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

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

159 survey responses were collected from Norwegian manufacturing firms in 2018. Structural equation modelling (SEM) was employed to analyse the data collected.

Findings

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 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 previously been studied 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.

1. Introduction

The competitive market is ever changing. Rapid changes in technology (Kapoor and Adner 2012), customer preferences (Jansen, Van Den Bosch, and Volberda 2006), as well as domestic and international market dynamics (Birkinshaw, Hood, and Jonsson 1998), have forced firms to integrate more closely with suppliers in order to increase own competitiveness.

An important dimension of supplier integration is information sharing. Information sharing can according to Olorunniwo and Li (2010: 456) be used as a "competitive weapon". 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, Padmanabhan, and Whang 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 an almost 20% decline in Nike share value.[1] Nike is not alone, Apple experienced in 2016 a failure to meet demand for iPhones due to supposed delivery problems from its supplier. Fitbit failed as well, as 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, Lambert, and Pagh 1997). Competitiveness stems from the capabilities that firms develop over time. Teece and Leih (2016: 6-7) conceptualise capability as "a set of activities the firm performs in a semi-routinized fashion to enable a particular set of tasks 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". 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, Vonderembse, and Doll 2002: 259).

[1] https://www.itworld.com/article/2798758/nike-says-i2-hurt-its-profits.html
[2] https://www.ft.com/content/d3200d14-a224-11e6-aa83-bcb58d1d2193

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, Gu, and Truong 2016). Based on trade-off theory logic, a firm primarily focuses on developing one capability at time (Boyer and Lewis 2002; Leong, Snyder, and Ward 1990; Vickery, Droge, and Markland 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, Ritzman, and Mallick 2000), as well as 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 improved 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, Rogers, and Charvet 2013; Mackelprang et al. 2014). When considering information sharing more specifically (being one aspect of supplier integration), both contextual, structural (Vanpoucke, Boyer, and Vereecke 2009; Barratt 2004), and cultural factors may explain the relationship (or lack of) between information sharing and competitive capabilities (Jungbae Roh, Hong, and Park 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) argue 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 i) quality conformance to specifications (Kristal, Huang, and Roth 2010) or ii) perceived production quality as reflected through customer satisfaction (Zeithaml 1988; Anderson, Fornell, and Lehmann 1994). Quality conformance to specifications is the degree to which a product or service functions as expected. This can be determined ex-ante sale (Anderson, Fornell, and Lehmann 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, Fornell, and Lehmann 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, Roth, and Dean (2003) found that the effect (or lack of) from competitive capabilities was contingent on the individual business performance measure used. Swink, Narasimhan, and Wang (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 i) managerial, ii) investor and iii) 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 as well as 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 (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). Since the discounted cash flow method is one way for valuation (Koller, Goedhart, and Wessels 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 return on equity (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, in order 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: 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

[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 (DPO) and days sales outstanding (DSO).

studies to use different financial indicator combinations in order 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 in order 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 A.T. Kearney (2018). The reason is that although Norway has a high cost base, they are well-developed and has 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 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, Selviaridis, and Näslund 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, Lau, and Mak 2003). This can be explained by how information sharing leads to improved forecasting and reduced inventory levels (Lee, So, and Tang 2000), enhanced planning and operational decision-making processes (Mohr and Spekman 1994; Yigitbasioglu 2010), as well as strategic decision-making processes (Li, Sikora, et al. 2006). 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, Lichtenstein, and Fink 2016; Milgrom and Roberts 1990). This is because a lack of contracts or contract incompleteness can increase the potential for opportunism (Clemons, Reddi, and Row 1993; Yan and Kull 2015; Wacker, Yang, and Sheu 2016; Schloetze 2012).

Ex-ante transaction costs may include searching for new suppliers, specifying needs, drafting contracts and negotiating terms (Benaroch, Lichtenstein, and Fink 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, Lichtenstein, and Fink 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: 426). Krause, Handfield, and Tyler (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, Vereecke, and Boyer (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, Lichtenstein, and Fink 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 less resources for monitoring and safeguarding transactions (Rosenzweig, Roth, and Dean 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 how the coordination costs decreases (Seggie, Kim, and Cavusgil 2006). This may provide the buying firm with a cost benefit, through factors such as mitigation of the bullwhip effect (Hosoda, Disney, and Gavirneni 2015; Pastore, Alfieri, and Zotteri 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, So, and Tang 2000).

Even though the supplier complies with initial contracts and agreements, there will most likely be a need for renegotiation and re-specification over time (maladaptation costs).

The reason is contingencies in the market and environment (Rosenzweig, Roth, and Dean 2003; Williamson 1999). But, lengthy and costly renegotiation process may be avoided through information sharing, as the supplier and buyer may more easily find a settlement (Rosenzweig, Roth, and Dean 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 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, Frankenberger, and Floyd (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, Revilla, and Choi 2011; Zhou, Zhang, et al. 2014). 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, Huang, and Roth 2010: 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, i) cost of good quality and/or ii) 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, Huo, and Zhao 2010; Malmi 2001). Appraisal and prevention costs will often be negatively related. For instance, 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, Jung, and Chen 2013; Samson and Terziovski 1999; Fawcett, Calantone, and Roath 2000). Others have found that product quality is positively related to firm performance (Sila 2007; Martínez-Costa, Martínez-Lorente, and Choi 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, Järvinen, and Lillrank 2004; Williams, Van Der Wiele, and Dale 1999; McNair, Polutnik, and Silvi 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, hypotheses 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 cash flow (Shetty 1988). Second, higher product quality acts as a type of differentiator from competitors, which may increase sales volume (Buzzell, Gale, and Sultan 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, hypotheses 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: 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, Chuang, and Hsu 2014; Wu and Chang 2012; Sinkula 1994; Hult, Ketchen, and Arrfelt 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: 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, Ketchen, and Arrfelt 2007).

Figure 1 illustrates the assumed relationships derived from the hypotheses. The following section will describe the research methodology and empirically test the assumed relationships.

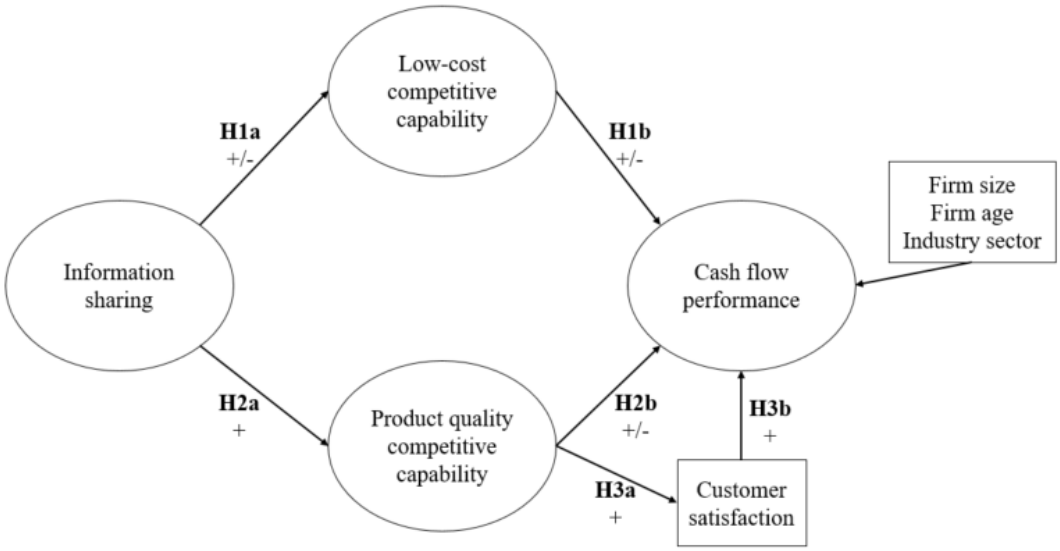

Figure 1. Structural model.

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.

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: i) item generation; ii) structured interviews; and iii) sample design and large-scale data collection.

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 as Wong *et al.* (2012) through: i) question formulation; ii) locating studies; iii) study selection and evaluation; iv) analysis and synthesis; and v) using the results. The question formulation was: how does supplier integration drive performance? In order 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 in order 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, performance was categorised into the sub-concepts of financial, market and firm value. This was done in order to identify research opportunities in the existing literature at a preliminary stage of the study, as well as obtaining conceptualisations and identifying relevant survey items/indicators.

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, as well as 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 in order 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 A.

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

[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 in order to ensure that the firms have both substantial business activities and sufficient internal resources for actively pursuing and managing integrative efforts with suppliers.

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 in order to increase response rate (Young 2005).[7] There existed some duplicate names within firms, as well as 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 last 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, Chuang, and Hsu 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 A 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%. 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% (Grandcolas, Rettie, and Marusenko 2003). Looking at similar web surveys, Cao and Zhang (2011) achieved a response rate of approximately 6%, while Narayanan, Narasimhan, and Schoenherr (2015) achieved approximately 7%. Hence, this study appears to be within an acceptable response range.

3.2 Descriptive statistics

Table 1 describes the respondents using various descriptive characteristics, such as respondent's job titles, industry grouping (MIG) and the type of supplier on which they based their response. In general, CEOs (41.5%) or managers (38.4%) answered the survey. This

[7] This was performed by Norfakta AS.

[8] The main industrialgroupings (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.

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%), and the rest are either manufacturers of consumer goods (33.3%) or capital goods (18.9%). 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%) or wholesale/distributors (24.5%). 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%).

Job title	Frequency	% of sample
CEO	66	41.5%
CFO	14	8.8%
Director, other (IT, strategy, operations, R&D, 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%**

Table 1: Descriptive statistics.

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).

In order 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 (See for instance Cao and Zhang 2011; Ou et al. 2010; Seggie, Kim, and Cavusgil 2006; Vanpoucke, Vereecke, and Boyer 2014; Vickery et al. 2003; Ahire and Dreyfus 2000; Yunis, Jung, and Chen 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 program 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 i) unidimensionality and convergent validity, ii) reliability, and iii) discriminant

validity, before verifying the iv) 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 i) absolute, ii) parsimony and iii) incremental/relative fit. Absolute fit is measured by the chi-square distribution and normed chi-square (χ^2 divided by degrees of freedom), with a normed chi-square of χ^2 <3.0 indicating a reasonable fit, whereas χ^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 2, 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

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

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 are therefore 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 2 shows, the AVE for each latent variable is higher than the squared correlation between two latent variables (shown in Table 3), 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; χ^2/df =1.481; RMSEA =0.055; CFI =0.957; TLI =0.946.

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

Table 2: CFA conducted from 159 respondents in Norwegian manufacturing firms.
*Dropped.

	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

Table 3: Diagonal value: squared root of AVE; non-diagonal value: correlation.

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 chi-square 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.

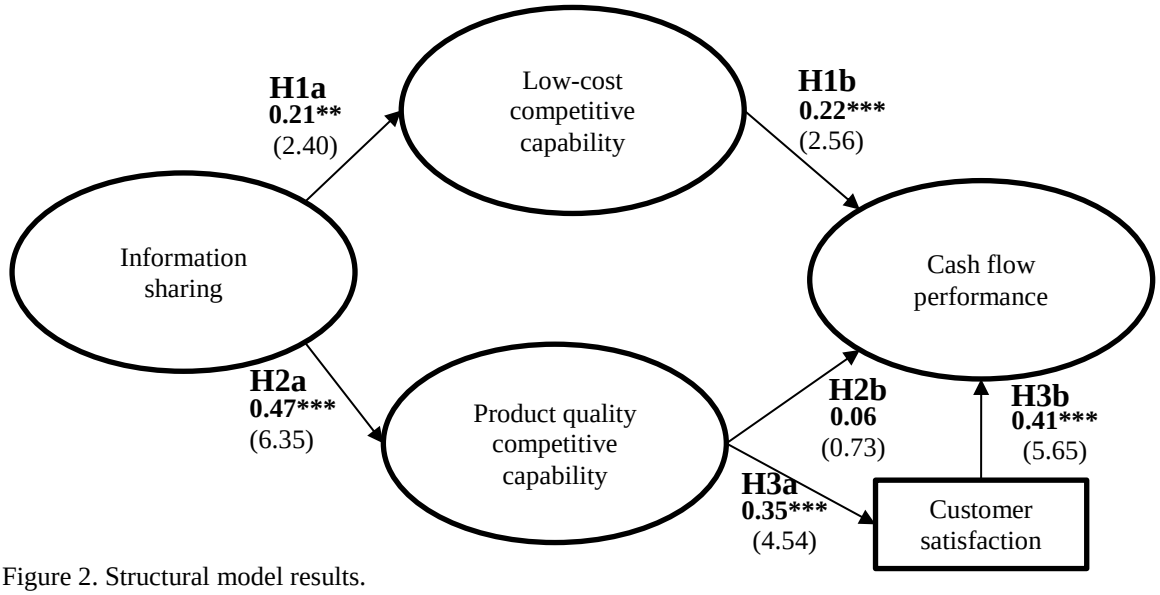

Figure 2. Structural model results.

Notes: 1. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

2. *z*-value in parenthesis.

3. Model fit statistic: $\chi^2 = 347.09$; df =181; χ^2/df =1.918; RMSEA =0.077; CFI =0.913; TLI =0.901

The results in Figure 2 support hypotheses 1a and 1b. 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.

Hypothesis 2a is supported, while hypothesis 2b is not supported. The standardised path coefficients are 0.47 ($z = 6.35$) and 0.06 ($z = 0.73$), respectively. Hypothesis 2a 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, hypotheses 3a and 3b 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, Lynch, and Chen (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, Lynch, and Chen 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).

Five thousand Monte Carlo simulations were run in order to test for the indirect effect. The results are shown in Table 3. 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, Kelley, and Maxwell 2011). The mediated path from information sharing on cash flow performance through product quality competitive capability was not significant.

Rather, the effect from 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, Kelley, and Maxwell 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% 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.

In order to assess the mediation effect size, Preacher, Kelley, and Maxwell (2011: 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. 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.

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

Table 3. Direct, indirect, and total effect.

Notes: 1. ***, **, and * denote significance at the 0.01, 0.05, and 0.1 levels, respectively.

2. *z*-value in parenthesis.

5.0 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 information sharing contributes to a decrease in various transaction costs related to coordination and decision making (Huang, Lau, and Mak 2003; Lee, So, and Tang 2000; Mohr and Spekman 1994; Yigitbasioglu 2010; Li, Sikora, et al. 2006). 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 in order 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 is 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 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, Van Der Wiele, and Dale (1999) have noted that the cost of quality may vary between 5–25% 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 suggest that cost of quality must be distinguished from other production cost aspects.

5.2 Managerial implications

The results from 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 need to be added in order 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 in order 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 focusing 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 seem to have managed both to increase product quality competitive capability through key suppliers, as well as 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 in order 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, as well as at the same time building a linkage between product quality competitive capability and customer satisfaction in order 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-organizational supply chain orientation" (Robinson and Malhotra 2005: 315). This may be a cultural question as well, creating a feedback loop between the firm and supplier, as well as the firm and its customers (Foster and Ogden 2008; Zeng, Phan, and Matsui 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

[10] https://www.consumerreports.org/car-reliability-owner-satisfaction/car-brands-ranked-by-owner-satisfaction/

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] Whereas 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 in order 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 centers, resulting in empty store shelves or shelves filled with the wrong goods. Target was forced to offer heavy discounts in order 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 2 billion dollars.[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 in order to capture more of the complex relationship between supplier integration and cash flow performance (Cao and Zhang 2011; Villena, Revilla, and Choi 2011). The same goes for competitive capabilities, as quality and low cost are only two of several competitive

[11] https://www.fiercepharma.com/special-report/relenza-pharma-s-biggest-flops
[12] https://www.reuters.com/article/us-target-canada-exclusive/exclusive-target-canadas-supply-chain-gridlock-how-barbie-suvs-snarled-traffic-idUSBREA4K03X20140521
[13] https://www.businessinsider.com/why-target-canada-failed-2015-1?r=US&IR=T&IR=T

capabilities (see review by Jitpaiboon, Gu, and Truong 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 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 to 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 in order 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 in order 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.

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Appendix A

Construct	Item	Code	Definition	Survey items based on

In the last 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: 139)	(Cao and Zhang 2011; Cao et al. 2010; Angeles and Nath 2001; Li, Ragu-Nathan, et al. 2006; Simatupang and Sridharan 2005; Vijayasarathy and Robey 1997; Zhou and Benton 2007; Zhou, Shou, et al. 2014; Li et al. 2005)
	exchange timely information	IS2		
	exchange accurate information	IS3		
	exchange complete information	IS4		
	exchange confidential information	IS5		
In the last 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)	CCPQ1	"[A] manufacturer's capability to consistently achieve conformance to specifications, fitness for use" (Kristal, Huang, and Roth 2010: 426)	(Miller and Roth 1994; Rosenzweig, Roth, and Dean 2003; Kristal, Huang, and Roth 2010; Ward et al.
	higher product durability (i.e., the amount of time or use before the product breaks down and replacement is preferred to continued repair)	CCPQ2*		
	higher product conformance quality (i.e., the degree to which a product meets established design standards)	CCPQ3		
	higher product reliability (i.e., the probability of a product malfunctioning or failing within a specified time period)	CCPQ4		
	a reduction in number of defectives/recalls	CCPQ5		
	reduced production costs	CP1*	"[A] manufacturer's capability to compete on cost" (Kristal, Huang,	
	reduced costs by increasing productivity	CP2		

Low cost			and Roth 2010): 426)	1998; Graham and Potter 2015)
	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 last 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: 145)	(Wu et al. 2006; Fullerton, McWatters, and Fawson 2003; Frohlich and Westbrook 2001; Berk and DeMarzo 2013; Randall and Farris 2009; Tan et al. 1999)
	cash flow margin (operating 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, Daugherty, and Keller 2000; Kim 2009; Stank, Keller, and Daugherty 2001)
How long, in total years, has your firm been conducting business with your selected key supply chain partner?	<1 year	LPH1		(Wu, Chuang, and Hsu 2014)
	1-5 years	LPH2		
	5-10 years	LPH3		
	10-20 years	LPH4		
	>20 years	LPH5		