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Avoiding Inertia in Collaborative Supply Chain Systems: The Decision-Makers Role

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AVOIDING INERTIA IN COLLABORATIVE SUPPLY CHAIN SYSTEMS: THE DECISION-MAKERS ROLE

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Abstract

To compete in knowledge intensive industries, firms are increasingly looking to trading partner collaboration as a means of bolstering innovation and competitive advantage. Specifically, many decision-makers are deploying Internet-enabled supply chain systems with the view to promoting collaborative activities and relationships with strategic suppliers. In reality, many of these so-called 'collaborative' supply chain systems have underperformed or been terminated. While these systems frequently achieve gains in operational performance, often they fail to enact any substantial relationship change or redesign business processes as required for collaboration. Hence, this study deploys a process-based approach to examine the intervention factors during implementation to distinguish successful from unsuccessful collaborative attempts. In this paper, the authors propose critical intervention requirements that decision makers need to consider when instigating and managing collaboration amongst trading partners. Based upon empirical data from an EC-Funded Fifth Framework Project, this research investigates the impact of an Internet-based system on three disparate industry supply chains attempting to promote collaboration within their supplier network.

Keywords: *Inter-Organisational Systems, Collaboration, Integration, Supply Chain Management, Internet-Enabled*

1. INTRODUCTION

In the drive for competitiveness, many knowledge intensive industries are pursuing supply chain coordination strategies as a way of adding value to compliment the cost reduction imperative. Successful coordination offers the potential to expand business strategies and operations by leveraging the competencies and capabilities of other firms in their supply chain. To implement this strategy, companies are increasingly deploying inter-organizational systems (IOS) to integrate the systems and processes of strategic supply chain members. Recently, several decision-makers have deployed Internet-enabled supply chain systems to promote collaborative activities and relationships with strategic suppliers. Volkswagen Group, for instance, have claimed to recoup their outlay costs for a supplier network portal within a year through reduction in administrative tasks, acceleration of processes, improved planning accuracy and improved transparency in the collaboration with suppliers (Neumann et al., 2005). In theory, the effective integration of the supply chain can create competitive advantages derived from access new markets, new technologies and new skills, to reduce operational costs and product time to market, and to optimise overall supply chain performance (Eisenhardt and Schoonhoven, 1996).

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In reality, few businesses, let alone entire supply chains have developed working collaborative agendas (Ross, 2003). Managers have continually struggled with the fine art of balancing cooperative relations with trading partners while at the same time trying to improve competitiveness. Certainly, Kanter (1994) highlights in her seminal article, that companies often fail to develop "collaborative advantage" due to the difficulties involved in acquiring and implementing the "art" of managing relationships. Trading partner collaboration poses significant challenges because of the uneven levels of competency and effectiveness of business processes found in the supply network (Ross, 2003). Additionally, strategic partnerships involving collaboration are costly to develop, nurture and maintain as well as being risky given the specialised resources and investments they require (Bensaou, 1999). Hence, it is imperative for decision makers to consider whether or not it is advantageous to instigate collaboration with trading partners. To this end, an evaluation of the successful factors in achieving collaboration is necessary (Mattesich et al., 2001).

The aim of this paper is to analyse the key success factors in achieving collaboration from implementing an Internet-enabled system among diverse supply chain participants. Firstly, the literature is consulted to incorporate the underpinning perspectives of information systems, supply chain management and collaboration studies. Secondly, this paper outlines the empirical project and unique methodology employed to capture the implementation process. Next, the findings from the implementation of an Internet-enabled system in three separate supply networks are analysed. Finally, the authors discuss the key intervention requirements that decision makers need to consider when instigating and managing collaboration amongst trading partners. In particular, this paper highlights the critical enablers which can also act as inhibitors of collaboration in buyer-supplier relationships in the context of supply chain systems. This study was developed and tested in conjunction with an EC-funded Fifth Framework Initiative - *Collaborative Improvement Tool for the Extended Manufacturing Enterprise*.

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1.1 Internet-Enabled Supply Chain Systems

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Since the 1960s with the advent of Electronic Data Interchange (EDI), information systems have been used to integrate trading partners. After nearly four decades of prior research, many authors (e.g. Clemons and Row, 1992; Malone et al., 1987) have illustrated the potential to reduce costs and provide operational benefits by introducing IOS systems within supply chains. In the 1990s, the emergence of the Internet shifted attention to this ubiquitous platform for trading partners to support collaborative applications to exchange information and knowledge (Harrison and Van Hoek, 2002). These collaborative IOS can be defined as hubs where companies can exchange proprietary data, jointly manage projects and cooperate on the design of new products (Williams, 2000). Often Internet systems are perceived as an 'enabling technology' (Porter, 2001) in providing operational and potentially strategic benefits to their supply chain activities (Handfield and Nichols, 2002). However, research on Internet-enabled IOS in the context of supply chains has been scant and fragmented (Subramani, 2004). This is evident in the extant literature where various terms have been used to describe these systems such as Internet-enabled (Barua et al., 2004; Subramani, 2004), Internet (or electronically)-mediated (Myhr and Spekman, 2005; Schultz and Orlikowski, 2004), and e-supply chains (Pant et al., 2003). Garcia-Dastugue and Lambert's (2003) argued that a wide range of Internet-enabled coordination mechanisms have empowered the supply chain by facilitating information flows, and the integration of business processes across the supply chain. One notable study is Subramani's (2004) study of the benefits of Internet-enabled supply chain systems for suppliers. She found patterns of system use enabled suppliers to both create value and retain a portion of the value created by the deployment of these systems in inter-firm relationships.

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For the purposes of this study, the main area of contention in the literature is the effect (or non-effect) of IOS on interpersonal relationships in the supply chain. Some research (Grover et al., 2002; Myhr and Spekman, 2005; Zhu and Kraemer, 2002) argues that routine communication tasks and data

exchanges are automated and monitored in an IOS, which releases trading partners to engage in more cooperative activities. Tomkins (2001) proposed that regular trading creates social bonds between parties based upon mutual understanding and trust where the interactions between companies often develop much further into supply chain partnerships with an implied sense of sharing in knowledge, decision-making and collective rewards. This argument is based on the idea that automation allows individuals to spend more time on intense, problem solving interactions which require more interpersonal and face-to-face contact.

However, this assertion is challenged by Schultze and Orlikowski's (2004) finding that a decline in customer-supplier interaction quickly led to a weakening of inter-firm relationships. They concluded that the use of Internet-based technology reduces the opportunity for joint problem solving and there is less collaboration among the participants which challenges the value of interpersonal, inter-firm relations (Schultz and Orlikowski, 2004). Delving further into this issue, Myhr and Spekman (2005) argued that electronically mediated exchange is a more important determinant of collaboration in supply-chain relationships involving standardised products, while trust is more of a factor in achieving collaboration involving customised products. This study inferred that by constant interaction and information sharing via electronically mediated exchange, partners experiences a closer bond and this serves to re-enforce trust that contributes to collaboration. However, in the complete absence of trust, these non-personal electronic exchanges will not be powerful enough to achieve the requisite base-line level of collaboration (Myhr and Spekman, 2005).

1.2 Collaboration in Supply Chain Systems

For successful implementation of an integrated supply chain system, a vital ingredient is generating collaboration amongst the trading partners. Collaboration is defined as a process of decision making among independent organisations involving joint ownership of decisions and collective responsibility for outcomes (Gray, 1991). Though frequently used interchangeably with terms 'cooperation' and 'coordination', collaboration is considered to subsume this more limited form of integration (see Figure 1). Cooperation, whereby firms exchange some essential information and engage some suppliers in longer-term contracts, represents the entry level of interaction. The next level of intensity is coordination whereby both workflow and information are exchanged in a manner that permits technical systems (e.g. EDI) and other integration mechanisms (e.g. Just-in-Time) that attempt to make seamless many of the traditional linkages between and among trading parties (Spekman et al., 1998). In many instances, trading partners have already achieved cooperation and coordination with key suppliers and customers. According to Spekman, et al. (1998) the movement from coordination to collaboration requires levels of trust and commitment that are beyond those typically found in both JIT and EDI relationships. In this context, collaboration can be viewed as the last step of a transition from open-market negotiation through cooperation to collaboration.

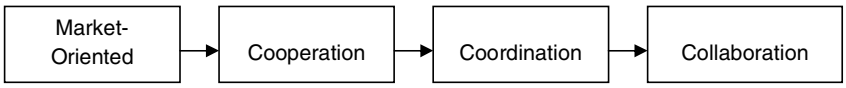

Figure 1 Continuum of Integration from Cooperation to Collaboration (Adapted from Spekman et al., 1998)

Interestingly, various authors (e.g. Huxham and Vangen, 2004; Zineldin and Torbjorn, 2003) have concluded that problems and failures in collaborative ventures are more common than successes. Zineldin and Torbjorn (2003) found that over a third of strategic alliances end in failure. In a review of the extant collaboration literature, Parung *et al.* (2004) conclude that most of the problems and failures seem to occur during the implementation stage. These authors identify three main reasons causes of failures: *inter-personal relationship; outcome performance;* and *organisational or structural.* The most commonly cited reason for failed inter-firm collaboration is problems in the relationship between the

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participants (Parung *et al.*, 2004). Many problems in the inter-organisational relationship have been identified such as: lack of trust; lack of commitment; ineffective communication between partners; and little attention to nurturing the working relationship(Huxham and Vangen, 2004). A second main reason for inter-firm collaboration failure is due to the lack of participant satisfaction with the performance outcomes of the collaboration (Parung *et al.*, 2004). For example, Zineldin and Torbjorn (2003) found the demise of the GM and Daewoo alliance was caused by lack of productivity and not achieving financial benefits.

Actually achieving any collaborative impact from a system between supply chain members is a difficult task. Pant et al. (2003) concluded firms need to understand different options for implementing e-enabled supply chains keeping in mind their resources and ability to handle associated challenges. Cultivating collaboration among disparate participants requires a level of change in behavioural aspects as well as technical processes. In reality, the implementation factors (technological) and process (behavioural) are inseparable since they are interrelated (Mendoza et al., 2005). Numerous studies have assessed the technical implementation dimensions of inter-organisational systems. Therefore, this paper focuses on the often neglected but essential ingredient of behavioural change. Behavioural change concentrates on the process change involved in the implementation of the system. Many studies (e.g. Mendoza et al., 2005) have suggested that re-engineering the business process is the most important part of implementing an inter-organisational technology. To fully achieve more information and knowledge sharing, organisations need to enact behavioural changes to foster collaboration. One way to promote behavioural change is to support individual action with structures and mechanisms. For example, a well-developed leadership role, high levels of trust, communication and interaction contribute to the concept of collaboration as synergistic, unique and often "unusually creative"(Huxham and Vangen, 2004). In a study of collaboration among supply partners, Boddy et al. (2000) found that actions taken to change aspects of the contextual relationship facilitated more cooperative behaviour. In particular, the improvement of interpersonal relations led to actions to create more formal mechanisms which supported future cooperation and collaboration.

2. METHODOLOGY

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Many previous studies evaluating buyer-supplier relationships and information systems deploy large-scale surveys using a static cross-sectional approach. This method often excludes the process involved in implementation, which is of paramount importance in relationships nurturing collaboration. Alternatively, Schultze and Orlikowski (2004) adopted a 'practice' socio-organizational perspective and examined the structural and interpersonal elements that are produced by everyday activities. The authors contend that adopting a practice lens omits the choice between macro- or micro-level analysis. The authors suggest that a practice lens directs attention to how macro-phenomena are constituted by micro-interactions, and how those micro-interactions, in turn, are shaped by macro influences and effects. In addition, a process-based approach allows the researcher to obtain more insight into the dynamics of the operationalisation, which distinguishes "collaborative technologies" from those based on coercion. A process-based methodology can examine the change occurring during various stages of implementation and impact from all the participants.

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The design of this study combined multiple forms of investigations including literature analysis; empirical studies and observations through a field study methodology. This field study approach consisted of deploying two questionnaires complemented by observations and interviews during interim periods of the initiation and implementation process of a collaboration project. These questionnaires were designed to investigate the main contributing factors to the partnership based around constructs shown to be significant in previous studies and validated through a pilot study involving one group of supply network participants *(further details in McNichols and Brennan, 2007)*. In order to investigate the dual perspectives of the dyadic relationship, this study examines the supply

network participants of both buyers and suppliers. All the participants were then grouped according to their dyadic relationship.

During the system implementation, the author observed twelve workshops involving the supply network. The majority of these meetings involved facilitation to build commitment and overcome any barriers blocking the progress of the collaborative initiatives and system use. Methods to build commitment included dedicated workshop sessions to: open up a dialogue for communication; idea generation; action planning; improvement project support; and forums to promote reflection practice and knowledge sharing. This workshop program ran concurrent with each phase of the project and system implementation. The author evaluated each phase to determine the key events influencing commitment intention and each actor's level of involvement *(further details in Middel and McNichols, 2006)*. To triangulate the evidence, the author compiled the minutes and facilitators' reports from all the cases in order to document the participants' involvement and commitment during the implementation process. By incorporating multiple sources of evidence, this study allows the data to converge in a triangulating fashion (Stoecker, 1991).

2.1 Empirical Data

The empirical data consists of three supply networks, each comprising a systems integrator and three or four existing suppliers. A system integrator (SI) is defined as a company that integrates components provided by suppliers. The suppliers were wide ranging, from small enterprises (50) to medium enterprises (up to 250) and were pre-selected by the system integrator. All these firms were participants in an EC-funded project called Collaborative Improvement Tool for the Extended Manufacturing Enterprise (Co-Improve). This academic-industry research project spanned the period from 2001 to 2004 and consisted of Dutch, Danish and Italian manufacturing-supply networks.

The Dutch System Integrator (SI) specialises in 'Motion Control'-systems for different markets, such as the automotive, truck, marine, medical and agriculture market. The company has mounted a strategic objective to produce zero-defect products together with the lowest total cost from world-class suppliers based on quality, cost and delivery. The suppliers selected by the system integrator to participate in the project all represent different types of relationships and deliver different categories of products (see Table 1). This selection allows information and communication to pass freely throughout the group without running the risk of revealing sensitive information to competitors.

	Dutch System Integrator	**Dutch 1**	**Dutch 2**	**Dutch 3**	
Description	Manufacturer of automotive hydraulics	Supplier of plastic parts	Supplier of precision parts	New supplier of cylinder-tubes	
Employees	> 700	200	55	160	
	Danish System Integrator	**Danish 1**	**Danish 2**	**Danish 3**	
Description	Manufacturer of mobile hydraulics	Supplier of metal parts	Supplier of foundries	Supplier of metal parts	
Employees	> 7500	80	250	65	
	Italian System Integrator	**Italian 1**	**Italian 2**	**Italian 3**	**Italian 4**
Description	Manufacturer of Aeronautical components	Supplier of surface metal parts	Supplier of structural components	Designer of manufacture prototypes	Supplier of metalworking & treatments
Employees	>1800	200	800	14	30

Table 1 Description of the Companies in the Co-Improve Project

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With more than 7.000 employees and 21 factories in North America, Europe and East Asia, the Danish System Integrator is among the largest manufacturers and suppliers of mobile hydraulics in the world. This global manufacturer produces hydraulic components and electronics to Original Equipment Manufacturers (OEM) of mobile machines within the agriculture and construction industries. The Danish integrator selected these suppliers due to their strategic significant however there was limited history of collaboration or IOS integration. Similarly, the Italian System Integrator is a large manufacturer of aircraft and sub-systems for the aeronautical industry in both the military and civilian markets. This firm's products are designed and assembled by the large aircraft consortia players. The suppliers for this project were chosen for the purpose of developing more integrated, collaborative relationships.

The technical architecture of the Co-Improve Software is a bespoke system based on TCP/IP protocols. The Co-Improve Software is a Web based product, with Java Server Pages (JSP), and HTML code. The software architecture is a three-tier solution: Web-client, software company platform, and Oracle database. This web-based portal only requires a web browser with 128-bit encryption capability to gain access to the secure server hosted by the software company. The aim for the Co-Improve software is to require zero installation and integration. To support the implementation of the software system and collaboration between participants, a formal intervention programme was established in all three networks over a period of eighteen months through a cycle of fifteen to eighteen workshops. These workshops were organised through mutual consent with the participants on a monthly basis, schedules permitting. The workshops were aimed at engaging companies in collaborative improvement activities, involving processes of diagnosing, fact-finding, implementation and evaluation of improvement actions. This series of workshops were designed to involve all the participants and immerse the firms in a learning environment to promote collaborative improvement projects and software system use.

3. FINDINGS

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The main purpose of the study is to evaluate the implementation dimensions that influence the impact of collaboration in buyer-supplier relationships. To this end, the author produced a 'case predictor-outcome matrix' (Miles and Huberman, 2004) to arrange the cases according to the impact of collaboration. As illustrated in Table 2, this matrix provides data from each case based on the main enablers and implementation variables identified as important contributors to the impact of collaboration. In total, sixteen separate indicators were combined to assess the perceived level of change from each participant. Interestingly, once the author compiled the total amount of perceived changes across all the variables, the respondents naturally fell into three distinct categories: *high change; medium change;* and *low change*. The first category (high change respondents) reported the greatest improvement during the system implementation with an increase across all the change variables from 20 to 30. Next, the moderate change group indicated a medium increase in total change between 10 and 20. Finally, the low change respondents reported only limited changes (if any) from 0 to 10.

One proposal of this study is that the level of impact achieved during the system implementation is directly related to the extent of change in communication behaviour, namely *quality of communication*, *information sharing* and *behaviour change*. During implementation, communication behaviours were found to be highly correlated to the impact from the collaborative system. This is most apparent when comparing the high/ moderate impact dyads to the low impact dyads. To verify, a nonparametric test measured the correlation between behavioural change and the five impact variables. A summary of the Spearman R correlation coefficient results show correlation is significant at the 0.01 level between behaviour change and four variables: *trust change*, *relationship change*, *knowledge sharing* and *process change*. In addition, a strong correlation (significant at the 0.01 level) was found between quality of communication change and *relationship change* and *goal sharing change*. Further results reveal correlation at the 0.05 significance level between quality of communication change and *trust change* as well as *process change*. Another correlation test examined the relationship between information sharing and the impact variables. The strongest relationship correlation (significant at the

0.01 level) was found with *trust change*, *knowledge sharing*, and *process change*. There was also a correlation (significant at the 0.05 level) with *relationship change*, and *goal sharing change*.

To determine the extent of impact, two categories were evaluated:

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1. Performance Impact:
    - *Efficiency improvement* was often associated with sustaining or increasing involvement coupled with an improvement in all the communication behaviour indicators.
    - P*rocess change* is related to levels of involvement, strength of commitment and all the communication behaviour change indicators.

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2. Relationship Impact:
    - *Relationship change* is linked to trust change, improvement in quality of communication and active involvement in the project.
    - *Knowledge sharing* is closely associated with information sharing, trust change and behavioural change.
    - *Trust change* is associated with higher levels of involvement, change in all three communication behaviours and strengthening commitment.
    - *Goals sharing change* was low, however the two dyads reporting most change had 'problem solving' conflict resolution approach and a substantial quality of communication increase.

Overall, the strongest indicator of the level of impact relates to three enablers (or disablers): *commitment*; *involvement* and *conflict resolution approach.* A strengthening of commitment and high level of involvement is associated with a moderate (or high) relationship change, trust change and process change. This implies that the cooperation element (as expressed through commitment and involvement) leads to trust change, relationship change and process improvement. Furthermore, the 'functional' conflict resolution approaches of problem solving and persuasion were more apparent in the dyads achieving the highest impact. In contrast, the avoidance of conflict resolution was exclusively consigned to the low impact dyads.

Dyads / Scope of Impact	Enablers (or Disablers)			Communication Behaviours			Impact of Collaborative Project					
	Commitment (*Change*)	Involvement (*Change*)	Conflict Resolution Approach	Information Sharing	Behaviour Change	Quality of Communication Change	Performance Improvement	Process Change	Relationship Change	Trust Change	Knowledge Sharing	
High Impact												
Danish 1	Strengthen	high ⇨ high	problem solving	mod/high	mod.	mod.	mod/ high	mod/high	mod	mod.	mod/high	
Danish 3	Strengthen	mod ⇨ high	persuasion/ problem solving	mod.	High	mod/high	mod.	mod.	mod/high	high	low/mod	
Moderate Impact												
Italian 2	Strengthen	high ⇨ mod/high	persuasion	low/mod	low/mod	mod/high	low	mod.	mod.	low/mod	low	low/ mod
Italian 3	Strengthen	high ⇨ high	persuasion	low	low/mod	mod.	low	low/mod	mod.	mod.	low/mod	none/ low
Italian 1	status quo	high ⇨ high	persuasion	mod/high	mod.	low/mod	mod.	mod.	none/ low	low	mod./high	low
Italian 4	status quo	high⇨ mod/high	persuasion	low/mod	low/mod	mod.	low/ mod	none/low	mod.	mod.	low	low
Low Impact												
Danish 2	status quo	mod ⇨ mod	persuasion	none	none/low	mod/high	low/ mod	low/mod	low/mod	none	none	low/mod
Dutch 1	reduction	high ⇨ mod	avoidance	low	Low	low/mod	low	low	none /low	none	none	none
Dutch 2	status quo	low ⇨ low	avoidance	low	None	none/low	low	low	none	None	none/ low	none
Dutch 3	reduction	low ⇨ low	avoidance	low	none/low	decrease/low	none	low	none	none/ low	none/ low	none

Table 2. Case Ordered Matrix: Enablers & Communication Behaviours Related to Impact of Collaborative Project

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4. DISCUSSION

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The literature provides little guidance in terms of methods for evaluating the impact of collaboration in supply chain systems. Contrary to some literature (Huxham and Vangen, 2005; Kanter, 1994), who classify the attainment of any benefits as collaborative advantage, the empirical findings suggest the existence of interim categories of collaborative improvements. Specifically, collaborative initiatives can lead to different levels and types of improvement without necessarily attaining a collaborative advantage. Overall, three patterns emerged that characterised the impact from collaborative initiative projects – *inertia, improvement* or *strategic advantage*. Interestingly, the findings revealed no significant differences in the pattern of impact among the four types of relationships categories (as outlined in Figure 1). Notably, each category of relationship contained 'inertia' and 'improvement' levels with no evidence of any relationships progressing to the 'strategic advantage' stage. A strategic advantage entails obtaining a sustainable collaborative advantage over competitors (Kanter, 1994). This supports Bensaou's (1999) findings who concluded that there was not one single category of buyer-supplier relationships who outperformed the others.

Firstly, the low change group (four dyads) revealed collaborative inertia since they were found to be relatively unproductive with minimal impact during the project. Their results suggest that the project did not achieve a level of operational advantages or impact from collaboration within their relationship commensurate with the resources expended. Of the four dyads, three were found in the Dutch network and one in the Danish group. Notably, all these dyads were also characterised as having a stable (or decreasing) degree of commitment and stagnant (or weakening) participation levels in the project. This provides support for Huxham and Vangen (2005) argument that 'collaborative inertia' is often the outcome from collaborative situations.

Secondly, the medium and high change groups (six dyads) achieved slight, moderate or significant levels of outcomes resulting in varying degrees of *collaborative improvement*. This indicates that the project had an impact on the trading relationships in terms of operational efficiency and possibly relationship improvement, however not necessarily a strategic gain. In the Danish 3 case, a purchasing agreement was signed for the first time providing some evidence of the relationship progressing towards attaining a strategic advantage. However, it is not surprising that this level of strategic advantage was not attained, given the limited timeframe of the project study.

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This study adds substance to the notion that communication problems are associated with a lack of success in strategic partnerships (Mohr and Spekman, 1994; Monczka et al., 1998). The findings imply that without communication behaviour change from both participants during the project, collaborative improvement does not materialise and inertia sets in. the implementation of relationships requires a reinforcement of behaviours that generate trust, mutual goals and adaptation, and other critical variables in the creation of a strong relationship. This offers further support for the correlation of collaborative success with a high level of perceived change in relationship and trust change. The significance of trust change during the project, corresponds to Huxham and Vangen's (2004) notion of a 'trust building loop', in which trust can be built incrementally via successful implementation of modest collaborative initiatives. In summary, these implementation findings suggest that behavioural change, quality of communication change, information sharing, and trust change are all correlated with the impact of collaboration within buyer-supplier relationships. Therefore, the evidence supports that a higher level of change in the communication behaviour during implementation will lead to greater impact on collaboration within buyer-supplier relationships.

Furthermore, three key enablers surfaced during the successful relationships: *involvement*; *commitment*; and *conflict resolution* approach. Firstly, higher involvement was found to be an important ingredient to producing a corresponding level of behavioural change during the implementation phase. The participants engaged in repeated interaction thereby increasing amounts of time and effort devoted to the relationship. Secondly, this study discovered a strengthening degree of commitment during the project was a significant indicator of the level of collaboration achieved. Interestingly, this is

irrespective of the commitment level displayed at the beginning. The key success factor was how much the particiapnts' level of commitment changed during the implementation. This strongly concurs with Kwon and Suh's (2004) assertion that accomplishing commitment is a key success factor in achieving supply chain integration.

Finally, the findings concur with other studies (e.g. Mohr and Spekman, 1994; Monczka *et al.*, 1998) that a higher use of *constructive conflict resolution* techniques including persuasion and joint problem solving, as opposed to 'smoothing over' or 'avoiding' issues, leads to successful partnerships. However, an additional discovery revealed the most extraordinary change within each type of relationship had a constructive conflict resolution coupled with an appropriate level of intervention to match the requirements of the relationship (i.e. project coordination and information sharing). This evidence supports Bensaou's (1999) assertion for the need to match the management of resources deployed to the relationship requirements in order to move towards a successful buyer-supplier partnership.

Overall, there were substantial obstacles to collaboration during the software system implementation. Most of the suppliers had the impression that this was another way of implementing cost reduction and quality programs. Furthermore, participants were constantly struggling with balancing operational priorities and devoting energy to this software system and collaborative project.

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5. CONTRIBUTION TO PRACTICE

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Deleted: Overall, there were substantial obstacles to collaboration during the software system implementation. Most of the suppliers had the impression that this was another way of implementing cost reduction and quality programs. Furthermore, participants were constantly struggling with balancing operational priorities and devoting energy to this software system and collaborative project. ¶

The key findings from this study can assist supply chain managers and industry practitioners. In a practical context, the outcome of this research can provide assistance in designing collaborative projects through selection of appropriate supply chain partners and improvement initiatives. In particular, this research offers some insights into implementing a successful collaborative improvement project. A manager seeking to deploy a collaborative improvement program needs to be aware of the criticality of the implementation process in order to encourage cooperation and trust through interactions. To achieve a successful impact from collaborative improvement requires facilitation to support the launch and progression of process and relationship initiatives. Problems arise when communication between the two parties is weak and the mutual benefit of the project is not reiterated at regular intervals. In particular, the management approach needs to:

1. Establish an intervention program that facilitates behavioural change amongst the participants;
2. Promote active participation and involvement in both buyer and supplier participants;
3. Maintain or build commitment in the project and partnership;
4. Intervene with a conflict resolution approach suitable to each relationship context.

Interestingly, the study found that any type of relationship (including market-oriented) can produce 'collaborative improvement' from instigating supply chain systems. However, the key for managers is to establish an appropriate intervention program to cater for each relationship type. Managers need to be cognizant of the intervention program which involves coordination and conflict resolution, information and knowledge exchange, and dedicated resource allocation. To appropriately manage a collaborative improvement project, the intervention level required varies according to the complexity of the relationship. Table 3 can be used by managers to identify the level of intervention necessary to match each relationship. Similar to Bensaou's (1999) assertion there are two paths to supply chain relationship failure: *under-designed* and *over-designed* relationships. For instance, in a market-oriented relationship only minor intervention is required to match the lower complexity but the potential collaborative improvement is limited. Any further intervention is ill-advised since it is over-resourced when compared to potential value. In contrast, a collaborative partnership requires intensive management intervention although it offers the potential to achieve a significant level of behavioural improvement.

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However, if the collaborative objectives are not achieved, the high intervention requirements can lead to a diminished return on investment.

Complexity of Buyer-Supplier Relationship ↑	Low (Laissez-faire)	Medium (Top Down)	High (Immersive)
Collaboration	Under-designed	Under-designed	Match
Coordination	Under-designed	Match	Match
Cooperation	Under-designed	Match	Over-designed
Market-Oriented	Match	Over-designed	Over-designed

Management Intervention Requirements

Table 3. Matching Intervention Requirements with Complexity of Relationship

After matching the intervention requirements, managers should select the most appropriate type of improvement initiatives based on the positioning of each relationship. Lower category relationships (market-oriented & cooperation) are advised to focus on incremental, process-based initiatives. The higher categories (coordination & collaboration) can strive for behavioural change through strategic collaborative initiatives. By limiting the project to the most appropriately chosen partners and initiatives, managers can reduce the risk of failure as so often occurs during the implementation process of collaborative projects.

In summary, this study uncovered many similarities in all three supply networks during the implementation process of the collaborative system. Notably, the findings highlighted the key intervention requirements for decision-makers to successfully implement a collaborative supply chain system. In particular, it revealed the criticality of the management intervention when attempting to instigate a collaborative supply chain system.

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Dyads / Scope of Impact	*Enablers (or Disablers)*			*Communication Behaviours*			*Impact of Co*		
	Commitment *(Change)*	Involvement *(Change)*	Conflict Resolution Approach	Information Sharing	Behaviour Change	Quality of Communication Change	Performance Improvement	Process Change	Relationship Change
High Impact									
Danish 1	Strengthen	high ⇨ high	problem solving	mod/high	mod.	mod.	mod/ high	mod/high	mod
Danish 3	Strengthen	mod ⇨ high	persuasion/ problem solving	mod.	High	mod/high	mod.	mod.	mod/high
Moderate Impact									
Italian 2	Strengthen	high ⇨ mod/high	persuasion	low/mod	low/mod	mod/high	low	mod.	mod.
Italian 3	Strengthen	high ⇨ high	persuasion	low	low/mod	mod.	low	low/mod	mod.
Italian 1	status quo	high ⇨ high	persuasion	mod/high	mod.	low/mod	mod.	mod.	none/ low
Italian 4	status quo	high⇨ mod/high	persuasion	low/mod	low/mod	mod.	low/ mod	none/low	mod.
Low Impact									
Danish 2	status quo	mod ⇨ mod	persuasion	none	none/low	mod/high	low/ mod	low/mod	low/mod
Dutch 1	reduction	high ⇨ mod	avoidance	low	Low	low/mod	low	low	none /low
Dutch 2	status quo	low ⇨ low	avoidance	low	None	none/low	low	low	none
Dutch 3	reduction	low ⇨ low	avoidance	low	none/low	decrease/low	none	low	none

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