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131. Inter-Organizational Systems (IOS) for Supply Chain Management (SCM): A Multi-Perspective Adoption Framework

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Abstract

There has been no framework developed, to date, that has been found to examine an Inter-Organisational System (IOS) for Supply Chain Management (SCM) from supplier and customer perspectives. This paper proposes such a framework and then uses four theories, namely resource dependency theory, organisational theory, actor-network theory and negotiated order theory, to understand how the framework supports management collaboration and interaction in the adoption of an IOS. This adoption framework is proposed to better study how senior management staff, from both supplier and customer perspectives, collaborate and interact in the IOS adoption process. The framework has been constructed from the literature identifying six major aspects for consideration namely: inter and intra organisational collaboration; strategic management approaches; supply chain design (SCD); business process redesign/reengineering (BPR); information systems (IS)/information technology (IT) architecture and external environmental factors. Understanding the interaction of management from customer and supplier perspectives in the adoption of an IOS for SCM, makes a significant contribution to knowledge in this area.

Keywords: Inter-Organisational (Organizational) Systems (IOS), Supply Chain Management (SCM), Strategic Management, Collaboration, Business Process Reengineering (BPR)

Introduction

> *"What does it take for two organisations to collaborate successfully when adopting an Inter-Organisational System (IOS) for Supply Chain Management (SCM)?"*

To answer this question, we look at the literature and develop an IOS for SCM adoption framework (that incorporates the customer and supplier perspectives) as well as analyse four theories: resource dependency theory; organisational theory; actor-network theory (ANT) and negotiated order theory to better understand the implication of the adoption framework. For simplicity of argument this paper examines a typical supplier-customer relationship using the IOS for SCM adoption framework, but we acknowledge that more than two organisations are normally in a supply chain network.

Premkumar (2000) discusses issues related to an integrated IOS in SCM, and highlights the potential benefits and management issues, and provides implementation guidelines. A number of studies such as Grover (1993), and Premkumar and Ramamurthy (1995) focus on factors that influenced the adoption of an IOS. Kurnia and Johnston (2000) use both factor and processual approaches to give a better understanding of IOS adoption. Teo et al. (2003) use institutional theory to explain how mimetic, coercive, and normative pressures could influence the intention to adoption an IOS. A few studies, such as Rahim et al. (2002) and Johnston et al. (2004), have examined the adoption of an IOS from both customer and

supplier perspectives. No framework to date has been proposed, however, to examine an IOS for SCM adoption in a supplier-customer relationship.

A theoretical framework is proposed within this paper that outlines six major aspects of IOS for SCM adoption namely: inter and intra organisational collaboration; strategic management approaches; supply chain design (SCD); business process redesign/reengineering (BPR); information systems (IS)/information technology (IT) architecture and external environmental factors. It is argued that an effective IOS for SCM adoption is influenced by a supplier-customer relationship; for instance, Frohlich and Westbrook (2001) find there is virtually no adoption of an IOS in the service industry. Furthermore, Bunker et al. (2007) recently explored and illustrated the need to recognise and act on the nature and influence of different perspectives in IS adoption.

This paper is limited to the management factors involved in the supply chain domain but acknowledges that other employees in the organisation also have their contribution to the adoption process. Management has an important role to play because they have the authority to approve the project, provide financial support and power to influence the required change and re-structure of the organisation (Markus 1983).

This paper is arranged in the following order: (a) discussion of the four proposed theories on which the adoption framework is based; (b) introduction and examination of the background of SCM and IOS; (c) construction of an IOS for SCM theoretical adoption framework; (d) discussion of each of the six aspects of the framework; and (e) conclusion and discussion the framework limitations and areas of future study.

Underlying Theories for an Understanding of IOS for SCM Adoption

Four theories, namely; resource dependency theory; organisational theory; actor-network theory; and negotiated order theory, are used as the underlying theories by which to understand and apply the IOS for SCM adoption framework. This framework supports how management collaborate and interact during the adoption process and so the four theories form the framework context (explained in detail in Section 0 of this paper) as it applies to different organisational cases. These theories will now be discussed in turn.

Resource Dependency Theory

Resource dependency theory provides "a holistic approach with explicit recognition of economic and socio-political dimensions of trading partner relationships" (Ratnasingham and Kumar 2000, p.547). Resource dependency theory is used to study how inter-organisational relationships help an organisation to better manage its resources and uncertainty (Koch 2002). However, supply and demand of resources can lead to the dominance of a buyer or supplier in a supply chain network (Cox 2001). In turn, supply and demand of resources can lead to an imbalance in a power relationship between suppliers and customers (Ratnasingham and Kumar 2000). This paper argues that resource dependency and power relationships influence management's decision in the adoption of an IOS for SCM.

Organisational Theory

Organisational theory has been used extensively to study organisations but the theory has also been used to study the relationships between two or more organisations (e.g. Bensaou and Venkatraman 1996). Literature usually focuses on structural characteristics (e.g.

centralisation, formalisation and complexity) and behavioural process characteristics (e.g. power and conflict) (Bensaou and Venkatraman 1996). We argue that structural and behavioural characteristics of managers influence the adoption of an IOS for SCM (Lambert et al. 1998). It has been argued that "a major limitation is that researchers have simply extended or adapted constructs from a within-organization setting to an across-organization level without articulating their distinct role or benefits in the new level of analysis" (Bensaou and Venkatraman 1996, p.85). This paper uses actor-network theory, therefore, to compensate for this limitation.

Actor-Network Theory (ANT)

ANT is proposed to examine the interaction between "actors", namely managers, within an organisation and in a supplier-customer relationship. One of the strengths of ANT is that people and technologies are considered as actors, and are examined together as a social-technical network: "modern affiliations among individuals, groups, and organizations entail the use of ICTs to varying degrees; therefore, all networks can be viewed as heterogeneous socio-technical actor-networks" (Lamb and Kling 2003, p.202). ANT "seeks to position itself firmly in the middle of the spectrum between technological and social determinism" (Rose et al. 2005, p.139). The proposed theoretical framework allows researchers to examine how people influence the adoption of technologies and how technologies influence people.

ANT allows the study of interaction between managers (people) as well as the IOS (technology). Like "actor SAP" described by Hanseth and Braa (2000 cf. Rose et al. 2005) in their study, IOS is a "powerful actor and an ally in getting the change process moving". While ANT has its strengths, it also has its limitations: "… whilst technology becomes an independent actor in its own right, no distinction is made between the agency of technology and humans" (Rose et al. 2005, p.139).

Negotiated Order Theory

"According to negotiated order theory, organizations negotiate the terms under which they will interact with one another in the future" (Nathan and Mitroff 1991, p.165). Negotiated order theory is used extensively in the behavioural science literature to study inter-organisational collaboration: "negotiated order theory thus focuses on the symbolic and perceptual aspects of interorganizational relationships, particularly on the evolution of shared understandings among stakeholders of the domain's structures and processes, limits and possibilities" (Gray and Wood 1991, p.10). We apply this theory to examine the interactions between different stakeholders to address a shared problem or cause; in the case of this study, adopting an IOS for SCM (Nathan and Mitroff 1991).

Collaborative negotiation allows managers to express their interests and needs, and negotiate their differences and changes required to make the collaboration work. Incremental collaborative negotiation helps to build commitment from managers (Westley and Vredenburg 1991). Furthermore, negotiation happens at both intra and inter-organisational level. The negotiation outcomes (with another organisation) have to be sold to managers (in various departments) within an organisation.

In order to understand how these four theories form the background to our proposed adoption framework, the next sections (3 and 4) of the paper will firstly define SCM and IOS, before examining the IOS for SCM adoption framework in Section 0.

Supply Chain Management (SCM)

"Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders" (Lambert and Cooper 2000, p.66). The benefits of SCM include improved productivity and operational efficiency; reduced inventories, operating costs, processing error and processing time (Lee et al. 1997; Frohlich and Westbrook 2001). Information sharing in a supply chain network is recognised as a way to overcome the *bullwhip effect*, which is defined as, "the phenomenon where orders to the supplier tend to have larger variance than sales to the buyer (i.e. demand distortion), and the distortion propagates upstream in an amplified form …" (Lee et al. 1997, p.546).

In a supplier-customer relationship in a supply chain network, it is important to understand who (supplier or customer) drives the flow of goods. Demand Chain Management (DCM) is defined by Frohlich and Westbrook (2002, p.729) as, "practice that manages and coordinates the supply chain from end-customers backwards to suppliers". DCM is a pull-process, i.e. the demand to buy goods is driven by the customers, whereas SCM is a push-process where the suppliers want to sell or push their goods to their customers (Frohlich and Westbrook 2002).

Inter-Organisational Systems (IOS)

The benefits of SCM can be realised if organisations integrate their business processes and information systems together (Frohlich and Westbrook 2001). An IOS is a solution for SCM as "an automated information system shared by two or more companies … An IOS differs from an internal distributed information system by allowing information to be sent across organisational boundaries" (Johnston and Vitale 1988, p.144). In an IOS environment, shared information is expected to be kept in quality, correctness, completeness and reliability otherwise the "garbage in, garbage out" adage applies (Toppen et al. 1998).

An IOS for SCM Adoption Framework

Authors such as Premkumar et al. (1997) and Iacovou et al. (1995) have published extensively in the area of IOS adoption. We propose that many managerial factors have an influence on the adoption process and this paper proposes a framework to allow researchers to examine and study how managers collaborate with their partners to: propose and execute a strategy; redesign a supply chain; redesign and reengineer business processes; and develop IOSs.
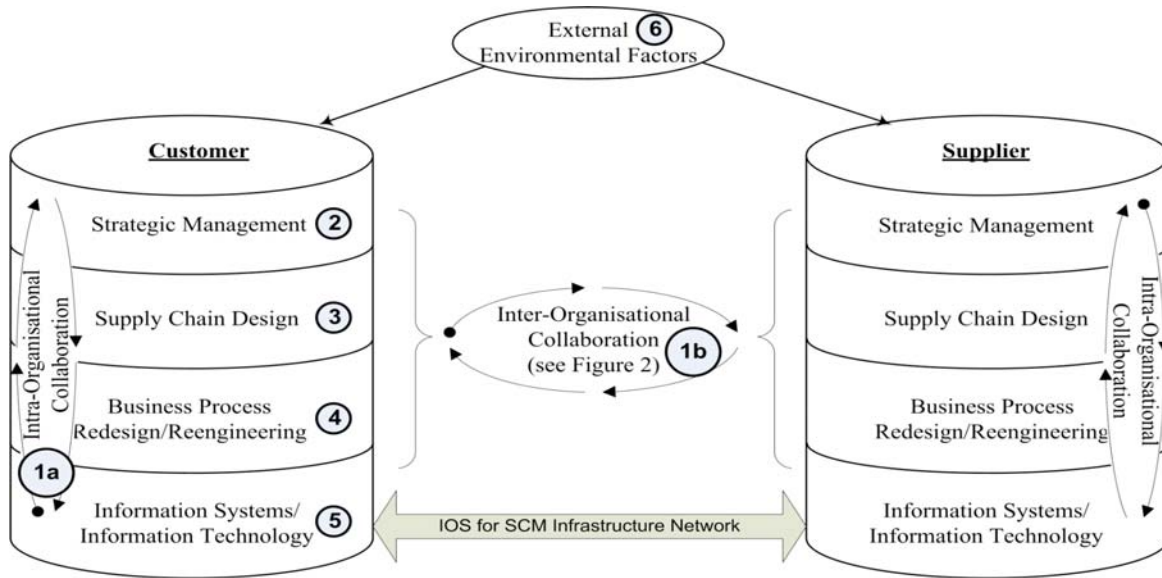
Figure 1: IOS for SCM Adoption Framework

For an IOS to function in SCM, it is "not only important to align the external partners' business strategies but also to look inward and redesign internal control systems and performance measures to ensure the success of these systems" (Premkumar 2000, p.64). Within an IOS for SCM adoption framework (see Figure 1) common aspects are identified (and numbered) as (1) collaboration ((a) intra- and (b) inter-organisational); (2) strategic management approaches; (3) supply chain design (SCD); (4) business process redesign/ reengineering (BPR); (5) inter organisational systems (IOS); and (6) external environmental factors. The issues addressed by the various aspects of the framework are assumed to be the same for both supplier and customer's management teams.

Inter-organisational collaborative activities (1b) are expanded further to study how parties collaborate at strategic, process and technical levels as illustrated in Figure 2. The numbering in Figure 2 reflects the numbering of aspects of managerial collaboration identified in Figure 1.
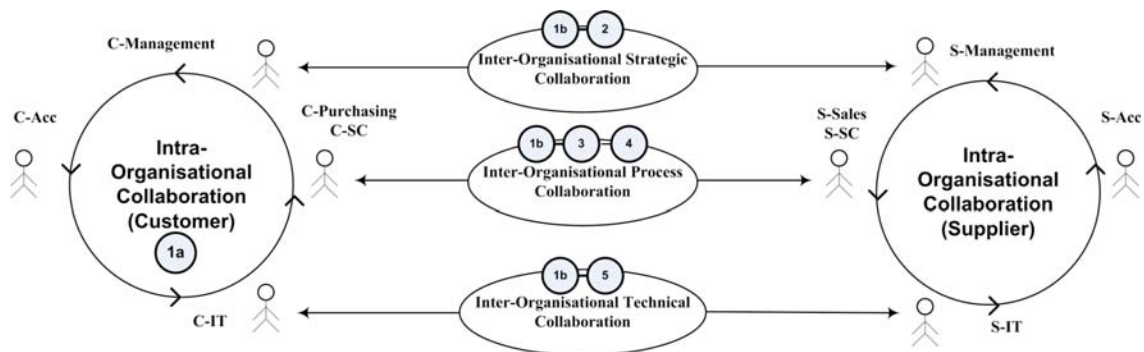
Note: C-SC and S-SC include supply, planning, logistics, manufacturing, warehousing etc...

Figure 2: Intra- and Inter-Organisational Collaboration

Table 1 presents a summary of what are considered to be the most important IOS adoption aspects that need to be addressed when organisations collaborate. These aspects and the

associated adoption factors in Table 1 are now addressed, discussed and justified for their presence in the framework.

Table 1 Important Aspects of IOS Adoption and Associated Factors

Aspects of Adoption	Adoption Factors (and References)
Strategic Management (for IOS adoption)	Financial benefits (cost savings) (Gunasekaran and Ngai 2004; Pang 2005)
	Needs and Motivation (Pang 2005)
	Resource Dependency (Koch 2002)
	Power (Iacovou et al. 1995; Teo et al. 2003; Premkumar et al. 1997)
	Inter-organisational relationship (Koch 2002)
	Trust (Hart and Saunders 1997; Lambert et al. 1998; Barratt 2004)
	Selecting a Partner
	Organisational Characteristics (Premkumar et al. 1997; Iacovou et al. 1995)
	Top Management Support (Premkumar et al. 1997; Grover 1993)
	Organisational Culture (Love and Gunasekaran 1997; Pang 2005)
	Value Added (Short and Venkatraman 1992; Porter 2001)
IS/IT Issues	IS/IT readiness (Iacovou et al. 1995; Premkumar et al. 1997)
	Selection of technologies and infrastructure (Gunasekaran and Ngai 2004)
	Development choice, e.g. in-house or third party (Premkumar 2000)
	Lack of IT Personnel (Gunasekaran and Ngai 2004)
External Environmental Factors	Competitor (Cavaye and Cragg 1995; Premkumar and Ramamurthy 1995)
	Professional and Business body (Teo et al. 2003)
	Government (Damsgaard and Lyytinen 1998)

Collaboration

For a supplier and a customer to adopt an IOS for their supply chain network, they must collaborate to (re)design their supply chain, change their business processes and (re)designed their systems. Collaboration is an important step for organisations when they want to revamp their supply chain network to adopt an IOS (Barratt 2004; Pang 2005).

Among researchers, there are various perspectives on the meaning of "collaboration"; collaboration is defined in this paper as, "the action of working with someone to produce something" (Oxford 2004). Collaboration is the process that links people within an organisation and across organisations to "produce something" which, in this case, is the implementation and adoption of an IOS for its SCM. The success of Dell's "Direct model" is linked directly to collaborative activities in communicating and forming relationships with its 1,400 suppliers but Dell admits that the establishment of collaboration with its suppliers is an uphill battle: "it takes a lot of hand-holding just to get the ball rolling" (Gilbert 2000).

The characteristics of collaboration in SCM are closer relationships, integrating processes, and the sharing of information, knowledge, risk, benefits and profits between organisations (Barratt 2004). It has been demonstrated, however, that to collaborate between organisations in a supply chain network is not an easy task (Barratt 2004). We classify collaboration as shown in Figure 1 (1a) *intra-* and (1b) *inter-organisational* collaboration.

(1a) Intra-Organisational Collaboration
Intra-organisational collaboration is described as the communication and interaction activities between actors in an organisation. Actors within an organisation (say, in this case the customer) include the top management team, departmental management and employees

working in departments presented as C-Management, C-Purchasing, C-SC and C-IT as shown in **Figure 2**. Some departments such as the Accounts department (C-Acc or S-Acc) might not be involved in the collaboration process directly but their input (e.g. cost-benefit analysis) or action might indirectly influence the action taken by managers from other departments within an organisation.

A fully functional IOS requires different managers from various departments within an organisation to work together: "… direct personal contacts across functions, liaison roles at each unit, cross-functional task forces, [and] cross-functional project teams" (Clark and Fujuimoto 1987, cf. Reich and Benbasat 2000). Research suggests that intra-organisational relationships can be problematic and a lack of communication, understanding or a reluctance to share information between departments may become a barrier to the adoption of an IOS.

(1b) Inter-Organisational Collaboration

On the other hand, an *inter-organisational collaboration* is an external communication and interaction between managers from different organisations (e.g. Dept C-Purchasing and Dept S-Sales shown in **Figure 2**). Inter- and intra-organisational collaborations are not isolated processes but one continuous communication and interaction process within an organisation (1(a)) and between organisations (1(b)) as shown in **Figure 2**. A prior strong inter-organisational relationship between organisations will have a strong influence on inter-organisational collaboration. Having an inter-organisational collaboration with a partner can influence the decisions taken within an organisation.

In **Figure 2**, inter-organisational collaboration is classified as strategic, process and technical based on who are involved in the facets. For instance, in the case of *inter-organisational strategic collaboration* (1a-2), we argue that an inter-organisational collaborative strategy is developed through collaboration between the management (C-Management and S-Management) from both parties. The three levels of collaboration are described as:

(a) ***Strategic Collaboration*** (1b-2): This is the collaboration between top and senior management from both parties. They discuss and develop a collaborative inter-organisational strategy that satisfies both parties.

(b) ***Process Collaboration*** (1b-3-4): This is the level where both parties have to collaborate to redesign the supply chain network and reengineer the business processes so they will fit both parties. Managers within an organisation, such as C-SC and C-IT, facilitate SCD and BPR through *intra-organisational collaboration*. At the same time, these managers collaborate across organisations with their partner such as C-SC and S-SC to design an inter-organisational supply chain solution and business processes. Hence, both intra- and inter-organisational collaboration, such as in the case of C-SC, are happening simultaneously and continuously for SCD and BPR.

(c) ***Technical Collaboration*** (1b-5): This is the technical collaboration to develop an IOS and supply chain infrastructure network between the IT departments (C-IT and S-IT) from both parties. Intra-organisational collaboration is expected between the IT and other departments, such as between C-IT and C-SC, to develop the systems.

Organisational theory and ANT can be used to enlighten us as to the behaviour, structure, interaction and influence between the managers within an organisation and with their partners. The outcome of the collaboration is for the managers to agree on an inter-organisational collaborative strategy that can be executed by both parties. Negotiation ordered theory is used to study the interaction between the managers as part of the negotiation process.

(2) Strategic Management

To effectively adopt an IOS for SCM an organisation must have a strategy. By way of a detailed example of how the IOS for SCM adoption framework can be applied, this paper will now examine the strategic management aspect of the framework in detail. Factors that can influence strategic management, as well as an application of the 4 theories in the IOS for SCM adoption process will be highlighted. Porter (1996, p.68) defines strategy as "the creation of a unique and valuable position, involving a different set of activities", and argues the essence of strategy is differentiation and choosing different sets of activities to achieve different values (Porter 1996). Table 2 gives a summary of the background of strategic management for an IOS adoption, key people in the development of a strategy and the overall strategic approach. The adoption factors are summarised in this section because we argue that the management has to support the adoption process before it can be executed. The application of the theories for the framework is addressed in Section 0.

Table 2 Summary (2) Strategic Management for IOS Adoption

	Issues/Factors	Description
2	**Strategic Management**	
	Background	
	Authors such as Porter (2001) argue the use of technologies such as EDI-based or Internet-based enable the strategy to provide competitive advantage; examples include Baxter Healthcare, American Airlines and Wal-Mart (Short and Venkatraman 1992).	
	Key People	
	Top Management, Senior Management, Project Leader (and Project Champion)	
	Purpose of an IOS strategy	
	An inter-organisational collaborative strategy is developed to fit the goals, needs and objectives from both parties. The strategy includes changes to business processes and the adoption of appropriate infrastructure and technologies.	
	Strategy Approach	
	No specific IOS adoption strategy is suggested in the literature and studying strategy in an IOS environment is complicated because it involves at least two organisations. We believe, however, we that the *systemic* approach as described by Whittington (1993) is the most appropriate approach because the on one hand, it focuses on profit and on the other hand, we can examine the social elements such as power which managers within and external to the organisation have to address.	

Factors that Influence Adoption of an IOS for SCM

By way of illustration some of the strategic management adoption factors for an IOS (presented in Table 1) are now summarised in Table 3. It is necessary to examine these adoption factors from both supplier and customer perspectives in order to understand how each of these factors lead to a successful adoption of an IOS for SCM.

Table 3 Factors that Influence the Adoption of an IOS for SCM

	Factors	Description
a	**Financial Benefits**	Organisations with the most to gain from "SCM vs. DCM" (as discussed) are more likely to be the ones motivated to develop a collaborative strategy. Reduced inventories, operating costs and processing error are examples behind the drivers of adopting an IOS (Frohlich and Westbrook 2001).
b	**Needs and Motivation**	An organisation must have interests, needs and motivation to collaborate with their partners to adopt an IOS for SCM (Pang and Bunker 2005; Supply Chain Council 2002).
c	**Resource Dependency**	Supply and demand of resources can lead to a dependency between a supplier and a customer. However, customers might not want to "lock-in" and depend on one supplier using its IOS because this hampers competition among its suppliers even when there is a clear financial benefit (Clemons and Row 1992). Resource dependency theory can be used to explain the drivers behind the adoption of an IOS and hence organisations with the most to gain are more likely to have these drivers in place.
d	**Power Relationships**	Resource dependency as discussed in (c) can lead to the dominance of a buyer or supplier in a supply chain network; this can lead to imbalance of power relationships between a supplier and a customer (Cox 2001). For example, Ford's strategy was to use its coercive power to lock in its suppliers to its proprietary network and inhibit them from trading with their competitors; thus, sharing information with its suppliers is not a reason behind the adoption (Webster 1995). The role of power can lead to different IT outcomes (Jasperson et al. 2002).
e	**Inter-organisational relationships**	Koch (2002) discusses inter-organisational relationship as a network, an alliance and resource dependency between organisations (c). Bensaou and Venkatraman (1996) develop a conceptual framework to understand inter-organisational relationships from information processing needs and capabilities. Oliver (1990) comes up with six contingencies for organisations to establish an inter-organisational relationship and they are (Oliver 1990; Koch 2002, p.69): • Necessity: firms enter relationships to meet necessary legal or regulatory requirements. • Asymmetry: firms enter relationships to exercise power or control over another organizations or its' resources. • Reciprocity: firms enter relationships to pursue common goals. • Efficiency: firms enter relationships to improve their internal input/output ratio. • Stability: firms enter relationships to respond to environmental uncertainty. • Legitimacy: firms enter relationships to appear in agreement with the prevailing norms.
f	**Trust**	Trust is developed between the organisations and trust can help to reduce uncertainty during IOS development; trust can include competence, openness, reliability and caring relationships (e.g. providing help and training). (Hart and Saunders 1997; Lambert et al. 1998).
g	**Selecting a Partner**	Selecting a right partner to collaborate with in a supply chain is mandatory and the selection criteria include; reliance of resources (c); power relationship (d); previous inter-organisational relationship (e); and trust developed between the organisations (f).

Application of Theories to the IOS for SCM Framework

The four theories and their application to the framework are summarised in Table 4. Researchers use these theories as the basis to study how managers interact and collaborate at a strategic level to adopt an IOS for SCM.

Table 4 Application of Theories

Theories	Description
Resources Dependency	Resource dependency theory is used to examine the influence of resources in the development of an IOS based on the relationship of an inter-organisational dependency between suppliers and customers. Resource dependency helps us to understand the "formation of interorganisational linkage [which] helps an organisation acquire resources and manage uncertainty" (Koch 2002).
Organisational and ANT	Two organisations are likely to have two different strategies and directions; thus, these strategies might not always be compatible with each other. This may result in an organisation having to start from one strategic approach and then change to a different one in order to achieve its objectives or to compromise its position with partners. The changes might be linked to physical constraints, incompatible systems or resisting change from partners. ANT helps to understand the interaction and influence from different managers within an organisation and between different organisations. ANT is also advantageous in the study of the formation of inter-organisational relationship and how inter-organisational relationship influences organisations to collaborate to adopt an IOS.
Negotiation Order	The power dominance resulting from resource dependency will influence the negotiation process between a supplier and a customer. The negotiation between managers will result in an outcome in inter-organisational collaboration. On the other hand, an intra-organisational collaboration influences the decision making within an organisation which in turn influences the decisions taken with its partners. Two organisations are expected to negotiate IOS issues, resolve their differences and comprise to find a common ground that lead to a proposed IOS collaborative strategy. It has been suggested to set up ground rules, e.g. trading terms, between organisations to avoid future conflict (Hammer 2001).

Having looked in detail at the strategic management aspects of the adoption framework as an example to explain its application, we will now briefly look at the other aspects of the framework in turn. Each of these aspects can be expanded (similarly to strategic management) for illustrative purposes when the framework is described in full.

(3) Supply Chain Design (SCD) and (4) Business Process Reengineering/Redesign (BPR)

An organisation and its partners have to collaborate and work together to redesign, reengineer and streamline common business processes to build a "superefficient" supply chain network (Hammer 2001). This is important because, "competition no longer means one company competing with another company – it means an entire supply chain competing with another supply chain" (El Sawy 2001, p.45).

These aspects (SCD and BPR) are tightly linked. SCD is the (re)design of a supply chain by integrating the flow of information, movement of goods and business processes such as production planning, inventory control, distribution and logistics (see Beamon 1998). SCD is influenced by other framework aspects such as selection of a strategy, the maturity of the technology infrastructure, level of collaboration, and the level of information sharing agreed between organisations. In turn, BPR is influenced by level of business processes which organisations willing to reengineer. In a real world situation, the original design of a supply chain might require further modification due to unforseen technological problems or business issues.

First of all, SCD depends on the selection of an IOS strategy, i.e. it influenced by this aspect of strategic management. Different SCM strategies, such as Just-In-Time (JIT), Zero Inventory (ZI), Efficient Consumer Response (ECR), Vendor Managed Inventory (VMI) or Continuous Replenishment Process (CRP), influence the design of an IOS for SCM.

Once SCD is aligned with a strategy, the business process modelling must fit the SCD in an IOS environment. To fit the SCD in an IOS environment, existing business processes have to be remodelled or reengineered. Hammer (1990) introduces the idea of "reengineering"; and with Champy (1993, p.32), they enhance the concept of BPR as, "fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed".

An organisation has to reengineer its business processes with their partners based on SCD to achieve the IOS functions - this is sometimes also known as "process X-engineering" (Champy 2002 cf. in Attaran 2004). Similarly, an organisation has to change and streamline its internal business processes to maximise the benefits of IOS (Hammer 2001; Short and Venkatraman 1992). An important point here is that organisations should understand their own processes first before attempting to understand their partners (Frankel et al. 2002). Without achieving BPR at the intra-organisational level, the benefits for an IOS might not be achieved at the maximum level. Intra- and inter-organisational collaboration between management will help drive BPR at the organisational level as well as at the inter-organisational level.

SCD and business modelling will lead to requirements for system and infrastructure development for an IOS. A process-oriented model such as the SCOR (Supply Chain Operations Reference) model could be used for both supply chain and process design; SCOR has been used as a designing tool as well as to identify, define and link business processes within an organisation (Supply Chain Council 2003). Furthermore, the SCOR model is used by large global manufacturers such as Coca-Cola and Unilever.

The inter- and intra-organisational collaboration is a continuous communication and interaction within an organisation and between customer and supplier which leads to enhance business processes. BPR has to fit both perspectives. The departments have to firstly agree to reengineer their intra-organisational processes within an organisation; and secondly, the inter-organisational processes have to fit with their partners' business processes. The enhanced business processes have to fit the new IOS for SCM, and vice versa.

BPR also has to consider employees within an organisation because changes are implemented for the employees but also by the employees. One of the negative aspects of BPR and systems implementations is that employees may be afraid of losing their jobs which lead to resistance to change (Markus 1983). Therefore, "the most successful reengineering projects direct attention to social design and process transformation …" (Teng et al. 1998, p.96). Examples of identified social design include defining jobs and incentives, developing and fostering shared values, and designing change management programs.

(5) IS/IT (in IOS) Factors
This paper does not focus on physical infrastructure or networking design of an IOS but the basic issues of constructing an IOS are addressed. Examples of an IOS include e-procurement

and EDI-built systems. IS/IT readiness is a major factor that influences IOS adoption (Iacovou et al. 1995; Premkumar et al. 1997). Technical compatibility could be a challenge for the organisations (Premkumar 2000) but with the advancement of technologies such as the Internet, portal and web services technologies, building an IOS for SCM is less troublesome than in the past (Attaran 2004; Frohlich and Westbrook 2001).

The physical architecture design of an IOS includes primary technology choice, client/server architecture and the nature of linkages (Premkumar 2000; Gunasekaran and Ngai 2004). Furthermore, depending on the strategy (e.g. with a single partner or with multiple partners) and the development costs, mean that an organisation has a choice of developing and implementing an IOS by way of: (a) an in-house team; (b) a third-party; (c) a purchased or packaged solution; (d) a combination of the options (a), (b) and (c) (Premkumar 2000). Finding personnel with essential skills to develop an IOS could also be a barrier for management, whilst another obstacle may be financial, where organisations have to invest capital to redesign their own internal systems as well as the IOS with their partners (Gunasekaran and Ngai 2004).

(6) Effects from the External Environment

The external environment also influences the IOS adoption process. An organisation might be pressured by its competitors within its industry to adopt an IOS (Cavaye and Cragg 1995; Premkumar and Ramamurthy 1995). Alternatively, an industry professional and business body might influence all of its members to adopt IOSs in a supply chain network or marketplace in order to improve the overall efficiency and effectiveness of that industry (Teo et al. 2003). Furthermore, a government might influence the level of awareness and adoption of IOS for a particular industry by providing funding and support for the development of an infrastructure (Damsgaard and Lyytinen 1998).

Conclusions, Limitations and Future Research

In summary, this paper develops an adoption framework to study the interaction between two different organisations and their management when adopting an IOS for SCM. This paper also recognises that the non-management members of an IOS project team have an important part to play in the adoption and implementation process overall, but that the model needs significant further development to include these roles.

The IOS for SCM adoption framework in this paper illustrates a one-to-one supplier-customer relationship. In the real world, supply chain networks are different for different industries; hence, different sets of adoption factors are expected to influence different industries (Pang 2005). We propose that a researcher must have an open-mind and "expect the unexpected" when using this theoretical framework. For example, if an organisation decides not to change its business process, then its partner might have to find an alternative way to work around the problem to find a different solution that might not be documented.

Depending on objectives of the future research, this IOS for SCM adoption framework could be applied to a case study, multiple case studies or used in an empirical study, in a selected industry or multi-industries to explore managers' views and understanding of IOS adoption from both customer and supplier perspectives. Focus on different dimensions of this adoption framework is expected to produce different research study results. Different actors (managers and employees) in the framework might have different perspectives in the adoption process.

The perspective of customer benefits might be different from those of a supplier. The way to execute a strategy within an organisation might be different from the approach to execute a strategy with its partners. An organisation might have the controlling power over its employees but the power over its partners might be different and delicate. Capturing the complexity of the IOS adoption process will help to further broaden our understanding of the dynamic nature of IOS for SCM and the interaction between managers (and their decisions) in the adoption process.

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