

# Documentos de Trabajo 57

---

## Customer Integration, Information Quality and Operational Performance: A Social Capital View

Roberto Chavez  
*Universidad Diego Portales*

Cristina Gimenez  
*ESADE*

Wantao Yu  
*University of East Anglia*

Brian Fynes  
*University College-Dublin*

Frank Weingarten  
*ESADE*

*Septiembre 2014*

---

# **Customer integration, information quality and operational performance: A social capital view**

Roberto Chavez\*

Facultad de Economía y Empresa, Universidad Diego Portales  
Santiago, Chile  
roberto.chavez@udp.cl

Cristina Gimenez

Operations and Innovation Management  
ESADE School of Business, Ramon Llull University  
Barcelona, Spain  
cristina.gimenez@esade.edu

Wantao Yu

Norwich Business School  
University of East Anglia  
London, UK  
wantao.yu@uea.ac.uk

Brian Fynes

Smurfit Graduate School of Business  
University College Dublin  
Dublin, Ireland  
brian.fynes@ucd.ie

Frank Wiengarten

Operations and Innovation Management  
ESADE School of Business, Ramon Llull University  
Barcelona, Spain  
frank.wiengarten@ucd.ie

\*Corresponding author

**Abstract:**

Much supply chain integration literature tends to be biased towards its positive impact on operational performance. However, inconclusive results demand investigation of the mechanisms through which supply chain integration can lead to superior operational performance. We propose information quality as such mechanism. The purpose of this study is to identify empirically the mediating role of information quality on the relationship between customer integration and operational performance, and the direct relationship between customer integration and operational performance. The study is based on a questionnaire sent to 228 manufacturing companies in the Republic of Ireland, and the relationships between the constructs are analysed through regression analysis. The results indicate that information quality partially mediates the relationship between customer integration and quality, delivery and flexibility. Further, information quality was found to fully mediate the relationship between customer integration and cost. For practitioners, when the objective is to improve quality, delivery and flexibility, manager should be aware that information quality alone might not be very effective. Instead, information quality should be complemented by customer integration efforts. When the objective is to improve cost, managers can enjoy cost advantage via their capability to obtain and exchange information quality.

Keywords: Customer integration, Information quality, Operational performance

## 1. Introduction

Supply chain (SC) integration is a fundamental principle of supply chain management (SCM), and represents a departure from traditional functional business processes to integrated structures of processes (Childehouse and Towill 2011). While the SC integration literature describes various integration characterizations and dimensions (e.g. Narasimhan and Das 2001, Cagliano *et al.* 2006, Patnayakuni *et al.* 2006, Van der Vaart and Van Donk 2008), customer integration emerges as a critical integration competency (Lambert and Cooper 2000, Christopher 1992). Customer integration refers to the collaboration and information sharing practices, between a focal firm and its critical customers, in order to become more responsive to customer needs and requirements (Vickery *et al.* 2003, Swink *et al.* 2007, Wong *et al.*, 2011). It has been suggested that the literature on SC integration tends to be biased towards its positive impact on operational performance; however inconclusive results (e.g. Ettlíe and Reza 1992, Swink *et al.* 2007, Devaraj *et al.* 2007) demand investigation of the mechanisms through which integration can lead to improved performance (Turkulainen and Ketokivi 2012).

Information quality has been implicitly proposed by the literature as such mechanism; which can largely determine the success of the integration effort (Malhotra *et al.* 2005). Information quality refers to information richness, rather than the amount, and thus it emphasizes the quality and nature of information shared between buyers and suppliers (Koka and Prescott 2002, Zhou and Benton 2007). Despite this, studies that address the mediating role of information quality on the SC integration literature are mostly exploratory (e.g. Vermeer 2000, Malhotra *et al.* 2005, Legner and Schemm 2008, Bailey and Francis 2008). On the empirical front, studies that investigate the mediating role of information quality on the SC integration - operational performance link are rather scarce and have produced mixed results (e.g. Cousins and Menguc 2006, Gulati and Sych 2007). For instance, while Cousins and Menguc (2006) did find support for supplier's communication performance mediating the relationship between SC integration and operational performance, Gulati and Sych (2007) did not find sufficient evidence to support the mediating role of information quality for the relationship between buyer-

supplier joint dependence and operational performance. This mixed support has been attributed to operational performance being often measured as an aggregated construct, which not only disregard the individual performance dimensions but also builds on the assumption that integration has “universal” effects on performance (Turkulainen and Ketokivi 2012). In view of this argument, this present research extends and complements the existing studies by explicitly investigating the mediating role of information quality on the relationship between customer integration, as an important dimension of SC integration, and four key individual dimensions of operational performance (Chen and Paulraj 2004), namely quality, delivery, flexibility and cost.

We have adopted social capital theory to explain the mediating role of information quality. Social capital has been regarded as the “relational glue” between suppliers and manufacturers, and thus the underling component that facilitates collaboration between trading partners in the SC (McGrath and Sparks 2005). Social capital theory posits that social structures constitute a valuable asset, which enables social actors to generate and exchange social resources (Nahapiet and Ghoshal 1988, Koka and Prescott 2002). Furthermore, like any other form of capital, social capital creates value, and thus it makes possible the achievement of benefits (Coleman 1988). Based on the social capital view, we expect that the dense interaction between buyers and suppliers (through customer integration) will enable firms to generate and exchange valuable and relevant information with one another (Koka and Prescott 2002, Inkpen and Tsang, 2005). This process will generate in turn an understanding of the parties’ mutual needs, and the necessary adjustments to improve performance (Cousins *et al.* 2006, Cousins and Menguc 2006).

In view of the previous argument, this research adds to the body of knowledge on SC integration, operational performance and social capital theory by addressing two research questions: (1) To what extent is the relationship between customer integration and operational performance mediated by information quality, and (2) To what extent does customer integration associate with operational performance. The answer to these questions will contribute to supplement previous studies by explaining why customer integration promotes operational performance. Further, through disaggregating

operational performance into its individual components, this paper will be able to identify the potentially different effects of customer integration, and thus elaborate more on inconclusive empirical results. This will potentially illuminate the “black box” of the relationship between SC integration efforts and performance (Gulati and Sych 2007). Furthermore, our study contributes to the building of social capital theory in the SCM context since there is little research that draws on this view in the area (Cousins *et al.* 2006). Finally, this paper is also important for practitioners to understand the mechanisms (i.e. information quality) that can make their integration efforts more effective for the operational performance measures that they choose to compete.

The remainder of this paper is organized as follows. First, a brief literature survey on concepts relevant to this study is provided, and research hypotheses developed. Second, study design and methodological procedures are described. Third, the findings of the study are presented and discussed, and a set of managerial implications are drawn. Lastly, we conclude with a summary of findings and conclusions along with the main limitations and scope for future research.

## **2. Theoretical background and hypotheses development**

### *2.1 Social capital theory and SCM*

The central position of social capital theory suggests that social structures constitute a valuable asset in themselves, which in turn facilitate the creation of “collectivity-owned” social assets (Nahapiet and Ghoshal 1988, Koka and Prescott 2002). Social capital thus not only refers to the social structures or networks that enable actions between social actors (e.g. individual persons or groups), but also to the resources or social assets that can be generated through the interaction between those actors (Nahapiet and Ghoshal 1998, Inkpen and Tsang 2005). Based on social structures and social assets, the literature describes various characterizations of social capital. For instance, Coleman (1988) describes three dimensions of social capital: trustworthiness, information sharing and relational norms and sanctions. Nahapiet and Ghoshal (1998) propose three forms of social capital: cognitive capital (resources that provide parties with shared

representations, i.e., type of language), structural capital (social capital that results from relationship network configuration, i.e., information sharing) and relational capital (e.g. social capital that emerges from relationships that develop through time, i.e., trust and norms). Koka and Prescott (2002) decided to differentiate between social structures and social assets, arguing that the literature has often confused social assets with social structures. Specifically, Koka and Prescott (2002) argued that social structures such as buyer-supplier relationships or strategic alliances enable firms to exchange social assets such as information richness, which emphasizes the quality and nature of information. This latter view is also shared by various studies that suggest that firms in close relationships are more likely to obtain richer information since the parties involved perceive more cooperation and mutual benefit in the relationship (e.g. Daft and Lengel 1986, Nonaka 1994, Uzzi 1997, Hansen 1999, Koka and Prescott 2002, Hult *et al.* 2004, Inkpen and Tsang, 2005).

In addition to social structures and social assets, the literature has also conceptualized social capital using a broader view, which includes the expected benefits resulting from the social actors leveraging their relationships. According to Coleman (1988), like any other form of capital, social capital creates value, and thus it makes possible the achievement of benefits. In other words, social actors who decide to invest in social structures obtain benefits through the process derived from both social structures and social assets (Autry and Griffit 2008). This broader view of social capital has been applied recently to the context of SCM since buyer-supplier relationships refer essentially to relationships between social actors who ultimately leverage their relationships to improve performance (Koka and Prescott 2002, Autry and Griffit 2008). For instance, Cousins *et al.* (2006) and Cousins and Menguc (2006) examined the association between the socialization process on the creation of relational capital between buyers and suppliers, which, in turn, can lead to improved supplier performance. Studies have also incorporated the structural and cognitive aspects of social capital, and investigated their association with buyer and supplier performance (e.g. Krause *et al.* 2007, Lawson *et al.* 2008, Carey *et al.* 2011, Villena *et al.* 2011).

Our study adopts this broader view of social capital and represents social structures by buyer-supplier relationship (Autry and Griffit 2008, Min *et al.* 2008) in the form of customer integration, which enable firms to generate and exchange social assets such as information quality (Koka and Prescott 2002, Inkpen and Tsang 2005) and, through that process, to achieve important benefits (Autry and Griffis 2008) in the form of operational performance.

## *2.2 Customer integration and information quality*

It has been suggested that value cannot be created only within the boundaries of single organizations, but also between organizations (Porter 1985). This argument became more evident as increased levels of global competition and new manufacturing strategies demanded a more integrative approach of the supply activity (Cousins and Menguc 2006). Capturing effectively this market's new competitive paradigm, SC integration refers to the fundamental shift away from managing individual functional processes, to managing integrated processes in the SC (Power 2005).

The literature on SC integration is extensive and provides various dimensions such as horizontal integration (the task of unifying functions and processes inside the company), vertical integration (the unifying control of functions and processes across companies) (Porter 1985), internal integration (integration activities performed within single organizations) and external integration (integration activities performed by suppliers and customers across the supply chain) (Rosenzweig *et al.* 2003).

Another characterization of SC integration suggests two major interrelated forms: forward and backward integration (Frohlich and Westbrook 2001, Cagliano *et al.* 2006, Patnayakuni *et al.* 2006). Forward integration involves integrating the forward physical flow of delivery schedules, capacity and product information from suppliers and customers. Backward integration is instead aimed at the backward integration of information (through information technology), and the flow of information such as customer orders and demand forecasts from customers to suppliers. A further

classification of integration involves the intent of integration, which ranges from arm's length relationships to more strategic and collaborative activities (Swink *et al.* 2007). Furthermore, some authors have described SC integration at multiple levels: customer integration, information sharing, logistics and distribution integration, supplier integration, and purchasing integration (Narasimhan and Das 2001, Romano, 2003, Power 2005, Van der Vaart and Van Donk 2008, Childehouse and Towill 2011).

It emerges from the literature though, that customer integration is often seen as a necessity and a critical competency for successful integration efforts (Lambert and Cooper 2000, Closs and Savitskie 2003, Tracey *et al.* 2005). Traditionally, competitive advantage in companies has been the result of cost reduction strategies; however, today's competitive environment demands a more 'customer-driven' approach, which integrates the customer as a fundamental part of the SC (Monczka and Morgan 1997, Bowersox *et al.* 2000, McAdam and McCormack 2001).

Customer integration is commonly associated with collaboration activities such as frequent customer contact and the evaluation of customer satisfaction and customer future expectations (Swink *et al.* 2007). According to Vickery *et al.* (2003), manufacturing plants use customer integration practices to assimilate and incorporate customer preferences and needs, and then become more responsive. All this is achieved through communication not only to understand customer's preferences but also to build long-term relationships (Swink *et al.* 2007, Wong *et al.* 2011). Accordingly, just like the broader concept of SC integration, customer integration refers to more than managing individual functional processes, and it is defined as the collaboration and information sharing practices, between a focal firm and its critical customers, in order to become more responsive to customer needs and requirements (Vickery *et al.* 2003, Swink *et al.* 2007, Wong *et al.* 2011).

Our literature review on customer integration highlights the importance of information sharing for SC integration. It has been suggested that SC collaboration processes always contain some form of information sharing (Wiengarten *et al.* 2010); however, the type of

information can ultimately determine how successful is the integration effort (Manrodt and Davis 1993, Petersen, 2005, Malhotra *et al.* 2005). Similarly, it has been argued that information sharing has different functions in the SC, and is not simply sharing information but when, how and with whom it is shared, which has different effects on the participants (Holmberg 2000).

The concept of information sharing has two broad aspects: quantity and quality, which are differentiated in the literature (Li *et al.* 2006, Zhou and Benton 2007). While the quantitative aspect of information sharing relates to the amount of information shared, the qualitative aspect refers to the type of information actually shared. Specifically, information quality refers to information richness, rather than the amount, and thus it emphasizes the quality and nature of information shared between a firm and its trading partners (Koka and Prescott 2002, Zhou and Benton 2007). As such, information quality includes aspects such as accuracy, timeliness, completeness, currency, ease to access and compatibility of information (Monczka *et al.* 1998, Moberg *et al.* 2002, Petersen, *et al.* 2005, Zhou and Benton 2007, Haug and Arlbjørn 2011). For instance, timely information refers to information received at the right place, to the right receiver and to the right time, whereas complete information is related to right quantity (Forslund and Jonsson 2007).

As SC relationships move from arm's length to fully integrated, richer information is expected to be shared since there is a mutual feeling that the relationship is beneficial for the parties involved (Moberg *et al.* 2002, Patnayakuni *et al.* 2006). In support of this assertion, there is evidence in the literature that investigates the relationship between forms of SC integration and information quality (e.g. Uzzi 1997, Siemieniuch *et al.* 1998, Yli-Renko *et al.* 2001, Patnayakuni *et al.* 2006, Li and Lin 2006). For instance, conducting case studies in the fashion industry, Uzzi (1997) found that information sharing in collaborative buyer-supplier relationships is more related to tacit information than information that is exchanged in arm's-length relationships (e.g. price and quantity data). Uzzi (1997) explain that close ties act as a platform for fine-grained information transfer, which in turn allow firms to jointly identify and prevent problems. Similarly, conducting a case study for fast-moving consumer goods, Siemieniuch *et al.* (1998)

found that SC collaborative practices resulted in the willingness to share relevant and mutually beneficial information. Yli-Renko *et al.* (2001) found that close interaction between innovative suppliers and their key customers facilitate knowledge acquisition, which considered strategic aspects of information such as customer needs and trends as well as technical know-how. In a study examining the relational antecedents of information flow integration; Patnayakuni *et al.* (2006) found that relational interaction routines (e.g. partner's involvement in quality and improvement initiatives) enabled information flow integration between buyers and suppliers. Although, Patnayakuni *et al.* (2006) did not address specifically the construct of information quality, they conceptualized information flow integration as the extent to which operational, tactical and strategic information is shared, which considered aspects of accuracy and ease to access information. Similarly, investigating the implications of inter-organizational relationships, Li and Lin (2006) found that aspects such as the level of trust and shared vision between buyers and suppliers facilitate the sharing of information quality, which considered aspects such as information timeliness, accuracy, completeness, adequacy and reliability.

The above empirical evidence highlights the association between different forms of SC integration and information quality. However, the literature also examines the association between information quality and operational performance, which will be discussed in the following section.

### *2.3 Information quality and operational performance*

Sharing enriched or quality information has been associated with superior operational performance such as product quality, SC flexibility, customer service and cost improvement (Mason-Jones and Towill 1997). Operational performance refers to the strategic dimensions from which a company chooses to compete (Narasimhan and Das 2001), and which can be achieved with the strategic alignment between manufacturing capabilities/resources and operational performance (Ho *et al.* 2002). There is general agreement in the operations strategy literature that quality, delivery, flexibility and cost

are the core and most often mentioned competitive areas (Ward *et al.* 1998, Narasimhan and Jayaram 1998), and it has been indicated that similar operational performance dimensions can be extended to the area of SCM (Pagell and Krause 2002).

With regard to quality, it was found that information quality, including aspects such as information timeliness, accuracy, adequacy, completeness and credibility, was positively associated with quality improvement (Monczka *et al.* 1998). Monczka *et al.* explain that when suppliers participate actively in new product development (NPD) efforts with customers, timely and credible information often translates into improved product quality. Similarly, investigating the benefits of internal and external communication methods, Carr and Kaynak (2007) showed that aspects such as information detail, frequency and timeliness were positively associated with superior product quality. Using modelling techniques, Sum *et al.* (1995) found that data accuracy was an important determinant of improved product quality among other operational measures. In a study that examined the effect of SCM spanning capabilities, Tracey *et al.* (2005) found that information dissemination (including aspects that reflect information readiness and information relevance) was positively associated with perceived product value and customer loyalty.

With regard to delivery, Monczka *et al.* (1998) explain that NPD requires suppliers to provide credible and timely information in order to reduce delivery measures such as product cycle time. Sum *et al.* (1995) found that sharing accurate data resulted in enhanced customer service such as shorter delivery lead-time and better meeting of delivery promises. Similarly, Boulard *et al.* (1996), Larson and Kulchitsky (2000) and Ahmad and Shroeder (2001) found that sharing timely demand information (through EDI) improved on-time delivery. More recently, Zhou and Benton Jr. (2007) found that information quality, including aspects such as information accuracy, availability, completeness, relevance and accessibility, has a significant and positive effect on delivery performance. Rossin (2007) also found that poor information quality in responsive supply chains resulted in missing product units and delayed orders.

With regard to flexibility, Sum *et al.* (1995) found that data accuracy has a positive impact on the ability to meet changes in volumes and products. Similarly, Gosain *et al.* (2004) found that the transmission of coordination information with little distortion, prioritizing the quality of the information shared, was associated positively with the ability to cope with product changes. This can be exemplified by Dell's effective strategy to improve flexibility. Breen and Aneiro (2004) explain that, despite a major 10-day disruption in American docks, Dell kept improving its speed and flexibility due to the exchange of relevant and strategic information with its key suppliers.

With regard to cost, Rossin (2008) found that, for responsive supply chains, poor information quality resulted in an increase in total costs. Also, in a study of Mexico's manufacturing industry, as one of the preferred production settings for American companies, Fawcett *et al.* (2000) demonstrated that the relevance of the information shared was critical for cost improvement. Examining the relationship between the different forms of information integration and operational performance, Cohen Culp *et al.* (2004) found that sharing relevant information was related to a positive change in profit margin (i.e. unit price less unit costs).

The above research evidence (the positive association between SC integration and information quality, and between information quality and multiple operational performance dimensions) suggests implicitly that information quality may act as a mediating variable. However, studies that have suggested that information quality can have an impact on the benefits gained through SC collaborative efforts are mostly exploratory (e.g. Vermeer 2000, Malhotra *et al.* 2005, Legner and Schemm 2008, Bailey and Francis 2008). For instance, in a case study developed to explore inter-firm collaboration in the UK red meat industry, Bailey and Francis (2008) found that despite the high levels of information sharing, there were still significant information discrepancies between buyers and suppliers. Bailey and Francis (2008) attributed this to information sharing alone not being sufficient, and that there is a need to consider greater alignment and integration between the parties involved. In another case study, Vermeer (2000) argued that poor information quality might be a reason for the increasing number

of negative results reported from information sharing and collaboration efforts. While Vermeer (2000) found initially that information sharing positively impacted on processing time, subsequent prevention and corrective activities in the ordering process due to poor data quality (e.g. wrong net prices and data entry errors) resulted in negative process performance. In another exploratory study, Legner and Shemm (2007) found that poor data quality (e.g. outdated product information) had a negative impact on the benefits of buyers and suppliers who pursue inter-firm integration forms. Conducting 16 case studies with enterprises in the IT industry; Malhotra *et al.* (2005) found that companies involved in collaborative efforts, which show operational efficiency and knowledge creation, were also characterized by advanced inter-firm integrative processes such as the exchange of high quality information.

Although the above studies have significantly furthered our understanding of the importance of information quality for the success of SC integration, their exploratory nature demands further empirical investigation. On the empirical front, research evidence that investigates the mediating role of information quality is relatively scarce and with mixed support in their results (e.g. Cousins and Menguc 2006, Gulati and Sytch 2007). For instance, Gulati and Sytch (2007) did not find sufficient evidence to support the mediating role of information quality on the relationship between buyer-supplier joint dependence and operational performance. Furthermore, Gulati and Sytch (2007) concentrated on a single industry and thus potentially limiting the generalization of their findings. While Cousins and Menguc (2006) found support for the mediation effect of supplier's communication performance (e.g. quality initiatives) on the relationship between SC integration and supplier's operational performance, their study used a composite construct that did not differentiate between information sharing and information quality.

The mixed support in the latter studies can be attributed to operational performance being measured as an aggregated construct. In a recent study, Turkulainen and Ketokivi (2012) suggest that the lack of association between SC integration mechanisms and operational performance can be attributed to operational performance being often measured as an

aggregate construct, which, on the one hand, disregards the individual components of operational performance, and, on the other hand, recognises integration as a “best practice” approach. According to Turkulainen and Ketokivi (2012), the integration concept tends to evoke a positive connotation in the literature; however, there is still empirical evidence that offers inconclusive and, sometimes, contradictory results (e.g. Ettlé and Reza 1992, Swink *et al.* 2007, Devaraj *et al.* 2007), which suggest the need to further investigate the specific mechanisms through which integration leads to superior performance. Accordingly, in view of the above argument and empirical evidence, this present research extends and complements the existing work by explicitly investigating the mediating role of information quality on the relationship between customer integration, as an important dimension of SC integration, and four key individual dimensions of operational performance, namely quality, delivery, flexibility and cost. Therefore, the following hypotheses are stated:

H1: Information quality mediates the relationship between customer integration and (a) quality, (b) delivery, (c), flexibility and (d) cost.

#### *2.4 Customer integration and operational performance*

Our hypotheses proposed the association between customer integration and operational performance being mediated by information quality; however, it has been suggested that customer integration can be directly and positively associated with operational performance. In support of these contentions, empirical studies have found a direct association between customer integration and operational performance (e.g. Frohlich and Westbrook 2001, Vickery *et al.* 2003, Rosenzweig *et al.* 2003, Droge *et al.* 2004, Flynn *et al.* 2010, Wong *et al.* 2011). Nonetheless, some of the above studies used an aggregated measure of integration, which did not differentiate between customer integration and supplier integration (Frohlich and Westbrook 2001, Vickery *et al.* 2003, Rosenzweig *et al.* 2003, Droge *et al.* 2004) and/or measured operational performance as

an aggregated construct (Frohlich and Westbrook 2001, Devaraj *et al.* 2007). As an exception, Wong *et al.* (2011) investigated and found support for the positive association between customer integration and multiple operational performance measures, namely quality, delivery, flexibility and cost; however, they focused on a single industry, which can potentially decrease the generalizability of their results.

This paper aims to contribute to the literature by considering a partial mediation effect. This relationship is consistent with the expectation of the social capital view since the literature, which suggests that social actors who decide to invest in social structures obtain benefits through the process derived from both social structures and social assets (Autry and Griffit, 2008). This means that although customer integration leads to better information quality, which in turn leads to better operational performance, based on the results of Flynn *et al.* (2010) and Wong *et al.* (2011), customer integration (i.e. frequent interactions and information sharing) can also lead to a better operational performance. For instance, Flynn *et al.* (2010) argue that customer integration, through collaborative attitudes and mutual problem solving, can result in cost and customer service improvement. Furthermore, customer integration promotes the coordination of tasks and joint identification of problems, which not only reduce waste (Swink *et al.* 2007) and facilitate cost and inventory reduction, but also helps to identify and solve quality problems (Wong *et al.* 2011). Therefore, the following hypotheses are stated:

H2: Customer integration is positively associated with (a) quality, (b) delivery, (c) flexibility and (d) cost.

### **3. Research methodology**

#### *3.1 Sampling and data collection*

A postal questionnaire was used to collect the data using a mailing list obtained from Kompass Ireland (one of Ireland's most accurate and up-to-date business data providers). The main population from which our sample was selected were the top 2.500 Irish companies in terms of turnover, profitability and size. However, as the practices

incorporated in the questionnaire were related to manufacturing activities, only manufacturing companies were considered. A total of 705 manufacturing companies were selected out of which 655 were contacted and subsequently sent a copy of the questionnaire (some companies have gone into liquidation or were manufacturing abroad). The main reasons for focusing on the Republic of Ireland are threefold. Firstly, the Republic of Ireland is considered a small but open and trade-dependent economy, which has changed rapidly from being an agriculture-dependent economy to having one of the highest GDPs per capita in Europe (Euro Info Centre 2007). Secondly, there has been a growing trend to outsource activities, mainly labour intensive activities to lower cost Eastern European countries and Asia due to Ireland's high labour costs (Huber and Sweeney 2007). This makes the effective use of the SC a key issue to business success in the Republic of Ireland. Finally, the current economic crisis requires a more effective and efficient use of resources, which justifies the strategic role of SCM in securing savings.

Only knowledgeable individuals holding relevant managerial roles were chosen as the key respondents in our study (Malhotra and Grover 1998). In order to increase the response rate, respondents were contacted personally to obtain their consent to participate in the survey (Dillman 2000, Ward *et al.* 1998). Furthermore, a benchmark score of each company's practices relative to their industry sector was offered as an incentive. After three follow-up contacts, a total of 236 questionnaires were received and 228 were usable. This results in a response rate of 36 percent, which can be regarded as satisfactory in this type of survey-based studies (Malhotra and Grover 1998, Frohlich 2002). As the demographics of our sample show in Table 1, the majority of responses were from production managers (32.6%), operations managers (25%), SC managers (18.4%) and general managers (17%). Further, our sample covers key manufacturing sectors in the Republic of Ireland such as the manufacturing of food (16.8%), machinery (12.8%), pharmaceuticals (12%), electronics (10.2%) and medical devices (9.7%), which can be regarded as a fair representation of manufacturing in Ireland. It has been suggested that the manufacturing of food has been dominant in Irish manufacturing but manufacturing activities have moved towards other industries such as pharmaceuticals, which virtually did not exist 30 years ago (Ruane and Gorg 1997).

-----Table 1-----

### 3.2 Non-response bias and common-method bias

If respondents differ substantially from individuals who do not respond, then responses cannot be generalized to the population (Miller and Smith 1983). However, Armstrong and Overton (1977) explain that people responding in later waves can be assumed to be more similar to people who do not respond at all due to the extra stimulus used by the researcher to encourage completion of surveys. Five items used in the questionnaire were randomly selected to compare the first twenty and last twenty returned questionnaires using the chi-square test. All the significance values of the selected items were above 0.01, which suggests an absence of non-response bias. Since the data were collected from single respondents the potential for common-method bias was assessed. In order to identify the potential effects of common-method bias, the literature suggests the use of statistical techniques such as Harman's single-factor through exploratory factor analysis (EFA) (Podsakoff *et al.* 2003, Boyer and Hult 2005). To conclude that common method bias is present either (a) a single factor will emerge from loading all variables into an EFA, or (b) one general factor will account for the majority of the covariance among measures (Podsakoff *et al.* 2003). The results of the EFA revealed six distinct factors and that the first factor explained 28.5 % of variance, which does not represent the majority of the total variance. To further assess common method bias, confirmatory factor analysis (CFA) was applied to Harman's single-factor model (Podsakoff *et al.* 2003, Flynn *et al.* 2010). After conducting CFA, the model fit indices were poor ( $\chi^2/df$  (1109/209) = 5.30, CFI = 0.82, NNFI = 0.80 and RMSEA = 0.14) and significantly worse than those of the measurement model ( $\chi^2/df$  (392/215) = 1.82, CFI = 0.96, NNFI = 0.95 and RMSEA = 0.06). This suggests that a single factor model is not acceptable and that common method bias is unlikely.

### 3.3 Validation and measurement scales

The validation process for the survey instruments was completed in three steps: content validity, construct validity and reliability (O'Leary-Kelly and Vokurka 1998, Zhou and Benton Jr. 2007). Firstly, a draft questionnaire was pre-tested with academics and practitioners (executive MBA students holding relevant managerial positions) to determine its content validity. As a result, a number of modifications were proposed to the questionnaire's layout and wording. The modified version of the questionnaire was pilot-tested with the target population to verify its appropriateness for this group. A total of thirty questionnaires were sent to the target audience and ten were returned. Terminology was again adapted to better suit the target population. Apart from these changes, no difficulty in completing the questionnaire was reported. Secondly, construct validity was established through unidimensionality. The implicit condition that a measure should satisfy in order to be considered unidimensional is that the measure must be associated with only one latent variable (O'Leary-Kelly and Vokurka 1998). Unidimensionality was established through the use of EFA with principal axis factoring, varimax rotation and extracting factors with eigenvalues greater than 1.0 (Tabachnick and Fidell 2001). A Kaiser-Meyer-Olkin (KMO) statistic of 0.858 confirmed the suitability of the items for factor analysis since KMO values greater than 0.60 can be considered as adequate for applying factor analysis (Hair *et al.*, 2006). Thirdly, in order to estimate reliability, the Cronbach's alpha coefficient was used, as it is a common method for assessing reliability in the empirical literature (Carmines and Zeller 1979). Table 2 shows factor loadings and reliability of customer integration, information quality and operational performance. Comments are offered on these results in the following paragraphs.

-----Table 2-----

*Customer integration* was measured using a five-item scale, based on those developed by Swink *et al.* (2007) and Li *et al.* (2006). The scale included questions on customer interaction, information sharing and the evaluation of customer satisfaction and expectation. *Information quality* was measured with scales based on Li *et al.* (2006) and Zhou and Benton (2007), and included five questions on information accuracy,

completeness, adequacy, reliability and relevancy. For the above scales items, respondents were asked to evaluate the extent to which they agree or disagree with respect to their business using a five-point Likert scale (being 1=strongly agree and 5=strongly disagree). *Operational performance* was measured by scales developed by Ward *et al.* (1998), who focused primarily on a production line as the unit of analysis, and thus on internal operational performance measures to develop their scales. We included scales addressing four internal operational performance dimensions: quality, delivery, flexibility and cost. For the latter scales, respondents were asked to evaluate how their firm compares to their major industrial competitor using a five-point Likert scale (being 1=superior and 5=poor or low end of the industry). Some items displayed low factor loadings, which were not considered for further analysis to ensure the quality of the measures. Based on the EFA, factor loadings for all items ranged from 0.463 (customer integration) to 0.832 (cost) (see Table 2), which are above the commonly used cut-off value of 0.40 (Nunnally 1978). The eigenvalues for the six factors are above 1.133 and the cumulative explained variance is 63.413%. Taken together this provides evidence for the validity of our constructs. In relation to reliability, all the scales show alpha values above or marginally below 0.7, which indicates high levels of reliability (Nunnally 1978).

This study includes industry type as control variable. Research has suggested that firms in some industries are more likely to obtain better performance from the implementation of certain SCM practices (e.g. Meijboom *et al.* 2005), and thus we decided to include four dummy variables to control for the impact of different industries: food, pharmaceuticals, machinery and electronics.

#### **4. Results**

Ordinary least square (OLS) analysis was used to formally test our hypotheses. Prior to carrying out the regression analysis, the data was tested for linearity and multicollinearity. Firstly, linearity and equality of variables were assessed and confirmed through plotting the standardized residuals against the standardized predicted values (Field 2009). Secondly, to test whether multicollinearity is present between the

independent variables, the correlation coefficients were calculated. To indicate an absence of multicollinearity, a common cut-off value of 0.70 has been suggested (Anderson *et al.* 2002). Table 3 shows that the correlation coefficients between our independent variables are below this level. Furthermore, multicollinearity can be also concluded if the maximum variance inflation factor (VIF) exceeds ten as the common threshold (O'Brien 2007). All variables in the model were consistently within this value (Max VIF = 1.314 in Table 4), which indicates and absence of multicollinearity.

-----Table 3-----

To test whether information quality mediates the relationship between customer integration and operational performance (quality, delivery, flexibility and cost), and the direct relationship between customer integration and operational performance, three steps were carried out following the approach adopted by Carey *et al.* (2011). In the first step, our control variables and the predictor variable (customer integration) were regressed against the mediator variable (information quality). In the second step, the predictor variable was regressed against each dependent variable (quality, delivery, flexibility and cost). Finally, in the third step, we regressed the dependent variables on both the mediator and predictor variables. All these effects must be significant in order to indicate a mediation effect, with the significance of each association between the predictor and outcome variables reduced by adding the mediator variable (Baron and Kenny 1986). Table 4 presents the results of the OLS regression analyses.

-----Table 4-----

The first step of the analysis indicates that customer integration is positively associated with information quality ( $\beta = 0.476$ ,  $p \leq 0.001$ ). Next, the results of the second step of the analysis reveal that customer integration is positively associated with quality ( $\beta = 0.336$ ,  $p \leq 0.001$ ), delivery ( $\beta = 0.313$ ,  $p \leq 0.001$ ), flexibility ( $\beta = 0.320$ ,  $p \leq 0.001$ ) and cost ( $\beta = 0.217$ ,  $p \leq 0.001$ ), which established that there was an effect to be mediated in each of the four models, and thus satisfying step two of the mediation test. With regard to the mediation effect in the third step, the quality model shows that, upon the inclusion of

information quality ( $\beta = 0.120$ ,  $p \leq 0.05$ ), customer integration continued to be significantly related to quality ( $\beta = 0.279$ ,  $p \leq 0.001$ ), providing evidence of partial mediation and thus partial support for H1a, and full support for the direct relationship between customer integration and quality (H2a). With regard to the delivery model, the association between customer integration and delivery continued to be significant ( $\beta = 0.237$ ,  $p \leq 0.001$ ) once the mediator was included ( $\beta = 0.159$ ,  $p \leq 0.05$ ), which indicates partial support for H1b but full support for H2b. Upon the inclusion of information quality ( $\beta = 0.150$ ,  $p \leq 0.05$ ), the flexibility model shows that the association between customer integration and flexibility continued to be significant ( $\beta = 0.248$ ,  $p \leq 0.001$ ), which indicates that information quality partially mediates the relationship between customer integration and flexibility (partial support for H1c and full support H2c). The cost model provides evidence of full mediation of information quality for the relationship between customer integration and cost (H1d), since the association between customer integration and cost became non-significant ( $\beta = 0.052$ , ns) by adding information quality ( $\beta = 0.348$ ,  $p \leq 0.001$ ). However, the lack of association between customer integration and cost indicates that H2d is not supported.

As an additional test for mediation, it has been suggested that Sobel test is superior in terms of power and intuitive appeal (Mackinnon *et al.* 2002). Using the interactive tool provided by Preacher and Leonardelli (2003), the Sobel test lends additional support for the mediated relationships hypothesized through a change in significance of the indirect effect. Specifically, we found support for information quality fully mediating the association between customer integration and cost ( $t = 4.559$ ,  $p \leq 0.001$ ), and partially mediating the relationships between customer integration and quality ( $t = 3.513$ ,  $p \leq 0.001$ ), delivery ( $t = 3.724$ ,  $p \leq 0.001$ ) and flexibility ( $t = 3.630$ ,  $p \leq 0.001$ ). We discuss these results in the discussion section next.

## **5. Discussion**

The main objectives of this study were to identify empirically the mediating role of information quality on the relationship between customer integration and operational performance (quality, delivery, flexibility and cost), and the direct relationship between customer integration and operational performance. While partial support was found for some of the hypothesized relationships, our findings provide valuable insights into how customer integration and information quality can enable multiple operational performance improvement. The significance of these contributions will be discussed in the following paragraphs.

### *5.1 Theoretical implications*

Empirical evidence that investigates the mediating role of information quality on the relationship between SC integration and operational performance is not only scarce but has also produced mixed results (e.g. Cousins and Menguc 2006, Gulati and Sytch 2007). This mixed support in the SC integration literature has been attributed to operational performance being often measured as an aggregated construct (Turkulainen and Ketokivi 2012). Our study extends the existing work by means of incorporating a disaggregated measure of operational performance, and thus identifying the potentially different mediating effects of information quality on the relationship between customer integration, as an important SC integration dimension, and multiple operational performance measures, namely quality, delivery, flexibility and cost.

Our results suggest that when customer integration practices, for example, frequent interaction with customers, are employed, quality, delivery and flexibility improvement can be achieved (independently of information quality). With regard to quality improvement, the above findings corroborate the traditional view that well-established customer relationships (e.g. customer feedback and the determination of current and emerging customer requirements and expectations) provide an input to quality (e.g. Schonberger 1995, Lengnick-Hall 1996, Samson and Terziovski 1999). With regard to delivery, our findings reinforce the notion that companies who integrate customers in their operations are more able to identify and eliminate activities that add no value, and

therefore improve delivery (e.g. Frohlich and Westbrook 2001, Rosenzweig *et al.* 2003). With regard to flexibility, our findings support the argument that flexible operations require high interdependence between customers and suppliers, and thus reinforces the view that in order to react successfully to change, companies need to be aware of their customers' views and needs (e.g. Ettl and Reza 1992, Rosenzweig *et al.* 2003). Our results are also consistent with the recent work of Wong *et al.* (2011), who have found in an integrated model that customer integration is consistently associated with quality, delivery and flexibility.

In addition to the above verification, perhaps the most important contribution of this study is the partial mediation effect of information quality (partial support to H1a, H1b and H1c). What can be inferred from this finding is that, when organizations want to pursue quality, delivery and flexibility, information quality alone is less effective in realizing these objectives. Instead, organizations will need to complement information quality with other integration resources, namely customer integration. This finding supports the exploratory work of Bailey and Francis (2008), who found that information transparency is not sufficient since demand distortion still existed, and that there is a need to consider greater alignment and integration between the parties involved (e.g. strong inter-firm relationships and socio-technical factors). We also support the exploratory work of Vermeer (2000), who found that, even when information is exactly what the user wants, there might still be problems due to information misinterpretation (the quality of the information may not be 100 %). In order to mitigate this effect, Vermeer (2000) suggests that the context of both, senders and receivers, need to be better aligned and integrated when discrepancies in the information occur.

An alternative explanation to the, apparently, lower relevance of information quality in its own right, especially for delivery and flexibility performance lies in the excess of information. For instance, Mendelson (2000) suggests that information overload can cause difficult decision-making, especially in information-rich environments. Another interpretation suggests that information quality may deteriorate in time, and thus its benefits will not increase proportionately once a threshold is reached (Sum *et al.* 1995).

In other words, significant changes in information quality beyond a certain limit will not make a major difference in terms of performance.

Overall, this finding (the partial mediation effect of information quality in the customer integration - performance relationship) is important in providing a better understanding of the relationship between information quality and operational performance in the sense that information that is relevant, accurate and timely may not be enough. Only when companies emphasize the relevance of the information to be shared (information quality) and use integration processes, as a platform to share relevant information, can firms achieve performance improvement in terms of quality, deliver and flexibility.

Another significant contribution of this research is the full mediation effect of information quality on the relationship between customer integration and cost (H1d). In other words, information quality is the means by which customer integration is translated into cost improvement. Customer integration efforts are not enough to materialize cost superiority. Instead, customer integration makes parties more open to communication (less inclined to withhold critical information), which not only enhances information exchange but also the exchange of relevant and fined-grained information. This in turn enables firms to process information more effectively, as opposed to deal with irrelevant information, providing unique advantages that have an impact on performance improvement (Gulaty and Sytch 2007). This finding supports the exploratory work of Legner and Shemm (2007), who found that, despite the existence of integration efforts, prevention and corrective activities due to poor data quality (e.g. wrong and outdated product information) resulted in a negative impact on the benefits of buyers and suppliers pursuing tighter integration.

The main implication of the full mediation effect for the customer integration-cost relationship is that, from the supplier's perspective, only through information quality, customer integration may be desirable for cost improvement. Furthermore, this finding supports the social capital view, which suggests that social structures create and facilitate the exchange of social assets, which in turn translate into positive returns (Koka and

Prescott 2002). According to Autry and Griffit (2008), social capital theory has a lot of potential to explain SCM phenomena since a SC is essentially a link between firms leveraging their relationships to improve performance. Accordingly, this research adds to the growing number of studies that build on social capital theory in the context of SCM by demonstrating that dense interaction between buyers and suppliers, through customer integration, can increase the richness of the information exchange since the parties perceive more cooperation and mutual benefit in the relationship. These social processes in turn create an understanding of the parties' mutual needs and the necessary adjustments, which will finally translate into positive benefits.

### *5.2 Managerial implications*

Our study has also important managerial contributions. Our research has demonstrated that both customer integration and information quality can be associated with operational performance improvement. According to Moberg *et al.* (2002), while information exchange is an important aspect of the overall integration concept, more research is needed that isolates communication processes from other factors that define integration. In doing so, managers can be given more detailed recommendations not only on how independent integration aspects interact with one another but also on how they impact on performance. More specifically, our findings show that when the objective is to improve quality, delivery and flexibility, sharing information quality alone may not be very beneficial. Instead, information quality should be complemented by customer integration efforts. However, when the objective is cost, sharing quality information will generate the means by which customer integration is translated into cost superiority. In other words, managers that are willing to invest in integration efforts with their key customers can enjoy expected cost advantage, via their capability to obtain and exchange relevant information. For instance, many managers mistakenly concentrate on integration investments such as EDI with customers; however, results demonstrate that only through the sharing of appropriate and relevant information is that firms achieve performance improvement (Zhou and Benton 2007).

## 6. Conclusion

While reach on SC integration is voluminous, empirical results are sometimes inconclusive. Accordingly, research on integration should concentrate on both empirically demonstrate how exactly integration produces higher performance, and which aspects of performance in particular are improved (Turkulainen and Ketokivi 2012). We believe we have addressed both issues in our study. Firstly, our study contributes positively to theory by strongly suggesting the value of information quality for the success of customer integration. Secondly, our research also implies that the effect of integration mechanisms depend on which dimension of operational performance is being considered. Furthermore, our study expands the social capital perspective in SCM by explaining how enhanced information exchange complements SC integration to improve performance.

While this study contributes to theory and practice, there are certain limitations that should be considered. In this study, we focused on the scope of the information shared and the quality of the information shared. However, there are some studies that considered IT as a third aspect of information sharing (e.g. Zhou and Benton Jr. 2007). Future research may consider the latter aspect for testing a wider perspective of information sharing. Also, we focused on the sharing of strategic information rather than operational information such as production or inventory-holding information. According to Patnayakuni *et al.* (2006), sharing strategic information not only allows buyers and suppliers to develop common forecasts, synchronise production, and coordinate inventory stocking, but also creates synergies that go beyond the sharing of operational information. Nevertheless, future research may also consider operational information for testing a wider perspective of information sharing.

Another important limitation is that the data consisted of responses from single key informants, which may cause common-method bias. Future research is called to target multiple respondents for more accurate results. Based on conceptual and empirical evidence, this study implies that higher levels of customer integration enable information quality. However, since the research methodology of this study is cross-sectional, it ignores the possible recursive relationship. It could be possible that improved information quality enables customer integration. As an extension and alternative to our research design, a longitudinal design can establish causal patterns (Blumberg *et al.* 2005). Although causation could not be claimed in this study, future research should consider a longitudinal design. Furthermore, it has been suggested that instead of a single research design, multiple research techniques may be required to have a holistic understanding of the operations management and SCM phenomena (Burgess *et al.* 2006, Boyer and Swink 2008). Again future research should seek to utilize multiple methods to examine a broader perspective of the field.

## References

- Ahmad, S. and Schroeder, R., 2001. The Impact of electronic data interchange on delivery performance. *Production and Operations Management*, 10 (1), 16-30.
- Anderson, D.R., Sweeney, D.J. and Williams, T.A., 2002. *Statistics for business and economics*. Cincinnati, OH: South-Western: Thomson Learning Publishing Company.
- Armstrong, J.S. and Overton, T.S., 1977. Estimating non-response bias in mail Surveys. *Journal of Marketing Research*, 14 (3), 396-402.
- Autry, C. W. and S.E. Griffis, 2008. "Supply chain capital: the impact of structural and relational linkages on firm execution and innovation", *Journal of Business Logistics*, Vol. 28, No. 1, pp. 157-173.
- Bailey, K. and Francis, M., 2008. Managing information flows for improved value chain performance. *International Journal of Production Economics*, 11 (1), 2-12.
- Baron, R.M. and Kenny, D.A., 1986. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51 (6), 1173-1182.

Blumberg, B., Cooper, D.R. and Schindler, P.S., 2005. *Business research methods*. Berkshire, UK: McGraw-Hill Education.

Boulard, K. E., Powell, S. G. and Pyke, David. F., 1996. Exploiting timely demand information to reduce inventories. *European Journal of Operations Research*, 92 (5), 239-253.

Bowersox, D.J., Closs, D.J. and Stank, T.P., 2000. Ten mega-trends that will revolutionize supply chain logistics. *Journal of Business Logistics*, 21 (2), 1-16.

Boyer, K. K. and Hult G. T., 2005. Extending the supply chain: integrating operations and marketing in the online grocery industry. *Journal of Operations Management*, 23(6), 642-661.

Boyer, K.K. and Swink, M. L., 2008. Empirical elephants--why multiple methods are essential to quality research in operations and supply chain management. *Journal of Operations Management*, 26 (3), 338-344.

Breen, B. and Aneiro, M., 2004. Living in Dell time, *Fast Company*, 88 (11), 86-96.

Burgess, K. Singh, P. and Koroglu, R., 2006. Supply chain management: a structured literature review and implications for future research. *International Journal of Operations and Production Management*, 26 (7), 703-729.

Cagliano, R., Caniato, F. and Spina, G., 2006. The linkage between supply chain integration and manufacturing improvement programmes. *International Journal of Operations and Production Management*, 28 (3), 282-99.

Carey, S., Lawson, B., Krause, D.R., 2011. Social capital configuration, legal bonds and performance in buyer–supplier relationships. *Journal of Operations Management*, 29 (4), 277–288.

Carmines, E. and Zeller, R., 1979. *Reliability and validity assessment*. California: SAGE Publications University Papers.

Carr, A. and Kaynak, H., 2007. Communication methods, information sharing, supplier development and performance: an empirical study of their relationships. *International Journal of Operations and Production Management*, 27 (4), 346-370.

Chen, I. J., Paulraj, A. and Lado, A., 2004. Strategic purchasing, supply management and company performance. *Journal of Operations Management*, 22 (5), 505-523.

Childerhouse, P. and Towill, D.R., 2011. Arcs of supply chain integration, *International Journal of Production Research*, 49 (24), 7441-7468.

Christopher, M., 1992. *Logistics and supply chain management*. London: Pitman.

Closs, D.J. and Savitskie, K., 2003. Internal and external logistics information technology integration. *International Journal of Logistics Management*, 14 (1), 63-76.

Coleman, J.S., 1988. Social capital in the creation of human capital. *American Journal of Sociology*, 94, 95-120.

Cousins, P.D. and Menguc, B., 2006. The implications of socialization and integration in supply chain management. *Journal of Operations Management*, 24 (5), 604-620.

Cousins, P.D., Handfield, R.B., Lawson, B., Petersen, K.J., 2006. Creating supply chain relational capital: the impact of formal and informal socialization processes", *Journal of Operations Management*, 24 (6), 851-863.

Daft, R.L. and Lengel, R.H., 1986. Information enrichment: designing the supply chain for competitive design. *Management Science*, 32 (5), 554-571.

Devaraj, S., Krajewski, L. and Wei, J. C., 2007. Impact of eBusiness technologies on operational performance: the role of production information integration in the supply chain. *Journal of Operations Management*, 25 (6), 1199-1216.

Dillman, D., 2000. *Mail and internet surveys: the tailored design method*. 2<sup>nd</sup> Ed New York, NY: John Wiley & Sons.

Droge, C., Jayaram, J., Vickery, S.K., 2004. The effects of internal versus external integration practices on time-based performance and overall firm performance", *Journal of Operations Management*, 22 (6), 557-573.

Ettlie, J. and Reza, E., 1992. Organizational integration and process innovation, *Academy of Management Journal*, 35 (4), 795-827.

Euro Info Centre, London Chamber of Commerce and Industry, 2007. The republic of Ireland: country profile", Euro Info Centre, London Chamber of Commerce and Industry, available at: <http://www.londonchamber.co.uk/docimages/2400.pdf> (accessed 18 October 2012).

Fawcett, S., Calantone, R. and Roath, A., 2000. Meeting quality and cost imperatives in a global market. *International Journal of Physical Distribution and Logistics Management*, 30 (6), 472-499.

Feldmann, M. and Müller, S., 2003. An incentive scheme for true information providing in Supply Chains. *Omega*, 31 (2), 63-73.

Field, A.P., 2009. *Discovering statistics using SPSS for Windows: advanced techniques for the beginner*. London, UK: SAGE publications Ltd.

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*, 28 (1), 58-71.

Forslund, H. and Jonsson, P. 2007, The impact of forecast information quality on supply chain performance. *International Journal of Operations and Production Management*, 27 (1), 90-107.

Frohlich, M. 2002, Techniques for improving response rates in OM survey research. *Journal of Operations Management*, 20 (1), 53-62.

Frohlich, M.T. and Westbrook, R., 2001. Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management*, 19 (2), 185-200.

Gosain, S., 2004. Enterprise information systems as objects and carriers of institutional forces: The new iron cage? *Journal of Association for Information Systems*, 5 (4), 151-182.

Gulati, R. and Sych, M., 2007. Dependence asymmetry and joint dependence in interorganizational relationships: effects of embeddedness on a manufacturer's performance in procurement relationships. *Administrative Science Quarterly*, 52 (1), 32-69.

Hair Jr., J., Anderson, R., Tatham, R. and Black, W., 2006. *Multivariate data analysis*. 6<sup>th</sup> Ed. U.S.: Prentice-Hall, Inc.

Hansen, M.T., 1999. The search-transfer problem: the role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly*, 44 (1), 82-111.

Haug, A. and Arlbjørn, J.S., 2011. Barriers to master data quality. *Journal of Enterprise Information Management*, 24 (3), 288-303.

Ho, D.C.K., Au, K.F. and Newton, E., 2002. Empirical research on supply chain management: a critical review and recommendations. *International Journal of Production Research*, 40 (17), 4415-4430.

Holmberg, S., 2000. A systems perspective on supply chain measurements. *International Journal of Physical Distribution and Logistics Management*, 30 (10), 847-868.

Huber, B. and Sweeney, E., 2007. The need for wider supply chain management adoption: empirical results from Ireland. *Supply Chain Management: An International Journal*, 12 (4), 245-248.

Hult, G.T.M., Ketchen, D.J. and Slater, S.F., 2004. Information processing, knowledge development and strategic supply chain performance. *Academy of Management Journal*, 47 (2), 241-253.

Inkpen, A.C., Tsang, E.W.K., 2005. Social capital, networks and knowledge transfer. *Academy of Management Review*, 30 (1), 146-165.

Koka, B.R. and Prescott, J.E. 2002, Strategic alliances as social capital: a multidimensional view, *Strategic Management Journal*, 23 (9), 795-816.

Krause, D.R., Handfield, R., B., Tyler, B.B., 2007. The relationships between supplier development, commitment, social capital accumulation and performance improvement. *Journal of Operations Management*, 25 (2), 528-545.

Kulp, S.C., Lee, H.L. and Ofek, E., 2004. Manufacturer benefits from information integration with retail customers. *Management Science*, 50 (4), 431-444.

Lambert, D.M. and Cooper, M.C., 2000. Issues in supply chain management. *Industrial Marketing Management*, 29 (1), 65-83.

Larson, P. and Kulchitsky, J., 1999. Logistics improvement programs: the dynamics between people and performance. *International Journal of Physical Distribution and Logistics Management*, 29 (2), 88-102.

Lawson, B., Tyler, B.B., Cousins, P.D., 2008. Antecedents and consequences of social capital on buyer performance improvement. *Journal of Operations Management*, 26 (3), 446-460.

Legner, C. and Schemm, J., 2008. Toward the inter-organizational product information supply chain—evidence from the retail and consumer goods industries. *Journal of the Association for Information Systems*, 9 (3-4), 119-50.

Lengnick-Hall, C.A., 1996. Customer contributions to quality: a different view of the customer-oriented firm. *Academy of Management Review*, 21 (3), 791-824.

Li, S., Ragu-Nathan, B.T., Ragu-Nathan, S. and Subba Rao, S., 2006. The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, 34 (2), 107-24.

Li, S and Lin, B., 2006. Accessing information sharing and information quality in supply chain management. *Decision Support Systems*, 42 (3), 1641–1656.

Mackinnon, D.P., Lockwood, C.M., Hoffman, J.M., West, S.G., Sheets, V., 2002. A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, 7 (1), 83-104.

- Malhotra, A., Gosain, S. and El Sawy, O.A., 2005. Absorptive capacity configurations in supply chains: gearing for partner-enabled market knowledge creation. *MIS Quarterly*, 29 (1), 145-87.
- Malhotra, M.K. and Grover, V., 1998. An assessment of survey research in POM: from constructs to theory. *Journal of Operations Management*, 16 (4), 407-425.
- Manrodt, K.B. and Davis, F.W., 1993. The evolution to service response logistics. *International Journal of Physical Distribution and Logistics Management*, 22 (9), 3-10.
- Mason-Jones, R. and Towill, D.R., 1997. Information enrichment: designing the supply chain for competitive advantage. *Supply Chain Management: An International Journal*, 2 (4), 137-48.
- McAdam, R. and McCormack, D., 2001. Integrating business processes for global alignment and supply chain management. *Business Process Management Journal*, 7 (2), 113-30.
- McGrath, R., Sparks, W.L., 2005. The importance of building social capital. *Quality Progress*, 38 (22), 45-49.
- Meijboom, B., Voordijk, H. and Akkermans, H., 2005. The effect of industry clockspeed on supply chain co-ordination, *Business Process Management Journal*, 13 (4), 553-571.
- Mendelson, H., 2000. Organizational architecture and success in the information technology industry. *Management Science*, 46 (4), 513-529.
- Miller, L.E. and Smith, K.L., 1983. Handling nonresponse issues. *Journal of Extension*, 21 (59), 45-50.
- Min S., Kim S. and Chen H., 2008. Developing social identity and social capital for supply chain management. *Journal of Business Logistics*, 29 (1), 283-304.
- Moberg, C.R., Cutler, B.D., Gross, A. and Speh, T.W., 2002. Identifying antecedents of information exchange within supply chains. *International Journal of Physical Distribution and Logistics Management*, 32 (9-10), 755-70.
- Monczka, R.M. and Morgan, J., 1997. What's wrong with supply chain management? *Purchasing*, 122 (1), 69-73.
- Monczka, R.M., Petersen, K.J., Handfield, R.B. and Ragatz, G.L., 1998. Success factors in strategic supplier alliances: the buying company perspective. *Decision Sciences*, 29 (3), 553-577.
- Nahapiet, J. and Ghoshal, S., 1998. Social capital, intellectual capital, and the organisational advantage. *Academy of Management Review*, 23 (2), 242- 266.

Narasimhan, R. and Das, A., 2001. The impact of purchasing integration and practices on manufacturing performance. *Journal of Operations Management*, 19 (5), 593-609.

Narasimhan, R. and Jayaram, J., 1998. Causal linkage in supply chain management: an exploration study of North American manufacturing firms. *Decision Sciences*, 29 (3), 579-605.

Nonaka, I., 1994. A dynamic theory of organizational knowledge creation. *Organization Science*, 5, 114-37.

Nunnally, J.C., 1978. *Psychometric theory*. New York, NY: McGraw-Hill Inc.

O'Brien, R.M., 2007. A caution regarding rules of thumb for variance inflation factors. *Quality and Quantity*, 41 (5), 673-90.

O'Leary-Kelly, S.W. and Vokurka, R.J., 1998. The empirical assessment of construct validity. *Journal of Operations Management*, 16 (4), 387-405.

Pagell, M. and Krause, D., 2002. Strategic consensus in the internal supply chain: exposing the manufacturing-purchasing link. *International Journal of Production Research*, 40 (13), 3075-3092.

Patnayakuni, R., Rai, A. and Seth, N., 2006. Relational antecedents of information flow integration for supply chain coordination. *Journal of Management Information Systems*, 23 (1), 13-49.

Petersen, K.J., Ragatz, G.L. and Monczka, R.M., 2005. An examination of collaborative planning effectiveness and supply chain performance. *Journal of Supply Chain Management*, 41 (2), 14-25.

Podsakoff, P.M., MacKenzie, S., Lee, J.Y. and Podsakoff, N.P., 2003. Common method biases in behavioural research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88 (5), 879-903.

Porter, M.E., 1985. *Competitive advantage*. New York, NY: Free Press.

Power, D., 2005. Supply chain management integration and implementation: a literature review. *Supply Chain Management: An International Journal*, 10 (4), 252-63.

Preacher, K.J., Leonardelli, G.J., 2003. Calculation for the sobel test. [http://people.hofstra.edu/Jeffrey\\_J\\_Froh/Website\\_Fall\\_08/Interactive%20Mediation%20Tests.htm](http://people.hofstra.edu/Jeffrey_J_Froh/Website_Fall_08/Interactive%20Mediation%20Tests.htm) (accessed 18th October, 2012).

Romano, P., 2003. Co-ordination and integration mechanisms to manage logistics processes across supply networks. *Journal of Purchasing and Supply Management*, 9 (3), 119-34.

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*, 21(4), 437-56.

Rossin, D., 2007. An exploratory analysis of information quality in supply chains: efficient and responsive models. *Journal of Global Business Issues*, 1 (2), 151-58.

Ruane, F. and Gorg, H., 1997. The impact of foreign direct investment on sectoral adjustment in the Irish economy. *National Institute Economic Review*, 160 (1), 76-86

Samson, D. and Terziovski, M., 1999. The relationship between total quality management practices and operational performance. *Journal of Operations Management*, 17(4), 393-409.

Schonberger, R., 1995. *World class manufacturing*. New, York, NY: The Free Press.

Siemieniuch, C.E., Waddell, F.N., and Sinclair, M.A., 1999. The role of partnership in supply chain management for fast-moving consumer goods: a case study. *International Journal of Logistics: Research and Applications*, 2(1), 87-101.

Subramani, M., 2004. How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly*, 28 (1), 45-73.

Sum, C.C., Yang, K.K., Ang, J.S.K. and Quek, S.A., 1995. An analysis of material requirement planning (MRP) benefits using alternating conditional expectation (ACE). *Journal of Operations Management*, 13 (1), 35-58.

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*, 25 (1), 148-64.

Tabachnick, B., Fidell, L. and Osterlind, S., 2001. *Using multivariate statistics*. 4<sup>th</sup> Ed., Boston: Allyn and Bacon.

Tracey, M., Lim, J.S. and Vonderembse, M.A., 2005. The impact of supply-chain management capabilities on business performance. *Supply Chain Management: An International Journal*, 10 (3), 179-191.

Turkulainen, V. and Ketovivi, M., 2012. Cross-functional integration and performance: what are the real benefits. *International Journal of Operations and Production Management*, 32 (4), 447-467.

Uzzi, B., 1997. Social structure and competition in interfirm networks: the paradox of embeddedness. *Administrative Science Quarterly*, 42 (3), 35-67.

Van Der Vaart, T. and Van Donk, D.P., 2008. A critical review of survey-based research in supply chain integration. *International Journal of Production Economics*, 111(1), 42-55.

Vermer, B.H.P.J., (2000). How Important is data quality for evaluating the impact of EDI on global supply chains? Proceedings of the 33<sup>rd</sup> annual international conference on system science, IEEE computer Society, USA, Hawaii.

Vickery, S., 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*, 21 (5), 523-539.

Villena, V.H., Revilla, E., Choi, T.Y., 2011. The dark side of buyer-supplier relationships: a social capital perspective. *Journal of Operations Management*, 29 (6), 561-576.

Ward, P., McCreery, J., Ritzman, L. and Sharma, D. (1998), Competitive priorities in operations management, *Decision Sciences*, 29 (4), 1035-1046.

Wiengarten, F. and Humphreys, P., 2010. Collaborative supply chain practices and performance: exploring the key role of information quality. *Supply Chain Management: An International Journal*, 15 (6), 463-473.

Wong, C.Y., Boon-itt, S., Wong, C.W.Y., 2011. The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management*, 26 (9), 604-615.

Yli-Renko, H., Autio, E., and Sapienza, H.J., 2001. Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal*, 22 (6-7), 587-613.

Zhou, H. and Benton Jr., W.C., 2007. Supply chain practice and information sharing. *Journal of Operations Management*, 25 (6), 1348-1365.

**Table 1: Demographics of the sample**

<b>Characteristics</b>	<b>Sample (%)</b>		<b>Sample (%)</b>
<b>Respondent's job title</b>		<b>No. of Employees</b>	
Production manager	32.6	Under 100	44.1
Operations manager	25.0	100-299	33.9
Supply chain manager	18.4	300-499	8.3
General Manager/Director	17.0	500+	13.7
Other managerial areas	7.0	<b>Majority ownership</b>	
<b>Industry sector</b>		Irish	43.0
Manufacturing of food	16.8	USA	29.0
Machinery	12.8	Continental Europe	17.9
Pharmaceuticals	12.0	UK	5.4
Electronics	10.2	Other countries	4.7
Medical devices	9.7	<b>Annual Turnover</b>	
Plastics	8.4	Under 25 m	43.7
Chemicals	7.5	25m but less than 50m	18.4
Fabricated metal products	7.1	50m but less than 100m	13.4
Motor vehicles and parts	4.4	100m but less than 200m	6.1
Wood/products of wood	4.0	200m+	18.4
Basic metals and other minerals	3.5		
Textiles and apparel	1.8		
Pulp, paper and paper products	1.8		

**Table 3: Mean, standard deviation and correlations of the constructs**

<b>Construct</b>	<b>Mean</b>	<b>S.D.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Customer integration (1)	2.001	0.568					
Information quality (2)	2.268	0.575	0.474**				
Quality (3)	1.895	0.595	0.342**	0.262**			
Delivery (4)	2.089	0.694	0.317**	0.272**	0.409**		
Flexibility (5)	2.395	0.716	0.326**	0.257**	0.374**	0.474**	
Cost (6)	2.545	0.747	0.222**	0.364**	0.417**	0.476**	0.474**

\*\*  $p \leq 0.01$

**Table 2: Factor analysis for customer integration, information quality and operational performance**

<b>Construct</b>	<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>	<b>F5</b>	<b>F6</b>
<i>Customer integration</i>						
We frequently interact with this customer to set reliability, responsiveness, and other standards for us	0.609					
We frequently measure and evaluate this customer satisfaction	0.648					
We frequently determine this customer future expectations	0.463					
We inform this customer of changing needs	0.641					
This customer shares proprietary information with us	0.484					
<i>Information quality</i>						
Information exchange between this customer and us is accurate		0.674				
Information exchange between this customer and us is complete		0.591				
Information exchange between this customer and us is adequate		0.561				
Information exchange between this customer and us is reliable		0.626				
Information exchange between this customer and us is relevant		0.623				
<i>Quality</i>						
High product performance			0.551			
High product reliability			0.715			
Conformance of final product to design specifications			0.587			
<i>Delivery</i>						
Short delivery time				0.577		
Delivery on due date (ship on time)				0.751		
On-time delivery (range of days/hours before and after due date/time)				0.785		
<i>Flexibility</i>						
Ability to introduce new products into production quickly					0.600	
Ability to adjust capacity rapidly within a short time period					0.611	
Ability to make design changes in the product after production has started					0.485	
<i>Cost</i>						
Production cost						0.558
Labour cost						0.711
Capacity utilization						0.540
Productivity						0.832
Eigen value	6.571	2.544	1.779	1.319	1.238	1.133
% of variance	28.571	11.060	7.734	5.735	5.384	4.928
Cumulative explained variance (%)	28.571	39.631	47.365	53.100	58.485	63.413
Reliability ( $\alpha$ )	0.751	0.782	0.704	0.816	0.682	0.810

**Table 4: Results of OLS analyses**

Variables	Standardised coefficients													
	Information quality		Model 1- Quality			Model 2 - Delivery			Model 3 - Flexibility			Model 4 - Cost		
	Step 1		Step 2	Step 3		Step 2	Step 3		Step 2	Step 3		Step 2	Step 3	
<i>Control</i>														
Industry type														
Food	-0.083	-0.090	-0.051	-0.056	-0.045	0.092	0.087	0.101	0.184*	0.179*	0.193*	0.025	0.022	0.053
Pharma	-0.020	0.005	-0.122	-0.104	-0.105	-0.042	-0.025	-0.026	-0.048	-0.031	-0.031	-0.096	-0.085	-0.086
Machinery	-0.029	-0.029	0.032	0.031	0.034	-0.123	-0.124	-0.119	-0.038	-0.039	-0.035	0.026	0.026	0.036
Electronics	0.067	0.062	0.084	0.080	0.072	0.084	0.080	0.070	0.055	0.051	0.042	-0.029	-0.032	-0.053
<i>Direct effects</i>														
Customer integration		0.476***		0.336***	0.279***		0.313***	0.237***		0.320***	0.248***		0.217***	0.052
<i>Mediating effects</i>														
Information quality					0.120*			0.159*			0.150*			0.348***
R <sup>2</sup>	0.013	0.239***	0.028	0.141***	0.151***	0.037	0.135***	0.154***	0.044	0.146***	0.163***	0.012	0.059***	0.152***
ΔR <sup>2</sup>	0.013	0.226***	0.028	0.113***	0.123***	0.037	0.098***	0.117***	0.044	0.102***	0.119***	0.012	0.047***	0.139***
Adjusted R <sup>2</sup>	-0.005	0.222***	0.011	0.121***	0.128***	0.020	0.115***	0.131***	0.027	0.126***	0.140***	-0.005	0.038***	0.129***
F	0.774	13.927***	1.602	7.259***	6.572***	2.156	6.916***	6.706***	2.546	7.571***	7.167***	0.699	2.808***	6.580***
ΔF	0.774	65.799***	1.602	29.079***	16.078***	2.156	25.028***	15.255***	2.546	26.508***	15.736***	0.699	11.116***	18.126***

Max VIF = 1.314

\* $p \leq 0.05$   
 \*\* $p \leq 0.01$   
 \*\*\* $p \leq 0.001$