



Influence of inter-organisational integration on business performance

The mediating role of organisational-level supply chain functions

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Abstract

Purpose – The purpose of this paper is to investigate the mediating role of organisational level supply chain activities on the effect of inter-organisational information systems (IOIS) and activity (IOA) integration on business performance of retailing organisations within Australia.

Design/methodology/approach – The study followed a causal research approach and survey methodology to collect data from the managers of food and hardware retailers. Multiple regression and MacKinnon *et al.*'s mediation analysis were used to investigate the hypothesised relationships.

Findings – The results suggest that inter-organisational information systems (IOIS) and activity integration have positive effects on customer responsiveness and financial performance of organisations. Organisational-level supply chain functions mediate the relationships between IOIS and activity integration and customer responsiveness, as well as financial performance.

Research limitations/implications – The research focused at the retailer level of the supply chain. Large-scale cross-sectional studies that include other levels of supply chain are required for generalisability.

Practical implications – The research suggests that organisations need to integrate their inter-organisational information systems and activities with supply chain partners to enhance supply chain and business performance.

Originality/value – The results extend the body of knowledge on inter-organisational information systems, inter-organisational integration and supply chain management. The study also provides some empirical insights into management practices in the retailing sector.

Keywords Information systems, Business performance, Supply chain management, Australia

Paper type Research paper

1. Introduction

Increasingly, organisations are using inter-organisational relationships to leverage supply chain partners' resources and capabilities, to cope with perceived environmental uncertainty and to enhance their competitive advantage (Bhatt and Trout, 2005). Most supply chain partners have realised the importance of using supply chain relationships and structures to facilitate fast response to customer needs and requirements (Defee and Stank, 2003). Supply chain relationships and integration enable organisations to overcome resource constraints through increased innovation and reduced costs, and uncertainties (Coviello and McAuley, 1999). Research suggests that inter-organisational integration is a vital governance mechanism in inter-organisational relationships (Narasimhan and Das, 2001; Ragatz *et al.*, 2002). Integration between partnering



organisations' activities and information systems is an important strategic tool in supply chain management (O'Callaghan *et al.*, 1992; Soliman and Janz, 2004), and that significantly influences relationship between supply chain members (Johnston and Vitale, 1988).

Research suggests that the implementation of inter-organisational information systems (IOIS) influences not only the performance of individual businesses but of the supply chain as well (Cousins and Menguc, 2005; Kettinger *et al.*, 1997). Implementation of IOIS enhances lead-time (Bhatt, 2000; Power and Sohal, 2002) and communication (Gracia-Dastugue and Lambert, 2003), and reduces lost shipments and cost inefficiency (Frohlich and Westbrook, 2002; Lancioni *et al.*, 2002). However, the full potential benefits of IOIS could be attained when organisations integrate their inter-organisational information systems and activities with supply chain partners (Fearon and Philip, 1999; Kim *et al.*, 2006). Further, Bhatt and Trout (2005) state that, inter-organisational integration enables supply chain partners to respond dynamic challenges in the marketplace.

Whilst there is a substantial body of research on the benefits of IOIS implementation, limited attention has been paid to investigating the outcome of benefits that could be accrued from IOIS and IOA alignment and integration (Frohlich, 2002; Kim *et al.*, 2006; Wu *et al.*, 2003). Further, there is also a lack of empirical work on the effects of IOIS and activities integration on supply chain performance (Golden and Powell, 2004). Therefore, the present study examines the effect of IOIS and IOA integration on the performance of retailing organisations, and also investigates the mediating role of organisational-level supply chain functions on the relationship between inter-organisational integration and business performance.

The paper begins with an overview of literature on inter-organisational integration, supply chain performance and business performance. The methodology used to test the hypotheses is outlined, followed by a presentation of research results and discussion. The paper concludes by outlining implications, limitations and areas for future research.

2. Literature review and hypotheses

2.1 Inter-organisational integration

Inter-organisational integration facilitates the physical flow of products, information and financial resources between suppliers and buyers, thereby, enabling supply chain partners to act as a single entity and configure their operations on a shared basis (Tan *et al.*, 1998). Kim *et al.* (2006) conceptualised inter-organisational integration as a two-dimensional construct composed of systems integration and activity integration. Inter-organisational information systems integration is considered as a distinct type of systems integration (Kim *et al.*, 2006) that involves the integration of networks of information technologies of partnering firms that facilitate information sharing between collaborating firms (Wyse and Higgins, 1993). Inter-organisational activity integration, on the other hand, is the integration of collaborating organisations' physical, financial and marketing activities (Rai *et al.*, 2006; Troy *et al.*, 2001).

IOIS integration is the coordination of information systems and communication processes between supply chain partners (Choy *et al.*, 2003; Kearns and Lederer, 2003). The use of IOIS enables collaborating organisations to quickly identify and communicate consumer requirements, and complaints to supply chain partners

(Soliman and Janz, 2004). According to Defee and Stank (2003), IOIS integration enhances an organisations' capability to exchange information and data in a timely, responsive and usable format. Thus, the benefits gained from IOIS integration depend on the reliability of the information transferred between supply chain partners (Kulp *et al.*, 2004).

Bagchi and Larsen (2002) refer IOA integration as a rally of key members of a supply chain network including external entities, towards a common goal. Further, activity integration encourages organisations to become more entrenched members of the network and develop a sense of belonging to the supply chain. Considering inter-organisational activity integration as external integration, Gimenz and Ventura (2005) refers the activity integration as the organisations' coordination and collaboration with supply chain partners. In general, organisations integrate their logistics and marketing activities with supply chain partners to attain competitive advantage (Gimenz and Ventura, 2005). Rai *et al.* (2006) grouped activities integration as physical, financial and information integration. Troy *et al.* (2001) emphasised the importance of marketing integration to achieve competitive advantage. Therefore, the study measured inter-organisational activity integration in the dimensions of physical flow integration, financial flow integration and marketing information integration.

2.2 Relationship between inter-organisational integration and organisational-level supply chain performance

Literature streams on supply chain management (SCM) and inter-organisational information systems (IOIS) have developed independently, with operations and logistics researchers focusing on supply chain management whilst information systems/information technology researchers have focused on IOIS domain (Shah *et al.*, 2002). Though, IOIS were developed as proprietary systems of large corporations, small and medium sized enterprises (SMEs) and small retailing firms are also increasingly using IOIS to enhance logistics and supply chain performance (Chow *et al.*, 1994).

According to Simchi-Levi and Kaminsky (2000), supply chain management requires collaboration between suppliers, manufacturers, wholesalers and retailers for the purpose of producing and distributing pre-established products effectively and efficiently. Further, collaboration between supply chain partners require IOIS and IOA integration to facilitate sharing of information with supply chain partners. However, whilst information systems integration provides opportunities it also brings challenges to supply chain members (Hausman and Stock, 2003). IOIS integration can enhance supply chain performance by facilitating organisations' information sharing capability (Kulp *et al.*, 2004) and responsiveness to changing customer and market needs (Malone *et al.*, 1987; Philip and Booth, 2001). According to Frohlich and Westbrook (2002), IOIS and IOA integration facilitates coordination between upstream and downstream supply chain partners, thereby, provide logistics benefits and relationships satisfaction. Additionally, the integration of inter-organisational activities facilitates just-in-time delivery, automatic replenishment and inventory management (Daugherty *et al.*, 1996). Thus, IOIS and IOA integration facilitates supply chain activities in individual organisations through the shortening of product development cycle time,

lowering manufacturing costs and enhancing product quality (Bhatt and Trout, 2005). Thus, we hypothesise that:

- H1. Inter-organisational information systems integration (IOIS) is positively associated with organisational-level supply chain performance.
- H2. Inter-organisational activity (IOA) integration is positively associated with organisational-level supply chain performance.

2.3 Relationship between inter-organisational integration and business performance

IOIS and IOA integration facilitate customer relationships and responsiveness by assisting individual organisations to effectively anticipate, track and respond to customer demands, wants and complaints (Hausman, 2000). Further, the integration of IOIS and IOA reduces operational costs and lead-times (Bhatt, 2000) and enhances service delivery (Thakkar *et al.*, 2008). Wu *et al.* (2003) state that, the integration of IOIS and IOA could facilitated customer responsiveness by providing detailed information about the product availability and demand, customer requests and complaints to upstream supply chain partners so as to help them to be more responsiveness in their services and product offering. The profitability and financial performance of an organisation is determined by an organisations' ability to obtain information and resources of the right quality, on time and at the most favoured prices (Thakkar *et al.*, 2008). IOA integration helps organisations to realise the full potential of their value-added activities and to gain a significant competitive advantage (Gunasekaran and Ngai, 2003). According to Rai *et al.* (2006), the integration of organisational physical, financial and information sharing activities enhances organisations' performance by improving sales volume, markets share and return-on-investment (Rai *et al.*, 2006). Thus we hypothesise that:

- H3. IOIS integration is positively associated with (a) customer responsiveness, (b) financial performance.
- H4. IOA integration is positively associated with (a) customer responsiveness (b) financial performance.

2.4 Relationship between organisational-level supply chain performance and business performance

Supply chain related organisational activities improve business performance through the elimination of inefficiency and optimum use of supply chain partner's capability, resources and technology (Monczka *et al.*, 1998; Tan *et al.*, 1998). Thus, the aim of supply chain management in most organisations is to enhance business performance through enhanced customer responsiveness, market share and profitability (Daugherty *et al.*, 1996). In addition, fast changing consumer tastes and preferences require organisations to quickly identify consumer requirements and address their needs through the logistics and supply chain activities such as just-in-time delivery, continuous replenishment, inventory management and flexibility that can be utilised to meet theses customer needs (Cox *et al.*, 2003). Thus, we hypothesise that:

- H5. Organisational-level supply chain performance is positively associated with (a) customer responsiveness, (b) financial performance.

2.5 The mediating role of organisational-level supply chain performance on the relationship between inter-organisational integration and business performance

Integration of IOIS and IOA improves business performance by coordinating and linking organisational level supply chain functions. According to Lancioni *et al.* (2002) consistent and detailed information sharing between supply chain partners result in quicker diagnosis and solutions to inventory and logistics problems, and improve consumer responsiveness. As suggested by Bhatt and Trout (2005), collaboration between organisations facilitates supply chain performance such as just-in-time delivery, efficient ordering and cost minimisation (Bhatt and Trout, 2005), thereby enhancing customer responsiveness and financial performance:

- H6. Organisational-level supply chain performance mediates the effect of IOIS integration on (a) customer responsiveness (b) financial performance.
- H7. Organisational-level supply chain performance mediates the effect of IOA integration on (a) customer responsiveness (b) financial performance.

3. Methodology

The data were collected from the Australian food and hardware retailing firms. Simple random sampling technique was used to select the respondents from a sampling frame that was supplied by the Australian Centre for Retail Studies (ACRS). The questionnaire package consisting of an explanatory statement, questionnaire and self-addressed reply paid envelope was sent to 2000 respondents. A total of 231 usable responses were received resulting in a response rate of 11.6 per cent.

The measurement items for the construct IOIS integration were adapted from Kim *et al.* (2006) and inter-organisational activity integration measures were borrowed from Rai *et al.* (2006). Supply chain-related organisational performance measures were adapted from Power (2005) and business performance was measured by looking at customer responsiveness (Wu *et al.*, 2003) and financial performance.

Separate confirmatory factor models were used to assess convergent and discriminant validity, so as not to violate ratio-to-sample (Hair *et al.*, 2005). Measurement items had standardised factor loadings ranging between 0.78 and 0.92 for the major constructs, above the recommended 0.5 cut-off point (Bagozzi *et al.*, 1991) (see Table I). The results also indicated t-values ranging from 13.29 to 23.71, were well above the 2 cut-off point and significant at $p < 0.05$. The reliability coefficients were between 0.64 and 0.92 and exceeded the 0.60 cut-off point suggested for exploratory analysis (Nunnally, 1978) (Figure 1).

Tests for multicollinearity, linearity and normality indicated non-violations of the assumptions. Following the tests of validity and reliability, regression analysis was used to test the relationships hypothesised in this study. Baron and Kenny's (1986) and MacKinnon *et al.*'s (2007) mediation analyses were performed to investigate the mediation role of supply chain related organisational performance on the effects of IOIS and IOA integration on business performance and customer responsiveness.

4. Results and discussion

As hypothesised, IOIS integration ($\beta = 0.278$; $t = 6.81$; $p < 0.001$) and IOA integration ($\beta = 0.318$; $t = 4.25$; $p < 0.001$) had significant positive influence on organisation-related supply chain performance, providing support for H1 and H2.

Measurement items	SFL	t-value	AVE and composite reliability
<i>Interorganisational information systems integration</i> (Kim <i>et al.</i> , 2006)			
Model fit indices: $\chi^2 = 157$; $df = 32$; RMSEA = 0.06; GFI = 0.93; AGFI = 0.89; CFI = 0.93			AVE = 0.82
			$\alpha = 0.84$
1. Our information systems have built-in functions to facilitate collaboration with supply chain partners	0.77	15.2	
2. Our firm can forecast and plan collaboratively with supply chain partners through integrated information systems	0.91	23.71	
3. Our integrated information systems allow our firm to project and plan future demand with supply chain partners	0.91	22.88	
4. Integrated information systems facilitate collaboration in demand forecasting and planning between our firm and supply chain partners	0.91	22.44	
<i>Interorganisational activity integration</i> (Rai <i>et al.</i> , 2006)			
Model fit indices: $\chi^2 = 13.5$; $df = 1$; RMSEA = 0.03; GFI = 0.99; AGFI = 0.99; CFI = 0.99			AVE = 0.75
			$\alpha = 0.89$
1. Physical integration between supply chain partners	0.82	16.1	
2. Financial integration between supply chain partners	0.95	24.2	
3. Marketing information integration	0.82	16.0	
<i>Operational/logistic performance</i> (Gunasekaran <i>et al.</i> , 2004)			
Model fit indices: $\chi^2 = 17.18$; $df = 9$; RMSEA = 0.05; GFI = 0.98; AGFI = 0.95; CFI = 0.99			AVE = 0.65
			$\alpha = 0.88$
1. Reduction in warehouse inventory	0.74	14.75	
2. Reduction in on-shelf inventory	0.68	13.00	
3. Just-in-time delivery of products	0.81	16.49	
4. Product traceability while the products move along the supply chain	0.71	13.84	
5. Flexibility in the supply chain	0.78	15.68	
6. Reduction in operations cycle time	0.73	14.33	
<i>Customer responsiveness</i> (Wu <i>et al.</i> , 2003)			
Model fit indices: $\chi^2 = 10.18$; $df = 4$; RMSEA = 0.05; GFI = 0.99; AGFI = 0.96; CFI = 0.99			AVE = 0.75
			$\alpha = 0.91$
1. Effectiveness in fulfilling supply chain partner order	0.78	15.40	
2. Effectiveness in dealing with supply chain partner's queries	0.83	16.15	
3. Time reduction to corrective actions on complaints by supply chain partners	0.82	17.47	
4. Effectiveness in acceptance and processing of payments	0.84	16.57	
5. Overall improvement in supply chain partner's responsiveness	0.70	13.29	
<i>Financial performance</i>			
			AVE = 0.82
			$\alpha = 0.94$
1. Sales volume increase	0.91	18.26	
2. Market share growth	0.84	16.10	
3. Gross profit	0.93	19.22	
4. Net profit	0.93	19.38	
5. Average return on investment	0.88	17.67	

Notes: RMSEA = Root Mean Square Error of Approximation; GFI = Goodness-of-fit Index, AGFI = Adjusted Goodness-of-fit Index; CFI = Comparative Fit Index; ^aThe scale format for each of these measures was 1 = "strongly disagree" to 7 = "strongly agree"; ^bSFL = Standardised Factor Loadings; (...) Source of measurements

Table I.
Results of CFA

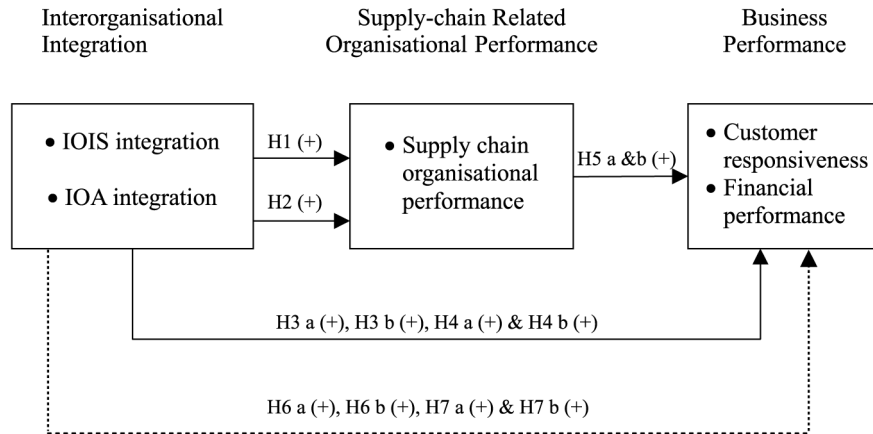


Figure 1.
Conceptual model and
hypothesised relationships

The proposed association between inter-organisational integration and business performance dimensions were also supported as IOIS integration ($\beta = 0.232$; $t = 4.29$; $p < 0.001$) and IOA integration ($\beta = 0.339$; $t = 3.43$; $p < 0.001$) had significant positive association on customer responsiveness. Thus the results provided support for *H3a* and *H4a*. As predicted IOIS integration ($\beta = 0.187$; $t = 2.47$; $p < 0.05$) and IOA integration ($\beta = 0.454$; $t = 3.27$; $p < 0.01$) had a significant effect on financial performance of organisations and provided support for *H3b* and *H4b*. Organisation-related supply chain performance had a significant positive influence on customer responsiveness ($\beta = 0.633$; $t = 9.48$; $p < 0.001$) and financial performance ($\beta = 0.505$; $t = 4.07$; $p < 0.001$). Thereby, *H5a* and *H5b* were supported.

To investigate whether the relationship between inter-organisational integration and business performance was mediated by organisation-related supply chain performance, the procedure suggested by Baron and Kenny (1986), and MacKinnon *et al.* (2007) were used. First the results indicated significant relationship between the independent variables (IOIS integration and IOA integration) and dependent variables (customer responsiveness and financial performance). Second, the relationship between the independent variables and mediating variable (supply chain related organisational performance) also indicated significant effect. Third, the mediating variable (adjusted for the independent variables) regressed with the dependent variables and indicated a significant relationship. Thus, the results supported Baron and Kenny's (1986) condition for mediation effects. Finally, the differences in regression coefficient between the direct and indirect model was estimated to test the significance of mediation effect (MacKinnon *et al.*, 2007). The relationship between IOIS integration and customer responsiveness indicated that the regression coefficient for direct effects ($\beta = 0.232$; $t = 4.29$; $p < 0.001$) was higher than the indirect effects ($\beta = 0.103$; $t = 1.97$; $p < 0.05$), and the differences were significant at $p < 0.05$ and providing support for *H6a*. For the relationship between IOA integration and customer responsiveness, the regression coefficient for direct effects ($\beta = 0.339$; $t = 3.43$; $p < 0.001$) was higher than the indirect effects ($\beta = 0.192$; $t = 1.99$; $p < 0.05$) and the difference was significant at $p < 0.05$, and thus provided support for *H7a*. Considering the relationship between IOIS integration and financial performance, the regression

coefficient for the direct effects ($\beta = 0.187$; $t = 2.47$; $p < 0.05$) was high compared to the indirect effects ($\beta = 0.141$; $t = 2.06$; $p < 0.05$), and the difference was significant at $p < 0.05$. Thus *H6b* was supported. The relationship between IOIS integration and financial performance indicated that, the regression coefficient for direct effects ($\beta = 0.454$; $t = 3.27$; $p < 0.01$) was higher than the indirect effects ($\beta = 0.111$; $t = 1.98$; $p < 0.05$) and the difference was significant at $p < 0.05$, and thus provided support for *H7b*. Thus, the mediation effects of organisation-level supply chain performance on the relationship between inter-organisational integration and business performance was supported.

The results of this study provide some insight into the role of organisation level supply-chain performance on the link between IOIS and activity integration, and business performance within the Australian retailing context. Consistent with prior literature (Bhatt and Trout, 2005; Kim *et al.*, 2006), the study indicated positive relationship between inter-organisational integration and supply-chain related organisational performance. The integration of IOIS and IOA with supply chain partners helps organisations to attain supply chain benefits such as just-in-time delivery, warehouse and on-shelf inventory reduction, cost minimisations, supply chain flexibility and traceability. The IOA integration promotes the development of trust and commitment between supply chain partners and encourages sharing of strategic information. Information sharing between supply chain partners facilitates the supply chain efficiency and effectiveness. The results of the mediating effects suggest that, facilitating supply chain activities at organisational levels helps integration of information systems and activities could improve customer responsiveness and financial performance. IOIS and IOA integration enhances timely, accurate and detailed information sharing and data that is crucial for supply chain performance, customer responsiveness and financial performance. Therefore, IOIS and IOA integration facilitate supply chain management functions and enable organisations to quickly and effectively respond to customer needs, queries and complaints and improves business performance.

5. Limitations and future research

This study has certain limitation that can be addressed in future research. First, as the study employed a cross-sectional research design, there could be a time lag between the organisations integrating information systems and the realisation of tangible benefits. A longitudinal research design could provide more insight into the relationships investigated in this study. Finally, data for the study was collected at the retailing level of the supply chain and the model may not be invariant across industries and stages of the supply chain. Thus, the results may not be generalisable to other levels of supply chain and other industries.

Though IOIS and inter-organisational activities significantly influence the organisations' level supply chain or logistics performance, and customer responsiveness, it is not clear at what level of integration can maximum benefits is achieved. As supply chain members integrate their information systems and activities to different levels, future research could focus on assessing the influence of level of integration at the basic, intermediate and advanced integration stages. Finally, future research could replicate the model at different stages of the supply chain and different contexts.

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Further reading

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