E–Collaboration Technologies and Organizational Performance: Current and Future Trends

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Chapter 8
Understanding the Progressive Nature of Inter–Organizational Systems (IOS) Adoption

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ABSTRACT

Inter-organizational Systems (IOS) cannot be adopted by any organizations in isolation from their trading partner. Their adoption requires cooperation and collaboration between trading partners and, therefore, is reliant on the nature of relationships between the parties involved. For organizations to progress in their IOS adoption, improvement in relationships between trading partners is required before they can adopt a more sophisticated IOS. In addition, through IOS adoption, trading partners can actually improve their relationships overtime. There has been some research that investigates relationships and how organizations progress from one level to the next level of adoption. However, these studies do not clearly define the concepts of relationship, IOS adoption and IOS adoption maturity. Furthermore, they do not adequately justify the exclusion of other variables in defining the relevant concepts and are not theoretically based. This research extends the Kurnia and Johnston (2000) process model of IOS adoption by incorporating the notion of IOS adoption maturity and reducing the scope from a supply chain to a dyadic level to enable better evaluations of IOS adoption progression. We argue that with the proposed model, the dynamics of IOS adoption maturity can be better examined empirically.

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INTRODUCTION

Inter-organizational Systems (IOS) are automated information systems, which are shared by two or more companies (Cash and Konsynski, 1985). Examples of IOS include Electronic Data Interchange (EDI) and Collaborative Planning, Forecasting and Replenishment (CPFR). Many organizations adopt IOS to improve their supply chain management. IOS offer organizations substantial benefits such as reduced inventory costs, elimination of redundant handling of data entries, improved scheduling, processing and distribution of goods and improved information accuracy, to name a few (Premkumar and Ramamurthy, 1995; Mentzer, 2004). IOS have become a strategic weapon for some organizations to obtain competitive advantage and have shifted competition from single firms competing individually to supply chains competing against other supply chains (Birou, Fawcett and Magnan, 1998; Lambert and Cooper, 2000).

Despite these benefits, many companies face difficulties in adopting these systems because such implementations are highly reliant on trading partners’ existing relationships which often are not favorable (Kurnia and Johnston, 2003). IOS adoption requires credible commitment of participating firms to work collaboratively to achieve common objectives and goals. Because of the inherent complexity in IOS adoption, there have been many attempts in the literature to study various aspects of IOS adoption by organisations (Kumar and Van Dessel, 1996; Damsgaard and Lyttinen, 1998; Saeed, Malhotra and Grover, 2005). Some studies (see for example, (Webster, 1992; Meier, 1995; Kumar and Van Dessel, 1996; Saeed et al., 2005; Ham and Johnston, 2007) indicate that unfavourable relationships often exist among trading partners, which makes IOS adoption difficult.

Realizing the importance of relationships in IOS adoption, there have been an increasing number of studies investigating Interorganizational (IO) relationships. For example, some studies examine IO relationship factors or aspects that contribute to adoption failures or success (Hart and Saunders, 1997; Ibrahim and Ribbers, 2006; Nagy, 2006), while others classify relationship types based on relationship intimacy and IOS types based on integration and then match levels of relationship intimacy with the levels of IOS integration (Choudhury, 1997; Shah, Goldstein and Ward, 2002; Redonodo et al, 2009). More recently, researchers do not only examine the interaction between relationship types and IOS types but also investigate how organizations move from lower levels to higher levels of intimacy of relationship and integration of IOS types (Ham and Johnston, 2007).

While there are some studies that shed light on how organizations can move or progress from a less sophisticated to a more sophisticated IOS based on relationships, it is difficult to base an empirical investigation on this work. This is because these studies are not theoretically strong and do not include, or justify the exclusion of, other factors such as organizational capabilities to investigate maturity or progression of IOS adoption.

Over the years, various frameworks have been developed within the IOS adoption field. For example, Damsgaard and Lyttinen (1998) examine IOS using micro, meso and macro level of analysis, Kumar et al. (1998) classify IOS studies as technical, economical or socio-political, Ramanathan and Rose (2003) explain the IOS adoption research in the form of stages. While these frameworks help us obtain a general understanding of the field, they do not emphasise the importance of time in the study of IOS adoption.

Kurnia and Johnston (2000), using IOS adoption of Efficient Consumer Response (ECR) as an example, present a process model of IOS adoption that includes a set of factors and also considers the role of time in IOS adoption. Their model has the potential to complement other studies that examine IOS adoption maturity. Their process model suggests that through dynamic interactions among industry/supply chain players, organizations...
modify their capabilities and technology vision in the course of adoption of a particular IOS. The model suggests broadening the scope of study to include both an individual organization and its inter-organizational environment (supply chain and/or industry) and extends the period of study in order to better capture the dynamic interaction among the industry players, which occur during the IOS adoption.

While the Kurnia and Johnston process model could be employed to investigate the notion of progression in IOS adoption, it would pose a challenge for empirical research since the model proposes the inclusion of an organization and its inter-organisational environment as the unit of analysis, which is practically difficult to achieve and the data produced would be difficult to interpret due to the complexity involved (Kurnia and Johnston, 2000). Therefore, in this paper, we modify the Kurnia and Johnston model by reducing its scope from a supply chain to a pair of organizations (dyadic level) and also refining the model to incorporate the idea of maturity of IOS adoption, which is necessary to obtain a complete picture of IOS adoption. It is important to note that even though our model is dyadic, we still consider the industry influence because IOS implementations cannot be completely understood without including industry variables in the study.

Our proposed model shows that during the course of IOS adoption, organizational capabilities and the nature of technologies can improve over time through better relationships between the two organizations. This, in turn, results in the ability of the two organizations to adopt a more sophisticated IOS, which further improves the relationships. We also argue that over time, this IOS adoption progression phenomenon occurs because of the reciprocal influences between the nature of trading partner relationship and the IOS adopted. Based on our model, we finally outline a number of propositions to be tested for further empirical studies.

In the next section, we present a summary of the Kurnia and Johnston study and highlight its limitations. We then discuss our proposed dyadic model of IOS adoption maturity. Next we justify the exclusion of some factors identified in previous studies. Finally, three propositions are formulated based our model and the paper is concluded.

THE KURNIA AND JOHNSTON IOS ADOPTION MODELS

Based on the taxonomy of Markus and Robey (1998), Kurnia and Johnston (2000) classify IOS studies according to the factor approach and process approach. This classification is useful not only because it highlights the theoretical inadequacies of the factor approach but also shows the importance of expanding the unit of analysis and the role of time in studying IOS adoption. The factors based studies assume that IOS adoption is determined by a number of predicting variables identified at a particular point of time. These studies examine (a) the nature of technology, (b) characteristics of the organization, and (c) some conditions in the environment of the adopting organization in order to predict adoption.

The first group of factor studies that have investigated “the nature of technology” has relied on Roger’s (1995) innovation theory as a foundation (O’Callaghan, Kauffman and Konsynski, 1992; Premkumar, Ramamurthy and Nilakanta, 1994; Teo, Wei and Benbasat, 2003). The individual factors include relative advantage, trialability, ease of use (Bouchard, 1993; Premkumar et al., 1994; Premkumar and Ramamurthy, 1995), and perceived risk (O’Callaghan et al., 1992). These studies argue that the more favourable the perceived characteristics of the nature of technology, the more likely the organizations are to adopt (or intent to adopt) the technology. The second factor group, “characteristics of the organization”, includes top management support, availability of the technological infrastructure, size, and structure.
These factors have been commonly regarded to predict adoption or intent to adopt (Premkumar and Ramamurthy, 1995; Premkumar, Ramamurthy and Crum, 1997; Chwelos, Benbasat and Dexter, 2001). The last factor group suggests that certain conditions that exist in the external environment of the focal organization may affect the decision to adopt an IOS (Grover, 1993; Premkumar and Ramamurthy, 1995; Segars and Grover, 1995). These factors include industry concentration (Grover, 1993; Segars and Grover, 1995), power (Hart and Saunders, 1998) and competitiveness (Premkumar et al., 1997).

The factor based studies (refer to figure 1) adopt a firm-centric perspective, which suggests that organizations do not have a strong influence over their environment and these studies do not account adequately for the fact that the action of firms changes their conditions over time (Kurnia and Johnston, 2000).

On the other hand, the process approach suggests that an organization’s implementation decision is an ongoing process of assessment and re-assessment of adoption aspects. The processual approach posits that the factors alone are insufficient to explain adoption without understanding the processes which are undertaken by the adopting organizations (Kurnia and Johnston, 2000). The Kurnia and Johnston process model represents a transition from the factor approach and is based on empirical evidence from the Australian grocery industry. They argue that the complex interaction between supply chain members in the process of adopting the IOS occurs over time and it is necessary to include the industry players as part of the unit of analysis. Thus, because organizations have an influence over their environment, they are able to change their conditions over time.

As illustrated in figure 2, the Kurnia and Johnston process model proposes the existence of two-way causal links (process) among actions of organizations, interorganizational environment (supply chain structure), nature of technology, and capability of the organizations. External factors are beyond the control of the organization, which include unpredicted demand, declining competitiveness and the political environment. They argue that the actions of the focal firm is not only influenced by the nature of technology, capability of organizations and environment factors but also modified by mutual interactions of the focal firm with its supply chain structure. The supply chain structure consists of the players, power relations, economic relations, communication relations, trust, and partnerships (Gregor and Johnston, 2001). This approach provides a better understanding of the way organizations adopt an IOS by investigating their industry structure, capturing the changes of technology and the role of organization in the process (for example, Damsgaard and Lyytinen, 1998). While the Kurnia and Johnston IOS process model has advantages, it is challenging to use for empirical investigation because the model
suggests the inclusion of supply chain players as part of the unit of analysis, which is in practice difficult to achieve and the complexity involved may create barriers to the interpretations of the findings. Moreover, this model does not explicitly capture the concept of IOS adoption maturity and hence may not be sufficient in exploring the IOS progression phenomenon.

To help investigate the IOS adoption maturity concept, in this study we modify the Kurnia and Johnston process model and propose a new model which explicitly incorporates the notion of IOS progression. Furthermore, the scope of the proposed model is reduced from a supply chain level to a dyadic level. It is important to note that even though we refer to the model as dyadic, we do not completely eliminate the industry structure from the proposed model. In other words, organizations are not independent from industry forces, which have to be included to understand how the industry affects organization’s decisions to adopt a particular system. The dyadic level is justifiable because: (a) our main objective is to conduct future case studies that investigate the maturity concept in IOS adoption, and by reducing the scope to a dyadic level we believe that we are able to better show how pairs of organizations move from one level of IOS adoption to the next level, (b) adoption decision is a fundamental activity between two organizations in a supply chain or a network (Nagy, 2006). For example, CPFR is generally being implemented by pairs of organizations (VICS, 2006) (c) focusing on the dyadic level permits researchers to advance further and faster (Iacobucci and Hopkins, 1992) in understanding complex IOS adoption phenomena and (d) by considering a dyadic level, we can also incorporate the industry influence in our study.

Therefore, using the theoretical concepts of Kurnia and Johnston, we propose a dyadic IOS adoption maturity model that retains the richness of their model while making empirical research into IOS adoption progression more feasible.

A DYADIC MODEL OF IOS ADOPTION MATURITY

The dyadic model is based on the concept that an IOS adoption is reliant on two organizations agreeing to use an IOS. Therefore, instead of studying one focal organization and its arbitrary trading partners we look at two particular organizations: organization (A) and its trading partner (B). As shown in the figure 3, organizations A and B have their own capabilities, their own perceptions of the nature of technology and their own actions. The part of the industry structure consisting of the dyad is now viewed as consisting of two elements: (a) relationships between the two organizations, and (b) other relationships within the rest of the supply chain players which are now viewed as external factors. The perceptions of organizations A and B of the nature of technology (arrows b) and their capabilities (arrows h) may enable or inhibit organizations’ actions to use the IOS (arrows f) and alter the dyadic relationship (arrows c). The two organization’s actions may modify their perceptions (arrows a) and improve their capabilities (arrows g) through various interactions with each other, their relationships, external environment and IOS sophistication. Furthermore, the dyadic relationship (arrows d) and external environment (arrows p) mediates organization actions to use the IOS (arrows f). IOS sophistication also affects the two organizations’ dyadic relationships mediated by organization actions (arrows c) because of routinized structured communication facilitated by the IOS sophistication (Cannon and Perreault, 1999). The new constructs of the simplified dyadic model are explained below.

Dyadic Relationships

The nature of dyadic relationships is defined in terms of common relational variables (Heide, 1994; Rinehart, Eckert, Handfield, Page and Atkin, 2004) identified from the interorganizational (IO) relationship and IOS literature. The three
defining relational variables that are the most frequently cited and investigated in the literature are trust, goal congruence and dependence. They are explained below:

1. Trust

Trust has been the most commonly investigated variable in the IO relationship literature. Trust is the belief that a trading partner will act in another party’s interest and will not behave opportunistically if given the chance to do so (Dwyer et al., 1987). The measures (sub-variables) of trust reported in the literature are reliability (see for example, Kumar et al., 1995b; Chow and Holden, 1997; Dyer and Chu, 1997; Zaheer et al., 1998), predictability (see for example, Crosby et al., 1990; Ganesan, 1994; Kumar et al., 1995a; Kumar et al., 1995b; Lush and Brown, 1996; Doney and Cannon, 1997), credibility (Ganesan, 1994; Doney and Cannon, 1997; Heide and John, 1992, Kumar et al., 1995a; Leonidou et al., 2006; Ulaga and Eggert, 2006; Palmatier et al., 2007), fairness (Kumar et al., 1995b; Dyer and Chu, 1997; Zaheer et al., 1998; Bejou et al., 1996, Doney and Cannon, 1997), trustworthiness (Johnston et al., 1993; Wray et al., 1994) and benevolence (Heide and John, 1992; Moorman, 1993; Heide, 1994; Ganesan, 1994; Kumar et al., 1995a).

These sub-variables have not been made distinct in all the articles. For example, Lendinou et al. (2006) do not have sub-variables of trust. In their study, trust has been regarded as a single dimension. However, from their survey items it can be inferred that their trust variable refers to benevolence and fairness. In other articles, the sub-variables of trust cannot be inferred because the authors did not specify their trust items or the items were too general (see, for example, Wray et al., 1994; Zineldin, 1995; Leuthesser, 1997; Selnes, 1998; Baker et al., 1999; Jap et al., 1999; Van Bruggen et al., 2005).

The importance of trust has also been emphasized in the IOS adoption literature also (see for example, (Hart and Saunders, 1997; Kumar et al., 1998; Karahannas and Jones, 1999; Ratnasingam, 2000; Saunders et al., 2004; Ibrahim and Ribbers, 2006). A number of IS studies have measures the various dimensions (sub-variables) of trust outlined above: benevolence (Jones and Bowie, 1998;
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Kumar et al., 1998; McCutcheon and Stuart, 2000; Ratnasingam, 2000; Carson et al., 2003; Gallivan and Depledge, 2003; Akkermans et al., 2004; Ratnasingam et al., 2005; reliability (Carson et al., 2003; Ibrahim and Ribbers, 2006; Kumar et al., 1998), integrity (Jones and Bowie, 1998; Kumar et al., 1998; Ratnasingam, 2001; Carson et al., 2003; Ratnasingam, 2003) and predictability (Kumar et al., 1998; Carson et al., 2003).

In this study, trust is measured by the reliability, capabilities and benevolence of trading partners, which are believed to capture the other sub-variables of trust used in the literature.

2. Dependence (Power)

Dependence is closely related to the concept of power. When one party is more dependent on the other party (for instance, for sales or purchases), it creates power (Anderson and Narus, 1990; Heide and John, 1988; Dwyer, Schurr and Oh, 1987; Ganesan 1994). In other words, organizations are limited in their ability to obtain or produce all resources making them dependent on their partners and others in the environment to acquire some resources (Pfeffer and Salancik, 1978). Dependency is an important characteristic of a relationship and influences a party’s degree of long-term orientation (Anderson and Narus, 1990).

IO relationship studies have also looked at how power imbalance affects trading partners’ relationship (Narus and Anderson, 1990; Johnston et al., 1993; Heide, 1994; Kumar et al., 1995b; Stock et al., 2000; Hibbard et al., 2001). Moreover, studies have gone further to investigate how the use by companies of their power over less powerful suppliers affects their relationship (Kumar et al., 1998). Van Bruggen et al. (2005) differentiate interdependence into three types: total, relative and customer dependence and examine the impact of each type on the quality of the relationship.

In an asymmetric relationship, when there is a powerful party, the dominant party can easily influence the less powerful party to abide by its terms and conditions and force it to adopt the system. This is the most commonly investigated type of dependence in the IOS literature (for instance, see Holland, 1995; Chan and Watman, 1999; Teo et al., 2003; Nagy, 2006) because this is usually the norm in any relationship structure. When there is a balanced power relationship and one of the parties is unwilling to implement the IOS, the initiating organization may implement the system with the reluctant organizations’ rivals. This may put competitive pressure on the unwilling organization and force it to implement the system. In the literature this type of pressure is commonly referred to as mimetic pressure (DiMaggio and Powell, 1983). More specifically, mimetic pressure occurs when an organization is forced to change its action over time in order to become similar to its rivals (DiMaggio and Powell, 1983). Teo et al. (2003) found empirical evidence of a link between organizations’ IOS adoption decisions and mimetic pressure. In this study, dependence is measured in terms of how costly a firm finds it to switch to other organizations, criticality of sales or purchase volume, the importance of maintaining social association, and the need to maintain good relationship with its partners (Heide, 1994; Kumar et al., 1995; 1998; Teo et al., 2003), which are believed to cover all the sub-variables of dependence in the literature.

3. Goal Congruence

Goal congruence refers to alignment of the goals of different components of an organization. In a dyadic or supply chain context, goal congruence is achieved when firm’s goals coincide with the goals of their trading partners. Goal congruence is regarded as a key component in establishing successful trading partner relationships (Jap, 2001; Lejeune and Yakova, 2005). IOS studies also recognize the importance of congruence in estab-
lishing partnerships. Some of the sub-variables of goal congruence include alignment of organizational cultures and size (Chen and Williams, 1998), goal compatibility (Bensaou, 1998; Ham and Johnston, 2007), and IT compatibility (Hendon, Nath and Basu, 1995; Kearns and Lederer, 2001; Lu, Huang and Heng, 2006). In this study, we define goal congruence as the extent to which the goals of two trading partners are aligned with each other. Goal congruence is determined by the extent to which two organizations support each other’s goals, compatibility and similarity of goals (Jap, 1999; Jap and Anderson, 2003), which are believed to capture the other sub-variables of goal congruence used in the literature.

The level of dyadic relationship is based on the degrees of trust, dependency and goal congruence. In other words, the higher the degrees of trust, goal congruence and dependence, the higher the intimacy level of the dyadic relationship of the two organizations.

**IOS Sophistication**

In the Kurnia and Johnston model, the outcome construct is called “IOS adoption”, which implies that the IOS system may or may not be used. As such, this definition will not serve the purpose of this study because maturity of IOS adoption is based on prior experiences with the IOS use. Therefore, in this study we rename this construct to “IOS sophistication” which refers to the actual use of particular IOS and not intention to use.

In this study we also adapt Ham et al (2003) differentiating variables to measure the levels of IOS sophistication. These authors provide a comprehensive framework that differentiates the types of IOS technologies. They use levels of complexity and commitment as variables to organize the different types of IOS. Depending on the complexity (the extent of standardisation required), IOS can be categorized into four types: coordination, cooperation, collaboration and integration initiatives. They provide examples for each type. For instance, an EDI is an example of a coordination type of IOS and Continuous Replenishment Program (CRP) is an example of a cooperation type of IOS. The commitment type of IOS includes standardization of infrastructure as well as operational, tactical and strategic levels of business processes. They argue that as complexity increases, the commitment required by organizations also increases. Since Ham et al.’s (2003) model can clearly differentiate the different types of IOS, the variables that are used to define the types/levels of IOS sophistication in this thesis have been built from their study.

While Ham et al. (2003) provide a description of each of the IOS types, the names of the two variables involved (extent of standardisation and complexity) do not explicitly capture the purpose of the system. Therefore, these two variables are redefined and renamed alignment of business practices and level of organizational (stakeholders) involved. The alignment of business practices shows the purpose of each IOS by specifically highlighting the shared organisational processes of the two organisations. Level of commitment is defined in terms of managerial attention, which does not specifically differentiate the types of IOS. These users of IOS include managers and other personnel at different organisational units such as procurement and warehouse. Thus, the level of organizational involvement variable captures the extent to which these shared practice penetrate to organisation levels other than just managers.

1. Extent of alignment of the two organizations business practices

This variable assesses the extent to which the system aligns the two (or more) organizations business related working practices. For example, EDI aligns procurement practices including ordering and receiving, whereas, CPFR aligns more business practices such as planning, forecasting and replenishment (including ordering and receiving) practices. As two organizations progress from one
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level of sophistication to the next, the extent of alignment accumulates from the lower level to the higher level because more sophisticated IOS generally depend on the existence of more basic IOS. Therefore, we can differentiate between different types of IOS by examining the extent of interoperation between the two organizations.

2. Level of organizational involvement

We define organizational involvement as the extent to which senior hierarchical management functions (operational, tactical, and strategic) are involved in the day to day functioning of the IOS. In other words, the deeper the organizational involvement required by the system, the more sophisticated the system employed. For example, EDI involves operational staff from the two organizations who are typically the personnel that use the information for conducting the procurement function. CPFR involves the tactical staff who are involved in planning and forecasting in the two organizations as well as those operational staff who are involved in replenishment.

Thus, the above two variables are actually related. The more the business practices of the two organizations are aligned by the IOS the higher the functional levels of management are involved, as illustrated above with EDI and CPFR.

A DYADIC IOS ADOPTION MATURITY MODEL WITH TIME AND PERFORMANCE DIMENSIONS

The dyadic IOS adoption model in figure 3 depicts that over time, two organizations would adopt a particular IOS (arrow f in figure 3) that is compatible with their capabilities, perception of the IOS, dyadic relationships and some external factors (arrows b, d, h and p in figure 3). The IOS adopted (arrow e in figure 3) will then improve their own performance and in turn lead to advancements in their capabilities, perception of the IOS and dyadic relationships (arrows a, c, and g). These modifications will enable them to progress to adoption of a more sophisticated IOS. Thus, the different types of IOSs adopted are a result of the various events from the interactions of the two organizations’ actions over time.

To further illustrate the IOS adoption progression/maturity suggested in figure 3 model, we explicitly show the time and performance dimensions involved in the model in figure 4a. The IOS sophistication at different time intervals (t1, t2 and t3) is an outcome of the influence of all the variables, their perceptions, capabilities, dyadic relationships, initial IOS use and some external factors. The model is also driven by performance, which is the result of using the IOS and is regarded as a key factor for organizations to adopt an IOS (Kumar and Van Dissel, 1996; Choudhury, Hartzel and Konsynski, 1998; Frohlich and Westbrook, 2001; Subramani, 2004; Lee and Lim, 2005). In simple terms, organizations would not progress to the next level of adoption maturity, if the current systems did not provide the expected benefits. Performance includes tangible benefits such as Return on Investment (ROI) in the form of reduction in paper flow, less manpower, and reduction in inventory storage and out of stock situations, higher sales and improved service levels and intangible benefits includes improved trading partner relationships and customer satisfaction (Lee and Lim, 2005; VICS, 2007).

The model in figure 4a illustrates that the actions of the two organizations are triggered by the levels of these variables, but organizations can also modify these variables because of the IOS use, which enables them to adopt the next level of IOS (arrows b, d, f, h and p). This process continues incrementally over time due to better performance experienced by the two organizations as a result of IOS use (arrows e). In other words, the changes in the two organizations’ current dyadic relationship, their perceptions of the nature of technology and their capabilities (arrows a, c and g) take place over time (at the individual
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Figure 4. Transition from a) IOS adoption model with overlapping variables to b) IOS adoption maturity model that reduces overlap of variables along time and performance dimensions.
organizational level). The different time intervals (times t1, t2 and t3) are extended snapshots of the alterations in the two organizations’ variables that have to be consistent with each other, and which are mediated by their actions (arrows b, d, h and p) to facilitate the next level of IOS adoption (arrow f). For example, at time t1, the actions of the two organizations are influenced by their perceptions of the nature of technology, their relationships and their capabilities to adopt and implement a particular IOS system such as EDI (arrows b, d, f, h, and p). After time t1, the two organizations’ experience from the system use will influence their actions (organization action time t1+) to modify their perceptions of the nature of technology, their dyadic relationship and their own capabilities. It is important to note that because each organization has its own variables, this alteration process is not an absolute step but may occur incrementally at different time intervals until the two organizations’ variables are consistent with the nature of adoption. Therefore, the two organizations will reach a higher level of IOS sophistication, which is at time tn.

SIMPLIFYING THE DYADIC IOS ADOPTION MATURITY MODEL

Thus far, we have argued that for two organizations to move from one level of IOS sophistication to the next (IOS adoption maturity t1 to t2), their perceptions of the nature of technology, their capabilities, their dyadic relationship and their IOS experiences are modified through the two organizations’ actions. However, there is a problem of including all these variables in an empirical investigation of progression of IOS, because some of the variables overlap with each other when the two organizations progress from time t1 to t2. The interactions between dyadic relationship and IOS sophistication of the two organizations indirectly capture their perceptions of the nature of technology, their capabilities and some aspects of industry structure. As explained earlier, the level of dyadic relationship of the two organizations is defined by the degrees of trust, dependence and partner alignment. These three variables affect perceptions of the nature of technology. For instance, when one of the organizations shows its intentions to adopt the next IOS, their perceptions of the nature of technology is shaped by their dyadic relationship, which is characterised by some level of trust (Kumar and Van Dissel, 1996; Hart and Saunders, 1997; Kumar, Van Dissel and Bielli, 1998; Karahannas and Jones, 1999; Ibbott and Keefe, 2004), dependence (Chwelos et al., 2001; Teo et al., 2003; Nagy, 2006) and goal congruence (Ham and Johnston, 2007).

Furthermore, as explained earlier, unwilling organizations may also be pressured to implement the IOS out of competitive necessity (Teo et al., 2003). They tend to imitate their equal rivals to maintain their social status in the industry and particularly with their partners. This mimetic pressure is related to industry structure. Therefore, by investigating ‘dependency’ as one of the variables, we also examine some aspects of the two organizations’ industry structure.

Also, the initial use of IOS affects the two organizations’ perceptions of the nature of technology and their capabilities for further adoption. For example, the adopted IOS creates the infrastructure for subsequent IOS implementations (Inkpen, 1996; Li and Williams, 1999; Corsten and Nirmalaya, 2005; Ham and Johnston, 2007). When the two organizations adopt an IOS, they are aware of each other’s internal IT infrastructure (Hendon et al., 1995; Kearns and Lederer, 2001), and they also create the initial joint capabilities such as training, defined roles and the existing IOS infrastructure for further implementations. Thus, this suggests that the various interactions
among the variables in the model shown in figure 4a can be well captured and represented entirely by the two new constructs in the model (dyadic relationship and IOS sophistication), and with two-way interactions between them over time. This simplification is summarized in figure 4b.

The model in figure 4b, illustrates that progression of IOS adoption can be adequately explained in terms of the interactions between dyadic relationship and IOS sophistication over time. Thus, we black box other variables because all the complex interactions between the two organizations involving their own capabilities, their perceptions of technologies and some aspects of the external factors, can be summarized in the two-way causal links between dyadic relationship and IOS sophistication (arrows a, b, c, d, e, f, g and h). During IOS adoption maturity at time tn, the dyadic relationship results in the highest level of IOS sophistication and no further progression takes place.

THE PROPOSED DYADIC IOS ADOPTION MATUREY MODEL

In this section, we explicitly show the two-way causal relationship between the dyadic relationship and IOS sophistication derived from the model in figure 4b and present a set of propositions for future work. We simplify our dyadic IOS adoption model by summarizing the various interactions among actions of capability of organizations, perception of technologies and the external factors in the two-way causal links between the dyadic relationship and IOS sophistication constructs. In this way, our final model (figure 5) is based on dyadic level variables. In addition, in this section we focus on the progression in maturity of IOS rather than events over time as represented by the model in figure 4b. In other words, we are underlining the actual major alterations that take place over an extended period because of better performance. Therefore, we transition from a model that includes organizational level concepts developing along a time dimension to a model that is based on dyadic level variables, which develop along an IOS adoption maturity dimension. The model depicted in figure 5 has three main constructs: dyadic relationship, IOS sophistication and IOS adoption maturity. As explained earlier, the dyadic relationship is qualified in terms of level of dyadic relationship (intimacy) that is based on the degrees of trust, dependence and goal congruence, and the IOS sophistication is qualified in terms of level of sophistication, which is composed of the extent to which the system aligns the two (or more) organizations business related working practices and organizational involvement in the IOS use. We define the level of IOS adoption maturity as the highest level to which the dyad has progressed in both dyadic relationship and IOS sophistication.

In addition, Figure 5 illustrates how trading partners progress from one level of IOS adoption maturity to the next level. For instance, IOS adoption maturity at level 1 is achieved when the dyadic relationship reaches level 1 (level 1 dyadic relationship) and the IOS sophistication reaches level 1 (level 1 IOS sophistication). Therefore, to achieve a particular level of IOS adoption maturity, a particular level of dyadic relationship and a particular level of IOS must be achieved first. It is important to note that the level of IOS adoption maturity is the alignment between the two constructs: dyadic relationship and IOS sophistication. In other words, any two organizations are unable to reach a level of IOS adoption maturity if the system is not fully used. When two organizations are in the process of adoption, and their relationship is unfavorable, they would not progress to the next level and would be in between the levels until their relationships improve or they are likely to abandon the initiative and therefore stay at the previous adoption maturity level.

As shown by the arrows in figure 5, the level of IOS sophistication depends on the level of dyadic
relationship and the level of dyadic relationship is also influenced by the level of IOS sophistication. In particular, a certain level of dyadic relationship is a prerequisite to adoption of an IOS at the level of sophistication that is in line with the level of dyadic relationship. The adoption of IOS at a particular level of sophistication, in turn, affects the level of dyadic relationship positively, leading to the achievement of the next level of dyadic relationship, which again feeds back and facilitates the adoption of an IOS at a higher level of sophistication and so on. Thus, with the model, we can illustrate how two organizations progress from one level to a higher level of IOS adoption maturity.

Based on the above discussion, we postulate the following three propositions regarding the progression in IOS adoption. X denotes the maturity level and can range from 1 to n (refer to diagram 5).

**Proposition 1:** Level X IOS sophistication can be achieved only if level X dyadic relationship is achieved.

**Proposition 2:** Level X+1 dyadic relationship is achieved only if level X IOS sophistication is achieved.

**Proposition 3:** Level X IOS adoption maturity can be achieved only if dyadic relationship and IOS sophistication at Level X are achieved.

A level 1 dyadic relationship may be characterized by some level of trust, minimal goal congruence and some degree of dependency. This could result in an IOS sophistication such as an EDI type of system. This level of IOS sophistication is characterized by its ability to automate the process of exchange of business documents such as invoice, purchase order, purchase order change, sales etc. This system involves participants from the operational levels. To progress to the next level of IOS adoption maturity, their experiences from the use of the EDI system improves their dyadic relationship at level 2. The dyadic relationship at this level may be characterized by an improvement in their trust and goal congruence while parties are more dependent on each other. Level 2 dyadic relationship again facilitates the adoption of an
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IOS with a higher level of sophistication. The IOS sophistication at level 2 could be adoption and use of a CPFR system. In terms of the extent of business work practice, such a system is characterized by synchronizing the trading organizations planning functions and helps the development of promotion and sales forecasts, while also provides replenishment plans and facilitates distribution of products based on joint demands. In terms of the level of organizational involvement, such a system requires involvement of personnel such as category managers, logistic planners, demand forecasting managers and key account managers. This system requires involvement of personnel not only at the floor level but also at the middle level such as the logistics manager, logistics planning manager and so on, who are involved with the distribution and logistic functions. Depending on their performance from IOS use and their dyadic relationships, level 2 or level 1 could be the highest level of IOS adoption maturity that the two organizations can achieve. In such a case, there may be no further progression.

ILLUSTRATION OF THE MODEL

In this section we provide a brief discussion of how Wal-Mart and Procter & Gamble progress in their IOS adoption over time (Clark and Lee, 2000; Grean and Shaw, 2002; Seifert, 2003), to illustrate the usefulness of our model. A summary of the progression experienced by these two companies is presented in Table 1.

In 1985, Wal-Mart had P&G online with its EDI solution, their relationship was characterised as being adversarial. Each company was focusing on pushing their own agenda and there was a low level of trust and goal congruence. Eventually by 1988, these two companies decided that if they were going to fully benefit from information

<table>
<thead>
<tr>
<th>Level of IOS adoption Maturity</th>
<th>Level of dyadic relationship</th>
<th>Level of IOS sophistication</th>
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<tbody>
<tr>
<td>Level 1- IOS adoption Maturity (1985)</td>
<td>The relationship was characterised as arms-length, where each company was looking after its own benefits, having a short term focus, and there was no form of collaborative goals. There was lack of trust and goal congruence but with some dependence decided to adopt an EDI system.</td>
<td>The two companies implemented an EDI solution which automated the procurement business practices. The stakeholders that used the systems were operational level stakeholders such as Distribution Centre (DC) personnel, the accounts department and customer service personnel of the two companies.</td>
</tr>
<tr>
<td>Level 2- IOS adoption Maturity (1992)</td>
<td>The implementation of an EDI helped the two improve their dyadic relationship. Their level of trust and goal congruence increased from the previous level. P&amp;G and Wal-Mart developed a common vision to improve their efficiency and effectiveness. With this vision in mind, they wanted to build stronger collaborative initiatives to attain the highest benefits, leading to the introduction of VMI.</td>
<td>P&amp;G and Wal-Mart adopted Vendor Managed Inventory (VMI). VMI allows P&amp;G to access Wal-Mart’s inventory, monitor its inventory flow and takes decisions on order quantities and shipping. In other words, P&amp;G is responsible for the entire replenishment of Wal-Mart. The involved stakeholders included not only the previous level but now also the replenishment managers of the two companies.</td>
</tr>
<tr>
<td>Level 3- IOS adoption Maturity (1996)</td>
<td>With an improved dyadic relationship because of the use and realising the increased benefits of VMI, Wal-Mart was the first to introduce and implement CPFR.</td>
<td>Wal-Mart and P&amp;G extended their VMI to implement CPFR and it included sharing of POS data for joint planning and forecasting for better replenishment. This system also included processes to monitor supply chain performance. The involved stakeholders not only included the previous two levels but also promotion managers, demanding planning managers and supply chain directors of the two companies.</td>
</tr>
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technology, they would have to collaborate and improve their relationship.

During this period, they initiated a joint Wal-Mart/P&G team to lay long term plans to achieve mutual goals for them. After various ramifications of both IT and business processes and after years of joint planning and discussions, these two partners realised the best way to improve supply chain activities is to share information to reduce inventory and deliver goods more efficiently (Clark and Lee, 2000).

In 1992, their improved relationship paid off when they fully implemented Vendor Managed Inventory (VMI) as part of the Continuous Replenishment Program (CRP) because this system requires disclosure and sharing of information, which requires trust. The function of this system was to basically allow P&G to control inventory based on the data from Wal-Mart’s distribution centre (DC). This improved the flow of P&G products into Wal-Mart’s stores which resulted in reduction of out of stock, improved customer level, and reduced lead times. This also increased the two parties’ dependence because they were more reliant on each other than before.

Having improved their level of dyadic relationship because of VMI, Wal-Mart and P&G moved to the next level of sophistication. In 1998, they progressed to CPFR, which is an extension of VMI. This system is based on POS data, joint planning and forecasting. The system synchronises both their planning and forecasting data and then assists with replenishment decisions. Wal-Mart has implemented CRP and CPFR with its critical customers such as P&G, whereas EDI is being used with most of its supplier base because if a company would like to join Wal-Mart’s suppliers club, they have to be EDI compliant (Wal-Mart, 2008).

CONCLUSION

In this paper, we modify the Kurnia and Johnston (2000) IOS adoption process model by reducing its scope to a dyadic level and also extend it by introducing the concept of progression of IOS adoption. We introduced and defined three new constructs; “dyadic relationship”, “IOS sophistication” and “IOS adoption maturity”. By defining the IOS sophistication construct, we can differentiate between different types of IOS, which can serve as a measuring tool for future IOS studies. This is an essential step because most IOS adoption studies assume that IOS technologies are one general type of system and do not highlight the distinctive characteristics of different systems. For example, IOS studies that have investigated EDI systems, often assume that the same results apply to other types of IOS. Moreover, by distinguishing different IOS systems and assessing the link with the previous adoption of a less sophisticated IOS, we can also better understand and investigate IOS adoption maturity that evolves over time.

In addition, reducing the scope of the Kurnia and Johnston model has many research benefits: (a) we are able to better understand the notion of IOS adoption maturity because we focus research on the interaction of two organizations compared to the whole supply chain or industry, (b) we can justify that the two way causal effect of the dyadic relationship and IOS sophistication captures the concept of IOS progression, and (c) by investigating these two constructs (dyadic relationship and IOS sophistication), we can prevent or reduce the overlap of variables (such as capabilities of parties) which would create problems in empirical research, especially if the dyadic relationship construct is not clearly defined (see for instance, Ham and Johnston, 2007). Furthermore, in testing the propositions, the complex interactions behind the two way causal link between dyadic relationship and IOS use can also be examined indirectly to enrich the understanding of how relationships and IOS sophistication progresses over time. Moreover, researchers can adopt the dyadic relationship and IOS sophistication defining variables to categorise relationships into types, which can then match the IOS types.
Practitioners can also benefit from the model. IOS sophistication should not be treated as a single dependent variable, and practitioners should not base their implementation decisions on a single time assessment, but rather on a continuous evaluation process which is also related to performance measures. Hence, continuous assessment of their relationship and IOS sophistication should be done in different points of time to identify patterns and see if they are able to reach the maturity adoption level required. This can help practitioners form new, or evaluate existing, strategies to facilitate future IOS use.

Here we have illustrated the model using a literature case example of Wal-Mart and P&G, showing how they progressed from one level to the next level of IOS adoption maturity. However, future research is needed to empirically validate the model of this study. We are in the process of testing the three propositions of the model with dyadic pairs of organizations using case studies. In this study, we focus on observing how two organizations can progress from one level of IOS sophistication to the next based on their dyadic relationships. However, depending on the case availability, it would be also valuable to investigate whether two organizations might regress to a lower level of maturity, if their dyadic relationship becomes unfavourable.

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