when individually analysing each latent variable are reported. All the indicator factor loadings are significant, and the χ^2 is not significant for all the latent variables and is below the suggested threshold for normed χ^2. AVE is >0.50 for the latent variables, which together suggest unidimensionality and convergent validity (Brown, 2015). The RMSEA is slightly above the suggested threshold for cash flow performance, but the other fit statistics seem within acceptable ranges, and therefore, are included.

The factor/scale reliability is sufficiently high with all latent variables, having an RRC > 0.70, meaning the indicators sufficiently capture the true score of the latent variable (Raykov, 1997).

As Table II shows, the AVE for each latent variable is higher than the squared correlation between two latent variables (shown in Table III), meaning that the correlation between indicators in a latent variable is higher than across other indicators. In other words, there is sufficient discrimination between the different latent variables (Fornell and Larcker, 1981).

Testing the whole CFA measurement model before structural modelling also yielded satisfactory results. Model fit statistics showed that $\chi^2 = 244.40$; df $= 165$; $\chi^2/df = 1.481$; RMSEA $= 0.055$; CFI $= 0.957$; and TLI $= 0.946$.

4.2 Hypotheses testing results

Figure 2 illustrates the structural model and includes results from the hypotheses testing. In terms of overall fit, $\chi^2 = 347.09$ with df $= 181$, and the ratio of χ^2 to degrees of freedom is 1.918, which indicates a good fit. The other model fit indices are RMSEA $= 0.077$, CFI $= 0.913$ and TLI $= 0.901$, which are within acceptable ranges.

The results in Figure 2 supports *H1a* and *H1b*. The standardised path coefficients are 0.21 ($z = 2.40$) and 0.22 ($z = 2.56$), respectively, both being significant at the 0.05 level. Together, this indicates that there exists a mediation between information sharing and cash flow performance by cost performance.

H2a is supported, while *H2b* is not supported. The standardised path coefficients are 0.47 ($z = 6.35$) and 0.06 ($z = 0.73$), respectively. *H2a* is significant at the 0.01 level. Given that *H2b* is not significant, there does not appear to be a mediation between information sharing and cash flow performance by product quality competitive capability.

However, *H3a* and *H3b* are supported. The standardised path coefficients are 0.35 ($z = 4.54$) and 0.41 ($z = 5.65$), respectively. They are both significant at the 0.01 level. This indicates that there exists mediation between product quality competitive capability and cash flow performance through customer satisfaction.

4.3 Testing for mediation

The testing for mediation follows the Zhao *et al.* (2010) approach. These authors argue that what really matters when determining mediation is the indirect effect. This is especially relevant because information sharing is modelled here as only being indirectly related to cash flow performance. However, customer satisfaction will also be tested for direct and total effects.

This is done by running a Monte Carlo estimation, starting with the *a* and *b* coefficients (such as *H1a* and *H1b*) and their respective standard errors. Random normal variables for *a* and *b* are generated to create a distribution of *a*∗*b* values (Zhao *et al.*, 2010). The rationale was that Sobel's test has been proven to have lower power. This is due to the normal distribution assumption, as indirect effects are known to be highly skewed (Jose, 2013). The Monte Carlo simulation estimation approach has been shown to provide reliable estimates for the indirect effect, even though the normal distribution assumption is not met (Jose, 2013).

In total, 5,000 Monte Carlo simulations were run to test for the indirect effect. The results are shown in Table III. The mediated path from information sharing on cash flow performance through low-cost competitive capability is significant at the 0.1 level, with a standardised coefficient of 0.04 (1.66). This indicates that cash flow performance will increase with 0.04 standard deviation from every one standard deviation increase in information sharing indirectly via low-cost competitive capability (Preacher *et al.*, 2011). The mediated path from information sharing on cash flow performance through product quality competitive capability was not significant.

Table II CFA conducted from 159 respondents in Norwegian manufacturing firms

Survey items	Information sharing	Low-cost competitive capability	Product quality competitive capability	Cash flow performance
IS1*				
IS2	0.73 (17.24)			
IS3	0.92 (35.54)			
IS4	0.89 (31.54)			
IS5	0.35 (4.77)			
CP1*				
CP2		0.75 (17.73)		
CP3		0.79 (20.07)		
CP4		0.54 (8.57)		
CP5		0.85 (25.32)		
CP6		0.71 (15.24)		
QP1			0.77 (18.62)	
QP2*				
QP3			0.70 (14.50)	
QP4			0.87 (25.82)	
QP5			0.74 (17.19)	
CFP1				0.95 (105.54)
CFP2				0.99 (203.36)
CFP3				0.95 (104.80)
CFP4				0.68 (15.55)
χ^2 sig.	0.216	0.212	0.327	0.057
Normed χ^2	1.533	1.424	1.115	2.865
RMSEA	0.058	0.052	0.027	0.108
CFI	0.996	0.993	0.999	0.995
TLI	0.989	0.987	0.997	0.986
AVE	0.573	0.540	0.597	0.812
RRC (reliability)	0.750	0.847	0.850	0.947

Note: *Dropped

Table III Diagonal value: squared root of AVE; non-diagonal value: correlation

Variable	Information sharing	Low-cost competitive capability	Product quality competitive capability	Cash flow performance
Information sharing	0.757			
Low-cost competitive capability	0.040	0.735		
Product quality competitive capability	0.222	0.151	0.773	
Cash flow performance	0.048	0.149	0.072	0.902

Rather, the effect of product quality competitive capability was fully mediated by customer satisfaction. The standardised coefficient was 0.14 (3.49), which is significant at the 0.01 level. This suggests that cash flow performance will increase with 0.14 standard deviation from every one standard deviation increase in product quality competitive capability indirectly via customer satisfaction (Preacher *et al.*, 2011).

MacKinnon (2008) has suggested various ratios to express the indirect effect. Two of these are the ratio of indirect to total effect (RIT) and the ratio of indirect to direct effect (RID). They help to illustrate the relationship between product quality competitive capability, customer satisfaction and cash flow performance. The RIT is 0.70 (0.143/0.206), which means that about 70 per cent of the effect from product quality competitive capability on cash flow performance is mediated through customer satisfaction. The RID is 2.29 (0.143/0.063), which suggests that the mediated effect from customer satisfaction is

2.67 times as large as the direct effect from product quality competitive capability on cash flow performance (Table IV).

To assess the mediation effect size, Preacher *et al.* (2011, p. 108) suggest that Cohen's effect size may still be used to evaluate the effect size of mediation from the standardised coefficient. This implies that 0.01, 0.09 and 0.25 constitute small, medium and large effect sizes, respectively. This suggests that the low-cost competitive capability mediator has a small-to-medium effect size, while customer satisfaction has between medium and large mediation effect.

5. Discussion and limitations

5.1 Discussion of results
There are two main empirical findings in this study. First, low-cost competitive capability seems to be positively related to cash flow performance. This may be explained by how

Figure 2 Structural model results
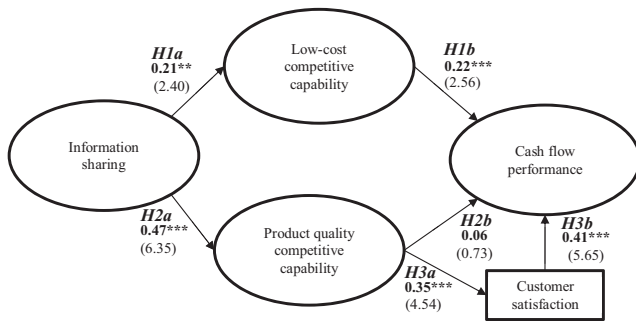
Notes: ***, ** and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively, z-value in parenthesis, model fit statistic: $\chi^2 = 347.09$; df = 181; χ^2/df = 1.918; RMSEA = 0.077; CFI = 0.913; TLI = 0.901

information sharing contributes to a decrease in various transaction costs related to coordination and decision making (Huang *et al.*, 2003; Lee *et al.*, 2000; Mohr and Spekman, 1994; Yigitbasioglu, 2010; Li *et al.*, 2006b). Product quality competitive capability is not directly related to cash flow performance, but is found to be fully mediated through customer satisfaction (Zhao, Lynch and Chen, 2010). This indicates that customer satisfaction is an important mediator between product quality competitive capability and cash flow performance (Yeung, 2008; Ou *et al.*, 2010; Yu *et al.*, 2013; Das *et al.*, 2000). This implies that both product quality competitive capability and customer satisfaction must be included to understand the relationship between product quality and cash flow performance.

Second, cash flow is developed and used as a unidimensional financial performance measure. This makes it easier to interpret the relationship between information sharing, competitive capabilities and financial performance. For instance, a positive relationship between low-cost competitive capabilities and cash flow performance indicates that cash flow will increase significantly due to improved low-cost competitive capabilities.

What is most surprising is the lack of significant and direct path relationship between product quality competitive capability and cash flow performance. This may be due to several reasons. First, Ataseven and Nair (2017) suggest that there might exist a more complex relationship (curvilinear), resulting in insignificant linear results between product quality competitive capability and performance. This logic is based on diminishing returns, as the marginal cost of increasing quality will be in excess of the marginal return through cash flow performance gains at a certain point (Ataseven and Nair, 2017).

Another reason may be that product quality and competitive capability is not sufficient itself to positively affect cash flow performance. The change in product quality competitive capability must also be translated into how the customer perceives the quality before it affects financial performance (Zeithaml, 1988). In other words, the quality conformance of a product may be required according to quality regulations and standards, but meeting and exceeding that level is not necessarily appreciated or communicated to the customer. The result is that the firm is not able to extract a higher price premium or sales volume from the product or service. This is in accordance with earlier studies finding a positive relationship between customer satisfaction and financial performance (Yeung, 2008; Ou *et al.*, 2010; Yu *et al.*, 2013; Das *et al.*, 2000; Song *et al.*, 2017). This supports Das *et al.* (2000) point that customer satisfaction is a principal criterion when evaluating product quality, and indicates that it must be taken into consideration when explaining the link between product quality competitive capability and performance.

There may be two different ways of understanding the lack of direct effect from product quality competitive capability on cash flow performance. First, if customer satisfaction absorbs most of the effects of higher sales price and volume, then only the cost of quality remains to have a direct effect on cash flow performance. Williams *et al.* (1999) have noted that the cost of quality may vary between 5-25 per cent of sales revenue. If not properly managed, the costs of achieving and sustaining product quality competitive capability may be so high that the financial performance does not sufficiently improve relative to maintaining a lower product quality competitive capability level.

Second, it may be that the effect from decreased cost of quality is absorbed by the low-cost competitive capability. The reason for this is that the cost of quality is not distinguished from other production-related costs operationalised under the low-cost competitive capability. This makes it difficult to isolate the various cost-effects achieved by the low-cost competitive capability, and equally cost of quality effects in the product quality competitive capability. For instance, improved information sharing may lead to a leaner inventory, which reduces the need for holding stock. This leads to decreased inventory costs. On the other hand, improved raw material quality may also reduce the need for holding inventory (i.e. leaner inventory). Although improved raw material quality increases purchase costs, it may create a positive net cost-benefit due to a reduction in scrapping and reworking costs. Both effects are related to production and inventory costs, but are not captured by the product quality competitive capability. This suggests that the cost of quality must be distinguished from other production cost aspects.

Table IV Direct, indirect and total effect

Path	Direct	Indirect	Total	RIT	RID	Mediated hypothesis	
Info → Cost → Cash	–	0.04* (1.66)	–	–	–	*H1a-H1b*	Supported
Info → Quality → Cash	–	0.03 (0.71)	–	–	–	*H2a-H2b*	Not supported
Quality → Customer satisfaction → Cash	0.06 (0.73)	0.14*** (3.49)	0.21	0.70	2.29	*H3a-H3b*	Supported

Notes: ***, ** and *denote significance at the 0.01, 0.05 and 0.1 levels, respectively, *z*-value in parenthesis

5.2 Managerial implications

The results of this study offers three managerial implications. First, firms should invest in external integration with their key supplier, as greater information sharing may lead to improved competitive capabilities in terms of low-cost or product quality (Yu *et al.*, 2013). Information sharing may be viewed as a competitive tool that managers can use to facilitate necessary changes in a highly competitive environment (Olorunniwo and Li, 2010). This is achieved by developing competitive capabilities. When explaining the relationships between competitive capabilities and cash flow performance, the low-cost competitive capability is more straightforward. As low-cost competitive capabilities lead to improved cash flow performance, profit margins may be improved through the lower cost base (all else being equal) and/or more competitive pricing that increases sales. However, more elaboration needs to be added to understand how information sharing leads to improved cash flow performance through product quality competitive capability. Managers cannot expect to increase their cash flow performance solely via increased product quality conformance. This suggests that product quality competitive capability does not automatically lead to a price premium or more customers, which then increases cash flow performance. Rather, managers must pay special attention to customer satisfaction to derive benefits from increased product quality competitive capability. This implies that in a performance measurement system (such as a balanced scorecard), customer satisfaction should be especially emphasised when focussing on product quality competitive capability compared to low-cost competitive capability. For those pursuing a product quality competitive capability, the title of Takeuchi and Quelch (1983) seminal paper in *Harvard Business Review*, "Quality is more than making a good product", still seems to be valid today.

Tesla is an example of a firm that seems to have managed both to increase product quality competitive capability through key suppliers and customer satisfaction. Indeed, Tesla received the highest customer satisfaction ranking in 2019 in the consumer report[10]. With its battery pack technology, the company has been working closely with Panasonic's production of battery cells to develop electric cars with a superior capacity to its competitors. This information sharing between Tesla and Panasonic has led to a higher degree of product quality conformance. Additionally, it has also increased customer satisfaction by (among others) offering of a battery guarantee in terms of years and capacity that surpasses the traditional New Vehicle Limited Warranty. Such guarantees can, of course, backfire if Tesla proves unable to deliver as promised, but it might also build customers' confidence in a company willing to provide guarantees that are better than typically expected when buying a new car (exceeding customer expectations). This shows how product quality competitive capability has been used as a competitive force and at the same time building a linkage between product quality competitive capability and customer satisfaction to improve financial performance.

Second, managers need to be aware of the important integration of both suppliers and customers in product quality. Product quality is a continuous process, rather than just a product to be marketed. This may build a stronger linkage between product quality conformance, customer satisfaction and financial performance. In other words, managers must go "from traditional firm centric and product-based mindset to an inter-organisational supply chain orientation" (Robinson and Malhotra, 2005, p. 315). This may be a cultural question as well, creating a feedback loop between the firm and supplier, and the firm and its customers (Foster and Ogden, 2008; Zeng *et al.*, 2013).

For many firms, this is easier said than done. For instance, the pharmaceutical manufacturing industry must balance between developing the best drug from a clinical efficacy point of view, and how the customer (prescriber and patient) experiences using it. A Mckinsey survey of 600 immunologists illustrated that if a prescriber is satisfied with a particular drug and the firm's contributions (i.e. the journey from development to clinical use), he or she is more than twice as likely as dissatisfied counterparts to prescribe it (Ascher *et al.*, 2018). Take for instance the launch of Relenza® (Zanamivir), an antiviral drug for the treatment of influenza. Relenza was the challenger to Tamiflu® (Oseltamivir), having almost equal clinical efficacy (Sugaya *et al.*, 2008). All else being equal, Relenza and Tamiflu competed for the same customers, but only one succeeded: Tamiflu. This may be explained at least in part by differences in drug administration, as Relenza did not take actions to meet customer complaints[11]. While Tamiflu can be taken as an oral tablet, Relenza comes in powder form with a Diskhaler (inhalator mechanism) that may aggravate respiratory problems for some patients (Williamson and Pegram, 2000). This example illustrates that firms need to continuously build a linkage between product quality competitive capability and customer satisfaction to achieve improved financial performance.

Third, there is a challenge of balancing the cost benefits of investing in supply chain information infrastructure and the benefits derived from using the shared information. This has been captured in this study by including the cash flow return (operational cash flow to total assets) indicator. If not balanced properly, the potential cash flow benefits may not be achieved due to either too great or too small asset investments.

Target's expansion into Canada is an example of a lack of sufficient investment in supply chain information infrastructure (i.e. too small asset investments)[12]. As the company moved aggressively into Canada, it needed to hire another firm to handle its logistics. The process went poorly. Information systems expected to receive orders that never came or they made wrong orders. The consequences were stockpiling of incorrect goods at distribution centres, resulting in empty store shelves or shelves filled with the wrong goods. Target was forced to offer heavy discounts to increase its inventory turnover. Two years after the initial launch, in 2015 it announced that it would pull out of Canada with a total loss of approximately $2bn[13].

5.3 Limitations and further research

There are some limitations in this study that must be addressed. Information sharing is only one aspect of supplier integration, and research could be broadened by implementing more aspects of supplier integration (for instance, distributive fairness and resource sharing). In addition, more "soft" characteristics (such as power and trust) may be added to capture more of the complex relationship between supplier

integration and cash flow performance (Cao and Zhang, 2011; Villena *et al.*, 2011). The same goes for competitive capabilities, as quality and low cost are only two of several competitive capabilities (review by Jitpaiboon *et al.*, 2016).

Some may also argue that cash flow performance offers only a limited view of financial performance compared with combining various aggregate financial performance indicators. However, given that it has a managerial, investor and methodological benefits, it could, in fact, be given greater importance. One extension of using cash flow measure is to view integration from both the supplier and customer perspectives. Here, the cash-to-cash components could instead be used as a cash flow performance measure. The benefit of this would be to shed more light on which components of cash flow are actually affected through integration (Kroes and Manikas, 2014).

A methodological concern in this study is that responses were based on only one key supplier within the manufacturing industry. This may be both a source of surveyor bias (Zimmerman, 2001) and limit the generalisation of the results. For instance, one respondent argued initially that if one manufactures bicycles, it is unnatural to select only one key supplier because all of the parts of a bicycle are equally important to complete the production cycle. While this can be true, the consequence of asking respondents to base their answers on several key suppliers is methodologically problematic. It becomes difficult to ascertain what their responses are based upon (the average benefits across several suppliers, a weighted answer based on purchase volume or contact frequency, and so forth). This is due to how different suppliers may warrant a different response for the various survey items. This method was therefore chosen to increase the reliability of the results.

As only a single respondent from each firm were selected, the customer satisfaction was based on self-reporting by the firm. However, as the respondents were mainly CEOs, CFOs and managers, they should be knowledgeable of this subject through customer satisfaction surveys/feedbacks conducted by their firms.

Notes

1 www.itworld.com/article/2798758/nike-says-i2-hurt-its-profits.html

2 www.ft.com/content/d3200d14-a224-11e6-aa83-bcb58d1d2193

3 Kroes and Manikas (2014) use the components of cash-to-cash as a measure for cash flow. As this study emphasises information sharing as part of supplier integration in regard to obtaining low costs and product quality competitive capability, two of the components are less relevant here: days payable outstanding and days sales outstanding.

4 "Competitive capabilities" was used somewhat interchangeably with "operational performance" as they shared the same survey items/indicators. This led to operational performance being moved and re-defined as a competitive capability.

5 Code 33 was not included because these were service- and not production-orientated firms.

6 This was done to ensure that the firms have both substantial business activities and sufficient internal resources for actively pursuing and managing integrative efforts with suppliers.

7 This was performed by Norfakta AS.

8 The MIGs by Eurostat is a way of statistically breaking down the economic activities of the manufacturing industry. Meaningful comparisons may be conducted because the firms are grouped based on what they are producing: intermediate goods (semi-finished products), consumer goods (products for direct consumption) or capital goods (production of tangible assets used for production). Although based on the NACE classification, it significantly reduces the number of groups.

9 Also called non-normed fit index (NNFI).

10 www.consumerreports.org/car-reliability-owner-satisfaction/car-brands-ranked-by-owner-satisfaction/

11 www.fiercepharma.com/special-report/relenza-pharma-s-biggest-flops

12 www.reuters.com/article/us-target-canada-exclusive/exclusive-target-canadas-supply-chain-gridlock-how-barbie-suvs-snarled-traffic-idUSBREA4K03X20140521

13 www.businessinsider.com/why-target-canada-failed-2015-1?r=US&IR=T&IR=T

References

Ahire, S.L. and Dreyfus, P. (2000), "The impact of design management and process management on quality: an empirical investigation", *Journal of Operations Management*, Vol. 18 No. 5, pp. 549-575.

Anderson, E.W., Fornell, C. and Lehmann, D.R. (1994), "Customer satisfaction, market share, and profitability: findings from Sweden", *Journal of Marketing*, Vol. 58 No. 3, pp. 53-66.

Anderson, J.C., Rungtusanatham, M., Schroeder, R.G. and Devaraj, S. (1995), "A path analytic model of a theory of quality management underlying the Deming management method: preliminary empirical findings*", *Decision Sciences*, Vol. 26 No. 5, pp. 637-658.

Anderson, E.W. and Sullivan, M.W. (1993), "The antecedents and consequences of customer satisfaction for firms", *Marketing Science*, Vol. 12 No. 2, pp. 125-143.

Angeles, R. and Nath, R. (2001), "Partner congruence in electronic data interchange (EDI)-enabled relationships", *Journal of Business Logistics*, Vol. 22 No. 2, pp. 109-127.

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.

Ascher, J., Höglund, D., M'Lika, A., Ostojic, I. and Vancauwenberghe, M. (2018), "From product to customer experience: the new way to launch in pharma", available at: www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/from-product-to-customer-experience-the-new-way-to-launch-in-pharma

Ataseven, C. and Nair, A. (2017), "Assessment of supply chain integration and performance relationships: a meta-analytic investigation of the literature", *International Journal of Production Economics*, Vol. 185, pp. 252-265.

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.

Benaroch, M., Lichtenstein, Y. and Fink, L. (2016), "Contract design choices and the balance of ex-ante and ex-post transaction costs in software development outsourcing", *MIS Quarterly*, Vol. 40 No. 1, p. 57.

Benner, M.J. and Veloso, F.M. (2008), "ISO 9000 practices and financial performance: a technology coherence perspective", *Journal of Operations Management*, Vol. 26 No. 5, pp. 611-629.

Benton, W.C. and Maloni, M. (2005), "The influence of power-driven buyer/seller relationships on supply chain satisfaction", *Journal of Operations Management*, Vol. 23 No. 1, pp. 1-22.

Berk, J. and DeMarzo, P. (2013), *Corporate Finance, Global Edition*, Pearson, Harlow.

Bharadwaj, N. and Matsuno, K. (2006), "Investigating the antecedents and outcomes of customer firm transaction cost savings in a supply chain relationship", *Journal of Business Research*, Vol. 59 No. 1, pp. 62-72.

Birkinshaw, J., Hood, N. and Jonsson, S. (1998), "Building firm-specific advantages in multinational corporations: the role of subsidiary initiative", *Strategic Management Journal*, Vol. 19 No. 3, pp. 221-242.

Boyer, K.K. and Lewis, M.W. (2002), "Competitive priorities: investigating the need for trade-offs in operations strategy", *Production and Operations Management*, Vol. 11 No. 1, pp. 9-20.

Brown, T.A. (2015), *Confirmatory Factor Analysis for Applied Research*, Guilford Press, New York, NY.

Buzzell, R., Gale, B. and Sultan, R.G. (1975), "Market share - a key to profitability", *Harvard Business Review*, Vol. 53 No. 1, pp. 97-106.

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

Carr, A.S. and Kaynak, H. (2007), "Communication methods, information sharing, supplier development and performance", *International Journal of Operations & Production Management*, Vol. 27 No. 4, pp. 346-370.

Chang, W., Ellinger, A.E., Kim, K. and Franke, G.R. (2016), "Supply chain integration and firm financial performance: a Meta-analysis of positional advantage mediation and moderating factors", *European Management Journal*, Vol. 34 No. 3, pp. 282-295.

Chen, Y. and Bharadwaj, A. (2009), "An empirical analysis of contract structures in IT outsourcing", *Information Systems Research*, Vol. 20 No. 4, pp. 484-506.

Chenhall, R.H. and Langfield-Smith, K. (2007), "Multiple perspectives of performance measures", *European Management Journal*, Vol. 25 No. 4, pp. 266-282.

Chen, I.J. and Paulraj, A. (2004), "Understanding supply chain management: critical research and a theoretical framework", *International Journal of Production Research*, Vol. 42 No. 1, pp. 131-163.

Cho, H.J. and Pucik, V. (2005), "Relationship between innovativeness, quality, growth, profitability, and market value", *Strategic Management Journal*, Vol. 26 No. 6, pp. 555-575.

Choi, T.Y. and Eboch, K. (1998), "The TQM paradox: relations among TQM practices, plant performance, and customer satisfaction", *Journal of Operations Management*, Vol. 17 No. 1, pp. 59-75.

Clemons, E.K., Reddi, S.P. and Row, M.C. (1993), "The impact of information technology on the organization of economic activity: the 'move to the middle' hypothesis", *Journal of Management Information Systems*, Vol. 10 No. 2, pp. 9-35.

Cooper, M.C., Lambert, D.M. and Pagh, J.D. (1997), "Supply chain management: more than a new name for logistics", *The International Journal of Logistics Management*, Vol. 8 No. 1, pp. 1-14.

Corbett, L.M. and Claridge, G.S. (2002), "Key manufacturing capability elements and business performance", *International Journal of Production Research*, Vol. 40 No. 1, pp. 109-131.

Costa, D. (2015), "Reflective, causal, and composite indicators of quality of life: a conceptual or an empirical distinction?", *Quality of Life Research*, Vol. 24 No. 9, pp. 2057-2065.

Crook, T., Combs, J., Ketchen, D. and Aguinis, H. (2013), "Organizing around transaction costs: what have we learned and where do we go from here?", *The Academy of Management Perspectives*, Vol. 27 No. 1, pp. 63-79.

Crosby, P.B. (1979), "Quality is free", *The Art of Making Quality Certain*, New American Library, New York, NY.

Crosby, P.B. (1996), *Quality Is Still Free: making Quality Certain in Uncertain Times*, McGraw-Hill Companies, New York, NY.

Das, A., Handfield, R.B., Calantone, R.J. and Ghosh, S. (2000), "A contingent view of quality management-the impact of international competition on quality", *Decision Sciences*, Vol. 31 No. 3, pp. 649-690.

Douglas, T.J. and Judge, W.Q. (2001), "Total quality management implementation and competitive advantage: the role of structural control and exploration", *Academy of Management Journal*, Vol. 44 No. 1, pp. 158-169.

Ebrahimi, M. and Sadeghi, M. (2013), "Quality management and performance: an annotated review", *International Journal of Production Research*, Vol. 51 No. 18, pp. 5625-5643.

Edwards, J.R. (2011), "The fallacy of formative measurement", *Organizational Research Methods*, Vol. 14 No. 2, pp. 370-388.

Ellinger, A., Daugherty, P. and Keller, S. (2000), "The relationship between marketing/logistics interdepartmental integration and performance in US manufacturing firms: an empirical study", *Journal of Business Logistics*, Vol. 21 No. 1, pp. 1-22.

Fawcett, S.E., Calantone, R.J. and Roath, A. (2000), "Meeting quality and cost imperatives in a global market", *International*

Journal of Physical Distribution & Logistics Management, Vol. 30 No. 6, pp. 472-499.

Fayers, P. and Hand, D. (1997), "Factor analysis, causal indicators and quality of life", *An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation - Official Journal of the International Society of Quality of Life Res*, Vol. 6 No. 2, pp. 139-150.

Fayers, P., Hand, D., Bjordal, K. and Groenvold, M. (1997), "Causal indicators in quality of life research", *Quality of Life Research*, Vol. 6 No. 5, pp. 393-406.

Flynn, B.B., Huo, B. and Zhao, X. (2010), "The impact of supply chain integration on performance: a contingency and configuration approach", *Journal of Operations Management*, Vol. 28 No. 1, pp. 58-71.

Fornell, C. and Larcker, D. (1981), "Structural equation models with unobservable variables and measurement error: algebra and statistics', JMR", *Journal of Marketing Research*, Vol. 18 No. 3, pp. 382-388.

Forza, C. and Filippini, R. (1998), "TQM impact on quality conformance and customer satisfaction: a causal model", *International Journal of Production Economics*, Vol. 55 No. 1, pp. 1-20.

Foster, S.T. and Ogden, J. (2008), "On differences in how operations and supply chain managers approach quality management", *International Journal of Production Research*, Vol. 46 No. 24, pp. 6945-6961.

Frohlich, M.T. and Westbrook, R. (2001), "Arcs of integration: an international study of supply chain strategies", *Journal of Operations Management*, Vol. 19 No. 2, pp. 185-200.

Fullerton, R.R., McWatters, C.S. and Fawson, C. (2003), "An examination of the relationships between JIT and financial performance", *Journal of Operations Management*, Vol. 21 No. 4, pp. 383-404.

Graham, S. and Potter, A. (2015), "Environmental operations management and its links with proactivity and performance: a study of the UK food industry", *International Journal of Production Economics*, Vol. 170, pp. 146-159.

Grandcolas, U., Rettie, R. and Marusenko, K. (2003), "Web survey bias: sample or mode effect?", *Journal of Marketing Management*, Vol. 19 Nos 5/6, pp. 541-561.

Grover, V. and Malhotra, M.K. (2003), "Transaction cost framework in operations and supply chain management research: theory and measurement", *Journal of Operations Management*, Vol. 21 No. 4, pp. 457-473.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2013), "Multivariate data analysis: Pearson new international edition", in Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (Eds), *Multivariate Data Analysis*, Pearson Education Limited, Harlow.

Hendricks, K.B. and Singhal, V.R. (2001), "Firm characteristics, total quality management, and financial performance", *Journal of Operations Management*, Vol. 19 No. 3, pp. 269-285.

Hennart, J.F. (1988), "A transaction costs theory of equity joint ventures", *Strategic Management Journal*, Vol. 9 No. 4, pp. 361-374.

Hennart, J.F. (1991), "The transaction costs theory of joint ventures: an empirical study of Japanese subsidiaries in the United States", *Management Science*, Vol. 37 No. 4, pp. 483-497.

Hobbs, J.E. (1996), "A transaction cost approach to supply chain management", *Supply Chain Management: An International Journal*, Vol. 1 No. 2, pp. 15-27.

Hosoda, T., Disney, S.M. and Gavirneni, S. (2015), "The impact of information sharing, random yield, correlation, and lead times in closed-loop supply chains", *European Journal of Operational Research*, Vol. 246 No. 3, pp. 827-836.

Houman Andersen, P. (2005), "Export intermediation and the internet: an activity-unbundling approach", *International Marketing Review*, Vol. 22 No. 2, pp. 147-164.

Huang, G.Q., Lau, J.S.K. and Mak, K.L. (2003), "The impacts of sharing production information on supply chain dynamics: a review of the literature", *International Journal of Production Research*, Vol. 41 No. 7, pp. 1483-1517.

Hult, G.T.M., Ketchen, D.J. and Arrfelt, M. (2007), "Strategic supply chain management: improving performance through a culture of competitiveness and knowledge development", *Strategic Management Journal*, Vol. 28 No. 10, pp. 1035-1052.

Jacobson, R. and Aaker, D.A. (1987), "The strategic role of product quality", *Journal of Marketing*, Vol. 51 No. 4, pp. 31-44.

Jansen, J.J.P., Van Den Bosch, F.A.J. and Volberda, H.W. (2006), "Exploratory innovation, exploitative innovation, and performance: effects of organizational antecedents and environmental moderators", *Management Science*, Vol. 52 No. 11, pp. 1661-1674.

Jin, Y., Vonderembse, M., Ragu-Nathan, T.S. and Smith, J.T. (2014), "Exploring relationships among IT-enabled sharing capability, supply chain flexibility, and competitive performance", *International Journal of Production Economics*, Vol. 153, pp. 24-34.

Jitpaiboon, T., Gu, Q. and Truong, D. (2016), "Evolution of competitive priorities towards performance improvement: a Meta-analysis", *International Journal of Production Research*, Vol. 54 No. 24, pp. 7400-7420.

Jose, P.E. (2013), *Doing Statistical Mediation and Moderation*, Guilford Press, London.

Jungbae Roh, J., Hong, P. and Park, Y. (2008), "Organizational culture and supply chain strategy: a framework for effective information flows", *Journal of Enterprise Information Management*, Vol. 21 No. 4, pp. 361-376.

Kapoor, R. and Adner, R. (2012), "What firms make vs. what they know: how firms' production and knowledge boundaries affect competitive advantage in the face of technological change", *Organization Science*, Vol. 23 No. 5, pp. 1227-1248.

Kaynak, H. (2003), "The relationship between total quality management practices and their effects on firm performance", *Journal of Operations Management*, Vol. 21 No. 4, pp. 405-435.

Kaynak, H. and Hartley, J.L. (2008), "A replication and extension of quality management into the supply chain", *Journal of Operations Management*, Vol. 26 No. 4, pp. 468-489.

Kearney, A.T. (2018), "Readiness for the future of production report 2018", available at: www.weforum.org/reports/

723

readiness-for-the-future-of-production-report-2018 (accessed 19th March 2019).

Kembro, J.H., Selviaridis, K. and Näslund, D. (2014), "Theoretical perspectives on information sharing in supply chains: a systematic literature review and conceptual framework", *Supply Chain Management: An International Journal*, Vol. 19 Nos 5/6, pp. 609-625.

Kim, S.W. (2009), "An investigation on the direct and indirect effect of supply chain integration on firm performance", *International Journal of Production Economics*, Vol. 119 No. 2, pp. 328-346.

Koka, B.R. and Prescott, J.E. (2002), "Strategic alliances as social Capital: a multidimensional view", *Strategic Management Journal*, Vol. 23 No. 9, pp. 795-816.

Koller, T., Goedhart, M. and Wessels, D. (2005), *Valuation: measuring and Managing the Value of Companies*, John Wiley & Sons, NJ.

Koufteros, X.A., Vonderembse, M.A. and Doll, W.J. (2002), "Examining the competitive capabilities of manufacturing firms", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 9 No. 2, pp. 256-282.

Krause, D.R., Handfield, R.B. and Tyler, B.B. (2007), "The relationships between supplier development, commitment, social capital accumulation and performance improvement", *Journal of Operations Management*, Vol. 25 No. 2, pp. 528-545.

Krishnan, G.V. and Largay Iii, J.A. (2000), "The predictive ability of direct method cash flow information", *Journal of Business Finance Accounting*, Vol. 27 Nos 1/2, pp. 215-245.

Kristal, M.M., Huang, X. and Roth, A.V. (2010), "The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance", *Journal of Operations Management*, Vol. 28 No. 5, pp. 415-429.

Kroes, J.R. and Manikas, A.S. (2014), "Cash flow management and manufacturing firm financial performance: a longitudinal perspective", *International Journal of Production Economics*, Vol. 148, pp. 37-50.

Lambert, D. and Harrington, T. (1990), "Measuring nonresponse bias in customer service mail surveys", *Journal of Business Logistics*, Vol. 11 No. 2, pp. 5-25.

Lechner, C., Frankenberger, K. and Floyd, S.W. (2010), "Task contingencies in the curvilinear relationships between intergroup networks and initiative performance", *Academy of Management Journal*, Vol. 53 No. 4, pp. 865-889.

Lee, H. (2004), "The Triple-A supply chain", *Harvard Business Review*, Vol. 82 No. 10, pp. 102-112.

Lee, H., Padmanabhan, V. and Whang, S. (1997), "The bullwhip effect in supply chains", *Sloan Management Review*, Vol. 38 No. 3, pp. 93-102.

Lee, H.L., So, K.C. and Tang, C.S. (2000), "The value of information sharing in a two-level supply chain", *Management Science*, Vol. 46 No. 5, pp. 626-643.

Leong, G.K., Snyder, D.L. and Ward, P.T. (1990), "Research in the process and content of manufacturing strategy", *Omega*, Vol. 18 No. 2, pp. 109-122.

Leuschner, R., Rogers, D.S. and Charvet, F.F. (2013), "A meta-analysis of supply chain integration and firm performance", *Journal of Supply Chain Management*, Vol. 49 No. 2, pp. 34-57.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S. and Subba Rao, S. (2006a), "The impact of supply chain management practices on competitive advantage and organizational performance", *Omega*, Vol. 34 No. 2, pp. 107-124.

Li, S., Rao, S.S., Ragu-Nathan, T.S. and Ragu-Nathan, B. (2005), "Development and validation of a measurement instrument for studying supply chain management practices", *Journal of Operations Management*, Vol. 23 No. 6, pp. 618-641.

Li, J., Sikora, R., Shaw, M.J. and Woo Tan, G. (2006b), "A strategic analysis of inter-organizational information sharing", *Decision Support Systems*, Vol. 42 No. 1, pp. 251-266.

Lumineau, F. and Henderson, J.E. (2012), "The Influence of relational experience and contractual governance on the negotiation strategy in buyer-supplier disputes", *Journal of Operations Management*, Vol. 30 No. 5, pp. 382-395.

McNair, C.J., Polutnik, L. and Silvi, R. (2001), "Cost management and value creation: the missing link", *European Accounting Review*, Vol. 10 No. 1, pp. 33-50.

Mackelprang, A.W., Robinson, J.L., Bernardes, E. and Webb, G.S. (2014), "The relationship between strategic supply chain integration and performance: a meta-analytic evaluation and implications for supply chain management research", *Journal of Business Logistics*, Vol. 35 No. 1, pp. 71-96.

MacKinnon, D.P. (2008), *Introduction to Statistical Mediation Analysis*, Lawrence Erlbaum, New York, NY.

Malmi, T. (2001), "Balanced scorecards in finnish companies: a research note", *Management Accounting Research*, Vol. 12 No. 2, pp. 207-220.

Malmi, T., Järvinen, P. and Lillrank, P. (2004), "A collaborative approach for managing project cost of poor quality", *European Accounting Review*, Vol. 13 No. 2, pp. 293-317.

Martínez-Costa, M., Martínez-Lorente, A.R. and Choi, T.Y. (2008), "Simultaneous consideration of TQM and ISO 9000 on performance and motivation: an empirical study of Spanish companies", *International Journal of Production Economics*, Vol. 113 No. 1, pp. 23-39.

Mehmetoglu, M. and Jakobsen, T.G. (2016), *Applied Statistics Using Stata: A Guide for the Social Sciences*, Sage, Los Angeles, CA.

Milgrom, P. and Roberts, J. (1990), "Bargaining and influence costs and the organization of economic activity" in Alt J.E. and Shepsle K.A. (Eds), *Perspectives on Positive Political Economy*, Cambridge University Press, Cambridge, pp. 57-89.

Miller, J.G. and Roth, A.V. (1994), "A taxonomy of manufacturing strategies", *Management Science*, Vol. 40 No. 3, pp. 285-304.

Mohr, J. and Spekman, R. (1994), "Characteristics of partnership success: partnership attributes, communication behavior, and conflict resolution techniques", *Strategic Management Journal*, Vol. 15 No. 2, pp. 135-152.

Nahapiet, J. and Ghoshal, S. (1998), "Social capital, intellectual capital, and the organizational advantage", *Academy of Management Review*, Vol. 23 No. 2, pp. 242-266.

Nair, A. (2006), "Meta-analysis of the relationship between quality management practices and firm performance –

implications for quality management theory development", *Journal of Operations Management*, Vol. 24 No. 6, pp. 948-975.

Narasimhan, R. and Nair, A. (2005), "The antecedent role of quality, information sharing and supply chain proximity on strategic alliance formation and performance", *International Journal of Production Economics*, Vol. 96 No. 3, pp. 301-313.

Narayanan, S., Narasimhan, R. and Schoenherr, T. (2015), "Assessing the contingent effects of collaboration on agility performance in buyer-supplier relationships", *Journal of Operations Management*, Vols 33/34 No. 1, pp. 140-154.

Olorunniwo, F.O. and Li, X. (2010), "Information sharing and collaboration practices in reverse logistics", *Supply Chain Management: An International Journal*, Vol. 15 No. 6, pp. 454-462.

Ou, C.S., Liu, F.C., Hung, Y.C. and Yen, D.C. (2010), "A structural model of supply chain management on firm performance", *International Journal of Operations & Production Management*, Vol. 30 No. 5, pp. 526-545.

Pastore, E., Alfieri, A. and Zotteri, G. (2017), "An empirical investigation on the antecedents of the bullwhip effect: evidence from the spare parts industry", *International Journal of Production Economics*, Vol. 209, pp. 121-133.

Porter, M.E. (1985), *Competitive Advantage: creating and Sustaining Superior Performance*, Free Press, New York, NY.

Porter, M.E. and Millar, V.E. (1985), "How information gives you competitive advantage", *Harvard Business Review*, Vol. 63 No. 4, pp. 149-160.

Prajogo, D.I. and Sohal, A.S. (2003), "The relationship between TQM practices, quality performance, and innovation performance", *International Journal of Quality & Reliability Management*, Vol. 20 No. 8, pp. 901-918.

Preacher, K.J., Kelley, K. and Maxwell, S.E. (2011), "Effect size measures for mediation models: quantitative strategies for communicating indirect effects", *Psychological Methods*, Vol. 16 No. 2, pp. 93-115.

Randall, W.S. and Farris, M.T. (2009), "Supply chain financing: using cash-to-cash variables to strengthen the supply chain", *International Journal of Physical Distribution & Logistics Management*, Vol. 39 No. 8, pp. 669-689.

Raykov, T. (1997), "Estimation of composite reliability for congeneric measures", *Applied Psychological Measurement*, Vol. 21 No. 2, pp. 173-184.

Rindfleisch, A. and Heide, J.B. (1997), "Transaction cost analysis: past, present, and future applications", *Journal of Marketing*, Vol. 61 No. 4, pp. 30-54.

Robinson, C. and Malhotra, M. (2005), "Defining the concept of supply chain quality management and its relevance to academic and industrial practice", *International Journal of Production Economics*, Vol. 96 No. 3, pp. 315-337.

Rosenzweig, E.D., Roth, A.V. and Dean, J.W. (2003), "The influence of an integration strategy on competitive capabilities and business performance: an exploratory study of consumer products manufacturers", *Journal of Operations Management*, Vol. 21 No. 4, pp. 437-456.

Rungtusanatham, M., Forza, C., Filippini, R. and Anderson, J.C. (1998), "A replication study of a theory of quality management underlying the Deming management method: insights from an Italian context", *Journal of Operations Management*, Vol. 17 No. 1, pp. 77-95.

Safizadeh, M.H., Ritzman, L.P. and Mallick, D. (2000), "Revisiting alternative theoretical paradigms in manufacturing strategy", *Production and Operations Management*, Vol. 9 No. 2, pp. 111-126.

Sahay, A. (2016), "Managing and Improving Quality: integrating Quality, Statistical Methods and Process Control", Business Expert Press, New York, NY.

Sahin, F. and Robinson, E.P. (2002), "Flow coordination and information sharing in supply chains: review, implications, and directions for future research", *Decision Sciences*, Vol. 33 No. 4, pp. 505-536.

Samson, D. and Terziovski, M. (1999), "The relationship between total quality management practices and operational performance", *Journal of Operations Management*, Vol. 17 No. 4, pp. 393-409.

Schloetze, J. (2012), "Process integration and information sharing in supply chains", *The Accounting Review*, Vol. 87 No. 3, pp. 1005-1032.

Segars, A.H. and Grover, V. (1998), "Strategic information systems planning success: an investigation of the construct and its measurement", *MIS Quarterly*, Vol. 22 No. 2, pp. 139-163.

Seggie, S.H., Kim, D. and Cavusgil, S.T. (2006), "Do supply chain IT alignment and supply chain interfirm system integration impact upon brand equity and firm performance?", *Journal of Business Research*, Vol. 59 No. 8, pp. 887-895.

Shetty, Y. (1988), "Managing product quality for profitibility", *S.A.M. Advanced Management Journal*, Vol. 53 No. 4, pp. 33.

Shi, M. and Yu, W. (2013), "Supply chain management and financial performance: literature review and future directions", *International Journal of Operations & Production Management*, Vol. 33 No. 10, pp. 1283-1317.

Sila, I. (2007), "Examining the effects of contextual factors on TQM and performance through the lens of organizational theories: an empirical study", *Journal of Operations Management*, Vol. 25 No. 1, pp. 83-109.

Sila, I. and Ebrahimpour, M. (2005), "Critical linkages among TQM factors and business results", *International Journal of Operations & Production Management*, Vol. 25 No. 11, pp. 1123-1155.

Simatupang, T.M. and Sridharan, R. (2005), "An integrative framework for supply chain collaboration", *The International Journal of Logistics Management*, Vol. 16 No. 2, pp. 257-274.

Sinkula, J.M. (1994), "Market information processing and organizational learning", *Journal of Marketing*, Vol. 58 No. 1, pp. 35-45.

Song, H., Turson, R., Ganguly, A. and Yu, K. (2017), "Evaluating the effects of supply chain quality management on food firms' performance", *International Journal of Operations & Production Management*, Vol. 37 No. 10, pp. 1541-1562.

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.

Stank, T.P., Keller, S.B. and Daugherty, P.J. (2001), "Supply chain collaboration and logistical service performance", *Journal of Business Logistics*, Vol. 22 No. 1, pp. 29-48.

Subramani, M. (2004), "How do suppliers benefit from information technology use in supply chain relationships?", *MIS Quarterly*, Vol. 28 No. 1, pp. 45-73.

Sugaya, N., Tamura, D., Yamazaki, M., Ichikawa, M., Kawakami, C., Kawaoka, Y. and Mitamura, K. (2008), "Comparison of the clinical effectiveness of oseltamivir and zanamivir against influenza virus infection in children", *Clinical Infectious Diseases*, Vol. 47 No. 3, pp. 339-345.

Swink, M., Narasimhan, R. and Wang, C. (2007), "Managing beyond the factory walls: effects of four types of strategic integration on manufacturing plant performance", *Journal of Operations Management*, Vol. 25 No. 1, pp. 148-164.

Takeuchi, H. and Quelch, J. (1983), "Quality is more than making a good product", *Harvard Business Review*, Vol. 61 No. 4, pp. 139.

Tan, K.-C., Kannan, V.R., Handfield, R.B. and Ghosh, S. (1999), "Supply chain management: an empirical study of its impact on performance", *International Journal of Operations & Production Management*, Vol. 19 No. 10, pp. 1034-1052.

Teece, D. and Leih, S. (2016), "Uncertainty, innovation, and dynamic capabilities: an introduction", *California Management Review*, Vol. 58 No. 4, pp. 5-12.

Um, K.-H. and Kim, S.-M. (2018), "The effects of supply chain collaboration on performance and transaction cost advantage: the moderation and nonlinear effects of governance mechanisms", *International Journal of Production Economics*.

Vanpoucke, E., Boyer, K.K. and Vereecke, A. (2009), "Supply chain information flow strategies: an empirical taxonomy", *International Journal of Operations & Production Management*, Vol. 29 No. 12, pp. 1213-1241.

Vanpoucke, E., Vereecke, A. and Boyer, K.K. (2014), "Triggers and patterns of integration initiatives in successful buyer–supplier relationships", *Journal of Operations Management*, Vol. 32 Nos 1/2, pp. 15-33.

Vickery, S.K., Droge, C. and Markland, R.E. (1993), "Production competence and business strategy: do they affect business performance?", *Decision Sciences*, Vol. 24 No. 2, pp. 435-456.

Vickery, S.K., Jayaram, J., Droge, C. and Calantone, R. (2003), "The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships", *Journal of Operations Management*, Vol. 21 No. 5, pp. 523-539.

Vijayasarathy, L.R. and Robey, D. (1997), "The effect of EDI on market channel relationships in retailing", *Information & Management*, Vol. 33 No. 2, pp. 73-86.

Villena, V.H., Revilla, E. and Choi, T.Y. (2011), "The dark side of buyer–supplier relationships: a social capital perspective", *Journal of Operations Management*, Vol. 29 No. 6, pp. 561-576.

von Hippel, E. (1994), "Sticky information" and the locus of problem-solving: implications for innovation", *Management Science*, Vol. 40 No. 4, pp. 429-439.

Wacker, J., Yang, C. and Sheu, C. (2016), "A transaction cost economics model for estimating performance effectiveness of relational and contractual governance", *International Journal of Operations & Production Management*, Vol. 36 No. 11, pp. 1551-1575.

Ward, P.T. and Duray, R. (2000), "Manufacturing strategy in context: environment, competitive strategy and manufacturing strategy", *Journal of Operations Management*, Vol. 18 No. 2, pp. 123-138.

Ward, P.T., McCreery, J.K., Ritzman, L.P. and Sharma, D. (1998), "Competitive priorities in operations management", *Decision Sciences*, Vol. 29 No. 4, pp. 1035-1046.

Williams, A.R.T., Van Der Wiele, A. and Dale, B.G. (1999), "Quality costing: a management review", *International Journal of Management Reviews*, Vol. 1 No. 4, pp. 441-460.

Williamson, O.E. (1977), "Markets and hierarchies", *Challenge*, Vol. 20 No. 1, pp. 70-72.

Williamson, O.E. (1979), "Transaction-cost economics: the governance of contractual relations", *The Journal of Law and Economics*, Vol. 22 No. 2, pp. 233-261.

Williamson, O.E. (1999), "Strategy research: governance and competence perspectives", *Strategic Management Journal*, Vol. 20 No. 12, pp. 1087-1108.

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

Williamson, J.C. and Pegram, P.S. (2000), "Respiratory distress associated with zanamivir", *The New England Journal of Medicine*, Vol. 342 No. 9, pp. 661-662.

Wong, C., Skipworth, H., Godsell, J. and Achimugu, N. (2012), "Towards a theory of supply chain alignment enablers: a systematic literature review", *Supply Chain Management: An International Journal*, Vol. 17 No. 4, pp. 419-437.

Wu, I.-L. and Chang, C.-H. (2012), "Using the balanced scorecard in assessing the performance of e-SCM diffusion: a multi-stage perspective", *Decision Support Systems*, Vol. 52 No. 2, pp. 474-485.

Wu, I.-L., Chuang, C.-H. and Hsu, C.-H. (2014), "Information sharing and collaborative behaviors in enabling supply chain performance: a social exchange perspective", *International Journal of Production Economics*, Vol. 148, pp. 122-132.

Wu, F., Yeniyurt, S., Kim, D. and Cavusgil, S.T. (2006), "The impact of information technology on supply chain capabilities and firm performance: a resource-based view", *Industrial Marketing Management*, Vol. 35 No. 4, pp. 493-504.

Yan, T. and Kull, T.J. (2015), "Supplier opportunism in buyer–supplier new product development: a China-US study of antecedents, consequences, and cultural/institutional contexts", *Decision Sciences*, Vol. 46 No. 2, pp. 403-445.

Yeung, A.C.L. (2008), "Strategic supply management, quality initiatives, and organizational performance", *Journal of Operations Management*, Vol. 26 No. 4, pp. 490-502.

Yigitbasioglu, O.M. (2010), "Information sharing with key suppliers: a transaction cost theory perspective", *International Journal of Physical Distribution & Logistics Management*, Vol. 40 No. 7, pp. 550-578.

Young, S. (2005), "Assessing the quality of evidence in empirical management accounting research: the case of survey studies", *Accounting, Organizations and Society*, Vol. 30 Nos 7/8, pp. 655-684.

Yu, W., Jacobs, M.A., Salisbury, W.D. and Enns, H. (2013), "The effects of supply chain integration on customer satisfaction and financial performance: an organizational learning perspective", *International Journal of Production Economics*, Vol. 146 No. 1, pp. 346-358.

Yunis, M., Jung, J. and Chen, S. (2013), "TQM, strategy, and performance: a firm-level analysis", *International Journal of Quality & Reliability Management*, Vol. 30 No. 6, pp. 690-714.

Zeithaml, V. (1988), "Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence", *Journal of Marketing*, Vol. 52 No. 3, p. 2.

Zeng, J., Phan, C. and Matsui, Y. (2013), "Supply chain quality management practices and performance: an empirical study" *Advancing Practice Through Theory*, Vol. 6 No. 1, pp. 19-31.

Zhao, X., Huo, B., Flynn, B.B. and Yeung, J.H.Y. (2008), "The impact of power and relationship commitment on the integration between manufacturers and customers in a supply chain", *Journal of Operations Management*, Vol. 26 No. 3, pp. 368-388.

Zhao, X., Lynch, J.G. and Chen, Q. (2010), "Reconsidering Baron and Kenny: myths and truths about mediation analysis", *Journal of Consumer Research*, Vol. 37 No. 2, pp. 197-206.

Zhou, H. and Benton, W.C. (2007), "Supply chain practice and information sharing", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1348-1365.

Zhou, K.Z., Zhang, Q., Sheng, S., Xie, E. and Bao, Y. (2014a), "Are relational ties always good for knowledge acquisition? Buyer–supplier exchanges in china", *Journal of Operations Management*, Vol. 32 No. 3, pp. 88-98.

Zhou, H., Shou, Y., Zhai, X., Li, L., Wood, C. and Wu, X. (2014b), "Supply chain practice and information quality: a supply chain strategy study", *International Journal of Production Economics*, Vol. 147, pp. 624-633.

Zimmerman, J.L. (2001), "Conjectures regarding empirical managerial accounting research", *Journal of Accounting and Economics*, Vol. 32 Nos 1/3, pp. 411-427.

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Appendix

Table AI

Construct	Item	Code	Definition	Survey items based on
In the past three years, to what extent do you agree or disagree with the following statements regarding your firm's collaboration with this supply chain partner?				
Our firm and supply chain partner...				
Information sharing	Exchange relevant information	IS1*	"[T]he extent to which critical and proprietary information is communicated to one's supply chain partner" Mohr and Spekman (1994, p. 139)	Cao and Zhang (2011), Cao *et al.* (2010), Angeles and Nath (2001), Li *et al.* (2006a), Simatupang and Sridharan (2005), Vijayasarathy and Robey (1997), Zhou and Benton (2007), Zhou *et al.* (2014b) and Li *et al.* (2005)
	Exchange timely information	IS2		
	Exchange accurate information	IS3		
	Exchange complete information	IS4		
	Exchange confidential information	IS5		
In the past three years, to what extent do you agree or disagree with the following statements regarding your firm's collaboration with this supply chain partner, when comparing with industry norms?				
By working with this supplier, our firm has achieved...				
Quality	Higher product performance quality (i.e. a product's primary operating characteristics)	QP1	"[A] manufacturer's capability to consistently achieve conformance to specifications, fitness for use" Kristal *et al.* (2010, p. 426)	Miller and Roth (1994), Rosenzweig *et al.* (2003), Kristal *et al.* (2010), Ward *et al.* (1998) and Graham and Potter (2015)
	Higher product durability (i.e. the amount of time or use before the product breaks down and replacement is preferred to continued repair)	QP2*		
	Higher product conformance quality (i.e. the degree to which a product meets established design standards)	QP3		
	Higher product reliability (i.e. the probability of a product malfunctioning or failing within a specified time period)	QP4		
	A reduction in number of defectives/recalls	QP5		
Low-cost	Reduced production costs	CP1*	"[A] manufacturer's capability to compete on cost" Kristal *et al.* (2010, p. 426)	
	Reduced costs by increasing productivity	CP2		
	Reduced costs by improving capacity utilisation	CP3		
	Reduced inventory costs	CP4		
	Reduced costs by reducing production cycle time	CP5		
	Reduced costs by reducing production lead time	CP6		
To what extent do you agree or disagree with the following statements regarding your firm's performance (looking at the whole firm) in the past three years, relative to primary competitors:				
Our firm has better...				
Financial performance	Operating cash flow	CFP1	"[T]he fulfilment of the economic goals of the firm" (Chen and Paulraj, 2004, p. 145)	Wu *et al.* (2006), Fullerton *et al.* (2003), Frohlich and Westbrook (2001), Berk and DeMarzo (2013), Randall and Farris (2009) and Tan *et al.* (1999)
	Cash flow margin (perating cash flow/net sales)	CFP2		
	Cash flow return (operating cash flow/total assets)	CFP3		
	Sales growth	CFP4		
Overall customer satisfaction	Customer satisfaction	CS1	Ability to meet or exceed customer expectations Zeithaml (1988)	Ellinger *et al.* (2000), Kim (2009) and Stank *et al.* (2001)
How long, in total years, has your firm been conducting business with your selected key supply chain partner?	<1 year	LPH1		Wu *et al.* (2014)
	1-5 years	LPH2		
	5-10 years	LPH3		
	10-20 years	LPH4		
	>20 years	LPH5		