

INTERORGANIZATIONAL SYSTEM (IOS) ADOPTION MATURITY: A MODEL AND PROPOSITIONS

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Abstract

Interorganizational systems (IOS) adoption requires cooperation and collaboration between trading partners and, therefore, is reliant on the nature of their relationships. There has been some research that examines the match between the different types of relationships and different types of IOS adoption and how IOS adoption moves from a simple system to a more sophisticated system. However, these studies do not precisely define the important constructs needed to understand this adoption progression, which makes them difficult to be used for empirical research. This research introduces a new model, which is called “IOS Adoption Maturity” model, to explicitly illustrate how organizations progress from one level of IOS adoption to the next level. Based on the previous studies, we define three important constructs (IO relationship intimacy, IOS sophistication and IOS adoption maturity) in the model. With this model, the dynamics of IOS adoption progression can be better examined empirically.

Keywords: *Interorganizational systems (IOS) maturity, IOS adoption, IOS types, IO relationship types.*

1 INTRODUCTION

Interorganizational systems (IOS) are automated information systems shared by two or more companies (Cash and Konsynski, 1985) such as Electronic Data Interchange (EDI) and Collaborative Planning, Forecasting and Replenishment (CPFR). IOS offers trading 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 (Mentzer, 2004; Premkumar and Ramamurthy, 1995). IOS have become a strategic weapon for some organizations to attain competitive advantage and have shifted the competition from single firms competing anonymously to supply chain 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 IOS adoption is contingent upon the cooperation of two or more companies in agreeing to implement these systems, adoption cannot be understood without considering the nature of Inter Organizational (IO) relationships required by trading partners (Choudhury, 1997)

IOS studies that investigate IO relationships can be grouped into two. The first group investigates the IO relationship variables that affect IOS adoption (Ibrahim and Ribbers, 2006; Karahannas and Jones, 1999; Nagy, 2006). These studies look at one or two aspects affecting a

particular IOS adoption and generalise their findings to other IOSs. In the second group, studies contend that because there are different types of IOSs, they require different types of IO relationships (Choudhury, 1997; Shah, Goldstein and Ward, 2002). These studies classify IO relationship types based on relationship intimacy or commitment and IOS types based on integration and then match levels of relationship intimacy with the levels of IOS integration (Shah et al, 2002; Ham, Reimer and Johnston, 2003). A more recent study (Ham and Johnston, 2007) not only examines the interaction between IO relationship types and IOS types but also investigates how organizations can move from lower levels to higher levels of intimacy of IO relationship types and integration of IOS types.

While the second group of IOS relationship research has shed some light on how IOS progresses from lower levels to higher levels, it is difficult to base an empirical investigation on this work. This is because the existing literature does not provide satisfactory measures of IO relationship types and IOS types. In addition, there are no IOS studies that have categorised relationships distinctively. This paper addresses the need to redefine IO relationships types and IOS types more specifically, so that better evaluations of how organizations move from lower levels to higher levels of IOS adoption can be done.

In particular, the aims of this study are to (1) define levels of IO relationship intimacy (IO relationship types) precisely, (2) define levels of IOS sophistication (IOS types) precisely, and (3) to develop a model, which we call the 'IOS Adoption Maturity' model, that shows the progression of IOS adoption by incorporating the concepts of IO relationship intimacy and IOS sophistication. Based on the model, a number of propositions are developed for further empirical studies.

In the next section, we present a review of IOS relationship studies. We then discuss the definition of levels IOS sophistication and IO relationship intimacy, based on categorization variable identified in the literature. Finally, we present the IOS Adoption Maturity model together with the propositions and conclude the paper.

2 PREVIOUS IOS RELATIONSHIP STUDIES

Some studies have investigated IO relationship variables that contribute to adoption failures, which include: lack of trust (Hart and Saunders, 1997), fear of dependency (Hart and Saunders, 1997; Nagy, 2006) and lack of goal congruence (Ham and Johnston, 2007). These studies are helpful because they provide an indication of the important IO relational variables that can influence the decision to adopt IOS. However, the limitation of these studies is that they examine a particular IOS such as EDI and implicitly assume that the IO relationship variables would have the same influence on other IOSs.

Realizing this limitation, other IOS relationship studies have examined the interaction between IO relationships types and IOS types (Shah et al, 2002; Ham et al, 2003). They contend that there are different types of IOS which can be categorised based on levels of integration or sophistication and different IO relationship types can be categorised based on the relationship intimacy or commitment between parties. Each IO relationship type then results in the adoption of a particular IOS. For example, since CPFR is a highly integrated system, it requires an IO relationship type of high intimacy. Recently Ham and Johnston (2007) moved a step further and introduced a process model to illustrate how prior adoption experiences provide the necessary prerequisites to adopt more sophisticated systems. They explore the process in achieving higher supply chain integration using three interrelated constructs (1) relationship intimacy (IO relationship types) which is the extent to which the

goals of trading organization are mutual; (2) IO structure, which is the extent to which the roles of organizations are aligned to each other and; (3) supply chain integration (IOS types) which is the extent of integration of information systems, policies and activities across organizations to illustrate how IOS matures from one level to the next. They argue that relationship intimacy (mutual goals) is necessary to facilitate IO structure (common interoperability), which, in turn, enables IO integration (IOS adoption).

These previous studies, offer a better understanding of the type of relationship needed for a particular IOS type. However, while the process model of Ham and Johnston illustrates the causal relationship between supply chain integration, relationship intimacy and IO structure, their framework is inadequate for empirical investigations for two reasons. First, the constructs are not satisfactorily defined. For instance, relationship intimacy is only based on common goals and does not include other important relationship variables identified in other studies. Second, the constructs defined in the model tend to overlap with each other. For instance, IO structure and supply chain integration are not easily distinguished. Organizational structure is defined as the roles assigned to organizations which is a prerequisite for integration. However, integration itself actually facilitates role assignment. Consequently, the model becomes complex and cannot be easily used in empirical investigations.

Our main objective is to conduct future case studies that investigate the maturity concept in IOS adoption that shows how pairs of organisations move from one level of IOS adoption to the next level. In assessing the level of maturity or progression of IOS adoption, the levels of IO relationship intimacy and the IOS sophistication are considered, because they are two critical constructs in IOS adoption. However, since the constructs are not clearly defined in the previous studies, they become difficult to measure and cannot be used as indicators to empirically investigate the IOS adoption maturity concept. Therefore, in this study we develop an IOS Adoption Maturity model by specifically defining, in a more precise way, different types of IO relationship based on the levels of relationship intimacy and different types of IOS based on the levels of IOS sophistication. Before we present the model, in the next section we discuss the categorising variables used in our model to define the IO relationship types and IOS types and present five levels of IO relationships and IOS types.

3 LEVELS OF IOS SOPHISTICATION AND IO RELATIONSHIP INTIMACY

3.1 IOS sophistication levels

In this study, we use the number of functions of the IOS and the level of organizational involvement as two variables for defining IOS sophistication. For the number of functions embraced by the IOS, we adopt Ham et al (2003) description of IOS types as it clearly shows the functions of different systems, but we also examine the IOS practice literature (such as VICS.org) to explicitly show how each system is different. We define level of 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. The more functions and organizational involvement in IOS adoption, the more sophisticated the IOS level. The levels of IOS sophistication are defined below.

Level 1. Matching IOS

This level of IOS has *no processes or functions that are integrated with very low organizational involvement*. The function of this system *is to match buyers and sellers* based

on price, quality or some mathematical programming (Narasimhan and Stoynoff, 1986). For instance, Alibaba.com provides access to thousands of trade leads in 27 industry categories and 1000 product categories posted by potential buyers and suppliers (Alibaba, 2006).

Level 2. Transactional IOS

Transactional IOS facilitate the exchange of business transactional information through standards such as EDI. In simple terms, transactional IOS creates a common language so the two organizations computer systems can communicate. This level of IOS does not require standardising processes but its ***function is 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 lower organizational levels*** because it does not require any major changes. Only data entry employees that process the business documents of the two companies are mainly involved.

Level 3. Operational IOS

Operational IOS is not only about computers communicating through standards, but it requires the organizations to alter some of their processes which typically involves changes to distribution and logistics processes. ***The function of this system is to streamline and coordinate routine interactions between the logistics functions at the warehouse, factories, distribution centres, and stores, to dispatch, receive and sort lot of goods*** (Kurnia and Johnston, 2003). Some examples include the Efficient Consumer Response (ECR). 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***, for example, who are involved with the distribution and logistic functions.

Level 4. Tactical IOS

A Tactical IOS system not only requires changes and alignment of the distribution and logistics functions but also requires coordination of the planning and forecasting processes of the two organizations. For example, CPFR ***synchronizes 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***. Such a system ***requires involvement of persons such as category managers, logistic planners, demand forecasting managers and key account managers*** (VICS, 2006). The success of the system is based on all the managers mentioned above working together so they can improve the demand estimate for product introductions, assortment changes, promotions and season changes (Smaros, 2006).

Level 5. Strategic IOS

A Strategic IOS involves streamlining processes at the strategic level. The two organizations integrate their strategic subsystems such as product design, research and development. For example, Joint Computer Aided Design (JCAD) aids parties to ***jointly produce product designs and communicates these designs to the lower level of the two organizations***. In the automobile industry, Toyota shares product design with its suppliers. This system ***involves participants from the strategic level such as the managing directors, product development managers and research managers and research personnel*** of the trading companies.

3.2 IO relationship intimacy levels

The IO relationship intimacy level is defined based on 3 categorisation variables which are trust, dependence and goal congruence because they are the most frequently cited and investigated in the literature (for instance, Hart and Saunders, 1998; Bensaou, 1998; Ibrahim and Ribbers, 2006; Karahannas and Jones, 1999; Lejeune and Yakova, 2005). The level of relationship intimacy is used to show the variations in trust, goal congruence and dependency. Arms length relationship has the lowest intimacy level, whereas Committed relationship has the highest level. The five levels of IO relationship intimacy are explained below.

Level 1. Arms length relationship

This relationship exists between parties with no obligation to each other because there are alternative sources of business and there is no personal connection to develop relationship. Parties **do not trust each other** and **their goals are different**, even though there **may or may not be some dependence**. Arms length relationship may be long term or short term, but the main principal is that when the exchange finishes, the relationship ends.

Level 2. Reliability-based relationship

This relationship occurs when parties start to feel some obligation because they are pleased in doing business with each other and there is some personal relation because of informal meetings. Parties find each other to be **reliable enough** to conduct business repeatedly. Parties focus on working independently and have **limited goal congruence** (for example: IT compatible), and **may be bilateral or unilateral form of dependence**. In a unilateral dependence, the less powerful party may be trying to cope with the demands of the powerful party to benefit from continuing business (Dabholkar and Neeley, 1998). Because **trust is low** in this level of relationship, some parties may have some contracts in place to regulate the relationship (Macneil, 1980).

Level 3. Competence-based relationship

This relationship is one step higher than the Reliability based relationship because there is some investment involved in establishing the relationship. It is beyond repeated purchase where parties may feel some obligation to provide additional services such as giving training to their partner's employees for using a new technology. The **trust level between parties is high enough** to allow parties to ease the monitoring of each other's activities because they believe that their partners are **competent enough** to perform their functions. They start to work together and their **goals are more aligned** than the previous relationship. Sharing of information through IOS integration facilitates for improvement in IO relationships (Pfeffer and Salancik, 1978) and, therefore, parties start to have a long term focus. Due to improved communication and business volume, the goals of parties become more compatible than the previous level. In the literature, this type of relationship is referred to as partnerships or alliances (Ellram and Cooper, 1990). Depending on the power structure, usually **the powerful party integrates the operations of the other** to maximize performance of operational activities (Rinehart et al., 2004).

Level 4. Mutually-dependent relationship

With this relationship, trading partners not only provide additional value added services but also jointly find solutions to each other's problems. In this relationship, stronger ties emerge because relationship norms have been established between the two organizations. Mutually dependent relationship is characterized by **goodwill level of trust**, where parties start

considering sharing critical information with their partners with the belief that the other party will act in both parties' interest. The *goals of both parties are highly coordinated*. They tend to share the same focus such as production flexibility, reduction in inventory etc. Since parties have assigned "asset specific" resources towards the relationship (Williamson, 1979), *the issue of power may become less relevant* as both parties bear the time, effort and cost.

Level 5. Committed-relationship

This relationship is achieved when parties are fully committed and equally dependent on each other where one party's benefit is also viewed as the other party's gain and visa versa. It is characterized by *parties fully trusting each other* to an extent that they believe that their *goals can only be achieved by working fully with their partners*. This relationship has a *bilateral power structure* because trading partners are dependent on each other for business. Parties become confident about each other's capabilities and they perceive one another as a single organization. Some scholars have referred to this type of relationship as vertical integration where several firms act as one by jointly conducting all the functions (Landeros and Monczka, 1989).

4 A MODEL OF IOS ADOPTION MATURITY

In this section we describe how the three constructs of our model, IOS sophistication, IO relationship intimacy and IOS adoption maturity are linked. We also discuss some plausible preconditions for progression from one level of IOS adoption maturity to another, which are then translated into testable propositions for future work. The IOS Adoption Maturity model shown in figure 1 illustrates how trading partners progress from one level of IOS adoption maturity to the next. To achieve a particular level of IOS adoption maturity, a particular level of relationship intimacy and particular level of IOS sophistication must be achieved first. However, a certain level of IO relationship intimacy is a prerequisite to adoption of an IOS at the level of sophistication that is in line with the level of IO relationship intimacy. The adoption of IOS at a particular level of sophistication, in turn, affects the level of IO relationship intimacy positively, leading to the achievement of the next level of IO relationship intimacy, which again facilitates the adoption of an IOS with a higher level of sophistication and so on. Thus, with the model, we can see how IOS adoption progresses from one level to a higher level. Below is the detailed explanation for each IOS adoption maturity level.

At Level 0 IOS adoption maturity, organizations have alternative sources of business and choose not to establish relationships mainly because of a lack of trust. 'Arms length relationship' may only result in the adoption of 'Matching IOS' and do not facilitate progression to the next level of IOS adoption maturity.

Level 1 IOS adoption maturity is triggered when parties start to develop some obligations through improved personal relations which changes the way they conduct business, leading to the establishment of a 'Reliability-based relationship'. The Reliability-based relationship then facilitates the adoption of 'Transactional IOS'. After implementation of Transactional IOS, parties realize the benefits of adoption and begin to trust each other. The routinized structured communication facilitated by the Transactional IOS adoption leads to changes in relationship intimacy, which results in the establishment of 'Competency-based relationship'. This is the beginning of level 2 IOS adoption maturity.

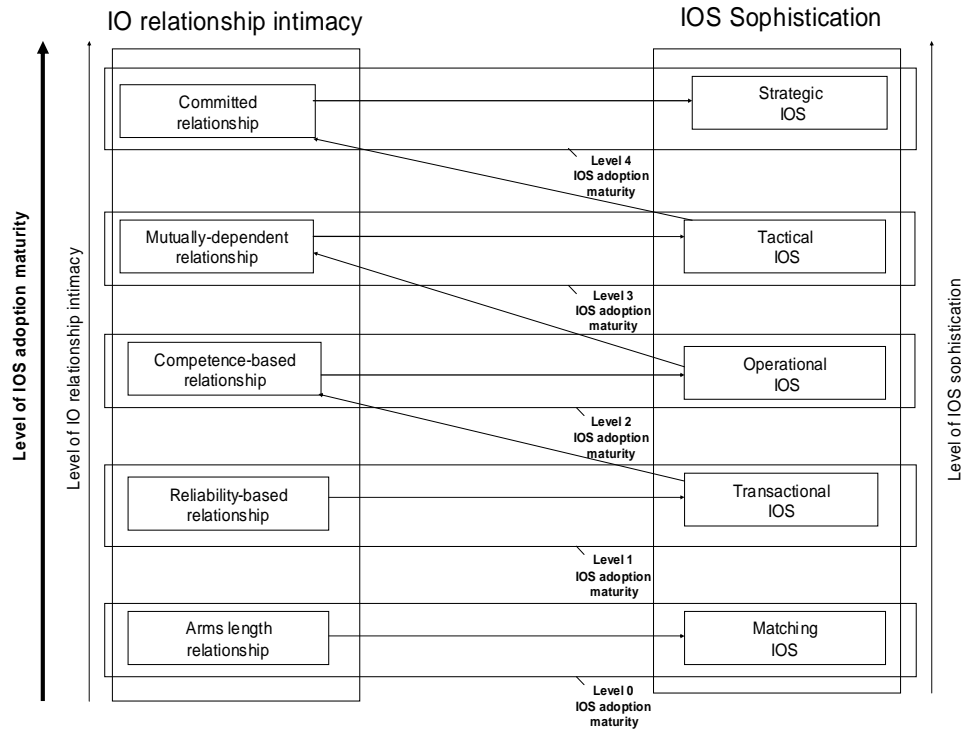


Figure 1: The IOS Adoption Maturity model

At level 2 IOS adoption maturity, parties are confined and locked into a system which affects their relationship indirectly, making them more dependent on each other resulting in a Competence-based relationship. Parties start to exchange information, which maximizes their relationship utility (Handfield and Bechtel, 2002; Mohr and Speker, 1994). Competence-based relationship then leads to adoption of 'Operational IOS'. Similar to the previous level, after a period of time and due to better performance because of the operational implementation, parties will naturally improve their relationships further to gain more benefits.

At level 3 IOS adoption maturity, parties begin to develop common norms and corporate relations because of higher integration. They mature to a 'Mutually-dependent relationship'. Because of such relationship, trading organizations are ready to adopt 'Tactical IOS' where parties are willing to sharing plans and forecasts to gain common goals. This incremental improvement in IOS enables a wide range of benefits by rationalizing the distribution systems, advancement in automation and joint decision-making. The tactical IOS facilitates the development of 'Committed relationship'.

The final level of IOS adoption maturity is marked by Committed relationship that is developed through adopting Tactical IOS. At this level parties are highly dependent on each other and have developed a strong bond. Parties here act as a single organization because they are fully integrated and, therefore, they are in a position to adopt a 'Strategic IOS'.

It is also important to note that while a particular IO relationship intimacy is necessary, it is not sufficient to adopt a particular IOS sophistication because there can be other factors determining the adoption. Similarly, while a specific IOS sophistication is necessary but not sufficient to make organizations progress to the next level of IO relationship intimacy.

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 4 (refer to diagram 1).

Proposition 1: *Level X IO relationship intimacy is a prerequisite for achieving Level X IOS sophistication. In other words, Level X IOS sophistication will not be achieved until IO relationship intimacy is built to Level X and so on for the other levels.*

Proposition 2: *Level X IOS sophistication is a prerequisite for Level X+1 IO relationship intimacy. Therefore Level X+1 IO relationship intimacy will not be reached until Level X IOS sophistication is achieved and so on for the other levels.*

Proposition 3: *Both IO relationship intimacy and IOS sophistication need to mature progressively to achieve any level of IOS adoption maturity and if either one stalls no further progression can take place.*

5 CONCLUSION

This paper builds on previous studies which suggest that adoption of more advanced forms of IOS depends on attaining more intimate organizational relationship between the adopting parties. The paper specifically considers three constructs, IO relationship intimacy, IOS sophistication, and IOS adoption maturity, and defines the relationships among them. Categorization variables for each construct were identified from the literature and used to define the different levels for each construct.

This study contributes to both theory and practice. To theory, this study provides a more precise definition of IO relationship intimacy levels that match the IOS sophistication levels. In this way, researchers can better understand the levels of IOS adoption maturity. The paper also derives plausible propositions concerning attainment of levels of IOS adoption maturity in a form that can be easily mapped and empirically investigated. To practice, this model can help practitioners evaluate their IO relationship intimacies in order to formulate strategies to move to the required level of IOS sophistication. 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.

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