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The role of relationships in the adoption of Interorganisational Information Systems (IOS)

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Abstract

The notion of progression in the adoption of Interorganisational Information Systems (IOS) has increasingly received attention from various researchers in the field of technology adoption, but currently there is still a limited understanding of how to address this important concept. Guided by our proposed IOS adoption maturity model, in this study we investigate the IOS adoption progression experienced by organisations within the Australian grocery industry through a multiple case study involving eight dyads. Our model focuses on the two way influence between dyadic relationship and IOS sophistication in the course of IOS adoption progression. This is the first study that provides empirical support for illustrating the notion of IOS progression. This study has important implications to both research and practice.

Keywords

Interorganisational Systems (IOS), Electronic Data Interchange (EDI), Electronic Business, and VRP.

INTRODUCTION

Interorganisational Information Systems (IOS) are automated information systems, such as Electronic Data Interchange (EDI) and Collaborative Planning, Forecasting and Replenishment (CPFR), which are shared by two or more companies. IOS offer trading organisations 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; Subramani 2004).

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 favourable. 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 et al. 1998; Damsgaard and Lyytinen 1998). Some studies, for example (Bensaou 1998), 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 Interorganisational (IO) relationships. For example, some studies examine relationship factors that contribute to adoption failures or success (see for example, Hart and Saunders 1997; Hart and Saunders 1998; 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 (Shah et al. 2002; Ham et al. 2003; Redondo et al. 2009). More recently, researchers not only examine the interaction between relationship types and IOS types but also investigate how organisations 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 discuss how organisations can progress from a less sophisticated to a more sophisticated IOS based on relationships (Ham and Johnston 2007), these studies are not theoretically strong and do not include, or justify the exclusion of, other factors such as organisational capabilities to investigate maturity or progression of IOS adoption. Based on the IOS adoption model of Kurnia and Johnston (2000), an IOS

adoption maturity model was developed in our previous work (Ali et al 2008) to address these gaps and to provide a basis to investigate the concept of IOS adoption maturity.

The objective of this paper is to illustrate the notion of IOS adoption maturity. We empirically test an IOS adoption maturity model developed in an earlier study by using eight dyadic case studies comprising of six companies (four manufacturers and two retailers) from the Australian grocery industry. Empirical evidence is provided to show how these cases progressed from one level to higher levels of IOS sophistication.

In the next section, we briefly present the literature on IOS adoption. Then, we discuss our IOS adoption maturity model. The research method and case analysis are discussed in the next section. Finally, the case findings are discussed and we conclude the paper with its implications, limitations and areas for future research.

LITERATURE REVIEW

Based on the taxonomy of Markus and Robey (1998), IOS studies can be classified according to the factor approach and process approach (Kurnia and Johnston 2000). The factor-based studies assume that IOS adoption is determined by a number of predicting variables identified at a particular point of time. (a) the nature of technology (O’Callaghan et al. 1992; Premkumar et al. 1994; Premkumar and Ramamurthy 1995; Teo et al. 2003), (b) characteristics of the organisation (Premkumar et al. 1997; Chwelos et al. 2001) and (c) some conditions in the environment of the adopting organisation (Grover 1993; Premkumar and Ramamurthy 1995; Segars and Grover 1995; Hart and Saunders 1998) in order to predict adoption.

The factor-based studies adopt a firm-centric perspective, which suggests that organisations 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.

On the other hand, the process approach suggests that an organisation’s implementation decision is an ongoing process of assessment and re-assessment of adoption aspects. This approach provides a better understanding of the way organisations adopt an IOS by investigating their industry structure, capturing the changes of technology and the role of organisation in the process (for example, Damsgaard and Lyytinen 1998; Kurnia and Johnston 2003; Kurnia and Johnston 2000).

While the process approach has its advantages, it is difficult to use for empirical investigation because the model suggests the inclusion of all the industry 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 (Kurnia and Johnston 2000). In addition, the process approach does not include the notion of IOS adoption maturity. Therefore, we propose a new model, which is called the IOS adoption maturity model, by incorporating the notion of IOS adoption maturity to capture progression.

THE RESEARCH MODEL

In this section, we present the IOS adoption maturity model adapted from our previous study (Ali et al 2008, Figure 1). The primary purpose of the IOS adoption maturity model is to provide a framework that is theoretically strong, justifies exclusion of other factors such as nature of technology and external factors, and is empirically testable. The model provides a sound theoretical base for empirical studies that investigate how organisations move from a less sophisticated to a more sophisticated IOS based on their relationships. The IOS adoption maturity model is based on two main constructs: dyadic relationship and IOS sophistication. The dyadic relationship and IOS sophistication are segmented into levels (types) in terms of categorization variables.

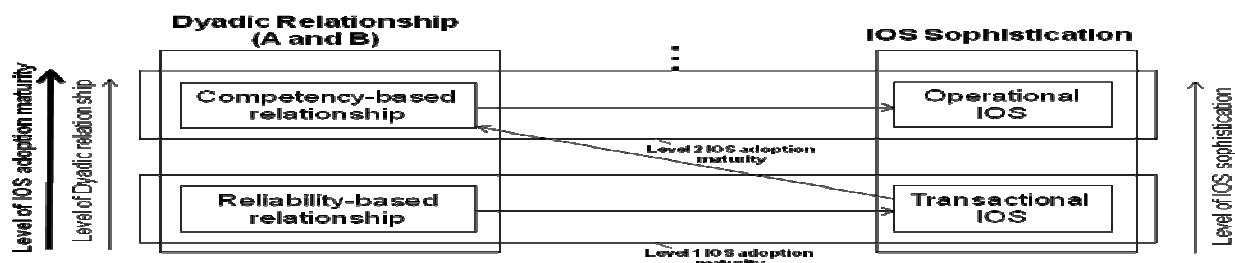


Figure 1: IOS adoption maturity model (Ali et al 2008)

Dyadic relationship

We define the level of dyadic relationship in terms of some common defining categorization variables identified from the IO relationship and IOS literature. The three variables that are most frequently cited from both literatures are collaborative ability, partner alignment and dependence.

Collaborative ability is defined as the ability of firms to initiate, maintain, and use business relationships (Ritter 1999). This variable is related to trust and capabilities. It is measured by the capabilities, reliability and benevolence (honesty and openness) of trading partners.

Partner alignment is defined as the extent to which the trading partners are aligned in terms of goal compatibility, benefit distributions (mutual benefits) and interactions with each other (communication and collaboration).

Dependence is related to how costly a firm finds it to switch to other organisations, dependability in terms of sales or purchase volume and the need to maintain a good relationship with their partners (Heide 1994; Kumar et al. 1995; 1998; Teo et al. 2003). It is measured in terms of criticality of trading partners to each other.

The higher the degrees of collaborative ability, partner alignment and dependence, the higher the level of the dyadic relationship of the two organisations.

IOS sophistication

We define the level of IOS sophistication by the extent of business practice alignment between the two organisations and the level of organisational involvement as its measurement variables.

The extent of business practice alignment between the two organisations assesses the degree to which the system aligns the two (or more) organisations business related working practices. For example, EDI aligns procurement practices including ordering and receiving, whereas, CPFPR aligns more business practices such as planning, forecasting and replenishment (including ordering and receiving) practices.

The level of organisational involvement is the extent to which senior hierarchical management functions (operational, tactical, and strategic) are involved in the day to day functioning of the IOS. For example, EDI involves operational staff from the two organisations who are typically the personnel that use the information for conducting the procurement function. CPFPR involves the tactical staff who are involved in planning and forecasting in the two organisations as well as those operational staff who are involved in replenishment.

The more the business practices of the two organisations are aligned by the IOS and the functional levels of management are involved, the higher the levels of IOS sophistication.

The IOS adoption maturity framework shown in Figure 1 illustrates the two-way connection between dyadic relationship and IO sophistication. The level of IOS adoption maturity is the highest level to which the dyad has progressed in *both* dyadic relationship and IOS sophistication. To achieve a particular level of IOS adoption maturity, a particular level of dyadic relationship and particular level of IOS sophistication must first be achieved. However, a certain level of dyadic relationship is a prerequisite to adoption of an IOS. 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 facilitates the adoption of an IOS with a higher level of sophistication and so on. Thus the dynamics of IOS adoption maturity from one level to a higher level can be examined. To demonstrate the maturity concept, we specifically define and name two levels explicitly below.

Level 1 IOS adoption maturity is triggered when dyads have a **reliability-based relationship**. This relationship is characterized by trading partners having *limited collaborative ability*. Parties find each other to be reliable enough to conduct business repeatedly. The two parties have *minimal alignment* and *one of the trading partners is more dependent* on the other party because of their power. Having a reliability-based relationship is necessary for the two parties to adopt a **Transactional IOS** such as an EDI system. This level of IOS sophistication is characterized by its ability to *align trading partner's procurement practices*. This system involves participants that are *responsible for fulfilment of orders*. The adoption of a Transactional IOS *improves the trading partners' relationship* in terms of their collaborative ability, partner alignment and dependency and we name the next level of dyadic relationship as a **competency-based relationship**. This is the beginning of level 2 IOS adoption maturity.

With a competency-based relationship, the two parties are then able to adopt the next level of IOS sophistication, which we call the **Operational IOS**. Unlike the transactional IOS where parties may implement the system with less critical manufacturers, the Operational IOS is implemented with more critical manufacturers or customers (*highly dependent on each other*). This system aligns the *trading partners' replenishment business practices* and the stakeholders involved include the *replenishment level managers* in addition to the procurement level stakeholders. With the Operational IOS, the two partners are then able to *improve their relationship further* to achieve the next level of dyadic relationship. This is the beginning of the next level IOS adoption maturity and the process continues as in the previous levels. Thus, we can examine the progression in both dyadic relationships and IOS sophistication of the two parties through the proposed IOS adoption maturity model. In this paper, we limit our study to the second level of IOS maturity only.

It is also important to note that while a particular level of dyadic relationship is necessary, it is not sufficient to adopt a particular level of IOS sophistication because there can be other factors determining the adoption. Similarly, while a specific level of IOS sophistication is necessary, it may not be sufficient to enable organisations to progress to the next level of dyadic relationship. Therefore, the propositions below are expressed as ‘only if’ conditions that imply necessary but not sufficient conditions. Based on the above discussion, three propositions regarding the progression in IOS adoption are postulated:

Proposition 1: *A Transactional IOS can be achieved only if a reliability-based relationship is achieved*

Proposition 2: *A competency-based relationship is achieved only if a Transactional IOS is achieved*

Proposition 3: *An Operational IOS can be achieved only if a competency-based relationship is achieved*

RESEARCH METHOD

Since this research deals with complex issues such as relationships and IOS sophistication between pairs of companies, case study research was employed because of its ability to help researchers understand a complex phenomenon within its real world context. The unit of analysis is pairs of organisations that have or had an IOS project. A total of six organisations participated in this research: two retailers (Companies A and B) and four manufacturers (Companies D to G). This resulted in a total of eight dyads, as both retailers were involved with all four manufacturers. The participant organisations represent typical examples of companies commonly found in the Australian grocery industry. Both open ended and semi-structured interviews were conducted with senior managers such as Supply Chain Directors and e-Business Managers because they were most likely to have first-hand information of IOS projects. The Supply Chain directors were interviewed at least twice and the other managers were interviewed once. There were also other forms of informal interactions with the participants over phone or through emails throughout the project. The interviews lasted for approximately 60 to 120 minutes. The data collection took place from July 2007 to August 2009. An interview protocol was used as a guide in all interviews. It included questions relating to topics such as the level of organisational involvement, stakeholders of the IOS, function of IOS, goals of IOS, dependence and collaborative ability. The respondents were first questioned about their current level of IOS sophistication and then they were asked about their relationship. We wanted to identify the nature of the relationship required for each type of system used. The data were transcribed after the interviews and were analysed by finding common themes through pattern matching logic (Yin 2003) using Nvivo software. The transcripts and the common themes extracted from Nvivo were examined by two additional researchers and any differences were resolved through discussion. We also examined additional documents related to the two companies’ backgrounds; IOS implementation and IT profile to triangulate the findings.

THE CASE STUDIES (DYADS)

The two retailers are among the top retailers in the Australian market. They have been in operation for more than 30 years and their annual sales for 2007 was over \$30 billion and have more than 70,000 staff. The manufacturers are among the top 20 vendors in Australia. All these manufacturers have more than 2,000 staff in the Australian region and their annual sales are over \$1 Billion.

From these six companies (two retailers and four manufacturers), a total of eight cases (dyads) are included in this project. These companies have been doing business together for more than 30 years and have followed the same maturity path. The cases and the levels of IOS sophistication used by the 18 dyads are summarised in Table 1.

All the dyads (Cases 1-8) first adopted a transactional IOS (EDI system) between 1996 and 1997. The dyads of Company A (Cases 1-4) implemented an operational IOS, a Vendor replenishment Planning (VRP) initiative in 2001 and the dyads of Company B (Cases 5-8) adopt an operational IOS, a Co-Managed Inventory (CMI) initiative between 1999 and 2002. Case 5 (Companies B and D) adopted an operational systems in 1999, and the rest of the dyads of Company B (Cases 6-8) adopted the operational IOS in 2001-2002. The CMI initiative of Company B was discontinued in 2003 and in 2008 these dyads adopted a VRP initiative. While the CMI initiative was discontinued, it serves as a good example to show how the dyads progressed from one level of sophistication to the next.

Table 1. The dyads and levels of IOS adopted

Cases	Companies	IOS adopted
Case 1	A and D	Transactional (EDI) and Operational (VRP initiative)
Case 2	A and E	Transactional (EDI) and Operational (VRP initiative)
Case 3	A and F	Transactional (EDI) and Operational (VRP initiative)
Case 4	A and G	Transactional (EDI) and Operational (VRP initiative)
Case 5	B and D	Transactional (EDI) and Operational (CMI initiative)
Case 6	B and E	Transactional (EDI) and Operational (CMI initiative)

Case 7	B and F	Transactional (EDI) and Operational (CMI initiative)
Case 8	B and G	Transactional (EDI) and Operational (CMI initiative)

CASE ANALYSIS

Empirical testing of proposition 1: *A Transactional IOS can be achieved only if a reliability-based relationship is achieved*

All eight dyads adopted a transactional IOS between 1996 and 1997. The data supports that all eight dyads agreed to use a Transactional level IOS to execute the day-to-day orders. This is an EDI system, which delivers the order documents from one partner to the other party (receiver) for the acquisition of goods. These dyads have agreed to use an EDI system to align their procurement practices. In addition, the case analysis indicates that stakeholders from the eight dyads include replenishment personnel who verify or place the orders, the e-business teams of the dyads who support the system, the Distribution Centre (DC) personnel of the dyads who receive and dispatch the goods, the accounts personnel of the dyads that receive or make the payments, the transportation personnel and the stores of Companies A and B.

The dyads relationship is characterised as reliability-based relationship. In terms of *capabilities*, dyads require to effectively use their IT resources mainly to build the EDI systems. The organisations in these dyads require working on their own systems and usually collaborate during the testing of the EDI before going live. The testing and implementation of the Transactional level of IOS sophistication require mainly IT resources.

Even with the full EDI implementation, [manufacturers] do not need the whole IT department with them but they should actually have someone that could help them implement the system. e-Business Manager, Company A

In addition, all the participants from the organisations in the eight dyads believe that they require minimal *reliability* in this relationship because a Transactional level of IOS sophistication was automating the procurement process and does not require much reliability. For example, the Supply Chain Director of Company G explains this view:

Once it [the EDI system] is set up and running I think it just becomes a business practice that top management can ignore, as long as it functions fine.

All the respondents believe that *benevolence* is not important in this arrangement. The respondents argue that they do not require being honest or open with each other. The Supply Chain Director of Company D explains this view:

b2b [an EDI system] doesn't require any trust [benevolence]. It's just technology. Supply Chain Director, Company D

It's either it works or it doesn't work. You either get it right or you don't get it right. So it's not really a question of benevolence I don't believe. Supply Chain Director, Company G

The data reveals that *goal compatibility* in this relationship is low because the goals of the system was enforced by the retailers (Companies A and B). In all the dyads, the manufacturers aligned their goals to comply with the powerful party's request from a relationship point of view.

In the past [1996-2000], we never did a good job of setting goals with our trading partners. Operations Manager, Company A

When Company B comes to you and says, "This is how it's going to be," and that's pretty much what they did, 33% of my business, "Yes sir." Supply Chain Director, Company G

In terms of *mutual benefits*, in 1997-1998 (the implementation time period), the manufacturers in all dyads believed that the benefits were more to the retailers. The Supply Chain Director of Company D:

If we wind the clock back [to 1997] and said "right, Company B want us to do [EDI] and Company A want us to do b2b and it's going to cost us this much over this period of time and write the business case for that," it wouldn't get passed at all. The business case is not there and it might save one or two people and you're going to get sort of a 17 year payback. I think if we dissected the actual costs that fall out as a result of doing it most of the cost benefits are retail.

In all cases, the participants argue that a reliability-based relationship does not require much *communication and collaboration* except when the Transactional level of IOS sophistication is at the implementation phase. The Supply Chain Director of Company D explains this view:

b2b[EDI] requires initial communication to get agreement on a mutually agreed process. You might not have a choice about it, because the powerful party dictates the standard, but you've got to agree it to be able to implement it. So you need to collaborate on, what is it, how do we make it work, all right, we'll make it work. And then, after that there's bugger-all collaboration

In terms of *dependence*, the two retailers are more powerful than all the manufacturers in the dyads. The two retailers account for about 75 percent of the manufacturers sales.

The empirical evidence provided above supports that the dyads have had a limited collaborative ability, low goal congruence and the weaker parties (manufacturers) were mandated to implement the Transactional IOS. This relationship is a reliability-based relationship, which was necessary for the dyads to implement an EDI system (Transactional IOS). Therefore, Proposition 1 has been supported by the case study data. A Transactional IOS has been achieved because the eight dyads have achieved a reliability-based relationship.

Empirical testing of proposition 2: *A competency-based relationship is achieved only if a Transactional IOS is achieved*

The adoption of a transactional IOS helped the two companies improve their relationship, which resulted in a competency-based relationship. In terms of *collaborative ability*, empirical evidence from the cases suggests that the implementation and use of the Transactional IOS improved their *capabilities*. All dyads argued that a Transactional level of IOS sophistication (EDI system) provides an ordering infrastructure for the VRPs (Operational IOS) to place orders.

[EDI] created a much cleaner, clearer order, which removed human error from the supplier's end on, for any misunderstandings and what the customer actually wanted. Because, prior to that, I imagine they would have worked off faxes and all sorts of things, which would have had rough descriptions of various codes, one of the numbers that were being transmitted. And now with EDI you have one code for one product. No mistakes can be made. Supply Chain Director, Company E

The implementation of a Transactional level of IOS sophistication illustrates that the parties in the 8 dyads were *reliable* and able to work together:

They [Companies A and B] are also keen on, you need to overcome relationship hurdles, IT hurdles, and be comfortable that you can trust the supplier to put someone, or embed someone, in the retailer's system. And be able to behave ethically. Because you have information to a lot of other people's products and promotional programs, which you then obviously can't share back within the supplier's business. Supply Chain Director, Company F

When these eight dyads implemented a Transactional level of IOS sophistication they started communicating more and this built *benevolence*. They were discussing issues about using the EDI and worked jointly to overcome them:

It shows that we are open, committed and we are willing to implement the VRP. Supply Chain Director, Company G

The adoption of a Transactional level of IOS sophistication helps the two parties in the dyads to achieve *partner alignment* in a competency-based relationship that is necessary for achieving an Operational level of IOS sophistication (VRP and CMI initiatives). The implementation of a Transactional level of IOS sophistication by the dyads illustrates that both parties support each other's *goals*. This also helped them to establish contacts and become closer to each other.

Yes, you are involved in the last one and you did well yes, we [companies A and B] will ask you into this one straight away. Supply Chain Director, Company E

In terms of *dependence*, the implementation of the transactional IOS made the two parties more reliant on each other than before.

If my relationship with a supplier is fully manual, so I procure my stock via a phone call, and I pay for it by stamping an invoice, and then arranging for a cash transaction. They're kind of discrete entities, almost unrelated business transactions. So I guess if you're on full EDI, and you've got documents that manage relationships, and those documents move really fast between each other, in terms of transaction flow I think you become more reliant on each other more than before. e-Business Manager, Company B

Thus, a Transactional level of IOS sophistication helped the dyads in terms of creating joint capabilities, providing them with reliable top management support, building more openness and honesty, and arriving at

common goals for achieving a competency-based relationship. This supports Proposition 2, which states that a competency-based relationship can be achieved *only if* a Transactional level of IOS sophistication is achieved.

Empirical testing of proposition 3: *An Operational IOS can be achieved only if a competency-based relationship is achieved*

All the respondents in the organisations in the dyads have indicated that the Operational level of IOS sophistication has *aligned their replenishment activities*. In all eight cases the VRP/CMI initiative (Operational level of IOS sophistication) has been implemented to facilitate the effective short-term replenishment of orders. Short-term replenishment of orders means that the vendors' personnel (who are called VRPs) use the retailers' internal system to continuously monitor stock levels and oversee orders that are approximately two to three weeks from time. In other words, the VRP and CMI initiatives involve the dyads placing VRPs in the premises of the retailers, so they can improve short-term supply chain effectiveness. These VRPs are provided access to a computer from which they are able to log on to the retailer's internal system. The retailers' internal system provides VRPs with information about their product items such as the daily stock withdrawals at the DCs, stock availability at the DCs, how much stock is in transit and so on. The only difference between a CMI and a VRP initiative is that the manufacturers' personnel (VRP) does not place the order but recommends the order for the replenishment team of the retailer. In a VRP initiative, they actually place orders on behalf of the re-buyers (inventory controllers or replenishment personnel) of the two retailers.

The *stakeholders* from both organisations include all the lower-level personnel from the Transactional level of IOS sophistication (DCs, warehouses, re-buyers) in addition to the middle-level personnel such as replenishment teams, logistics and distribution.

The empirical evidence indicates that the overall value of the collaborative ability variable improved in this relationship. The *capabilities* required by any two trading parties are more in this arrangement because the dyads must ensure that the personnel have proper training and understand both the manufacturers' and retailers' requirements and they require to have robust internal systems and EDI functionality (transactional IOS).

The data suggests that the *reliability of parties* is more in this relationship because (a) the manufacturers are increasing their overhead cost by employing these VRPs and they have to see value to continue supporting it; (b) the retailers have the manufacturers' personnel in their organisation to perform the replenishment duties, which changes their working practices. Top management needs to support these changes.

With VRP you need to get [reliability] in again because you're actually increasing your own company's head count. So that's quite a serious thing. However, once it's in we actually see a lot of value from it. So we don't really need top management, constant top management buy-in. Once [VRP initiative has been] implemented you need minimal reassurance that you've done the right thing.
Supply Chain Director, Company F

Benevolence (honesty and openness) is important for this arrangement because of three reasons: (a) the dyads have become more open because they are sharing more information with each other; (b) the manufacturers are placing vendor personnel in retailers' premises, which requires benevolence because there is potential to access confidential information; and (c) the retailers believe that the manufacturers would not abuse their ordering authority by over-ordering or recommending stock that is not required to meet targets or profits. The participants from each of the 8 dyads have stressed that there needs to be honesty and openness maintained between the two organisations in each dyad for the VRP program to work.

The VRP [CMI] has access to the entire customers systems. You are working in the office so you do see things. There is the potential to see documents from other suppliers.
Supply Chain Director, Company E

Empirical evidence from the case analysis indicates that in almost all the dyads partner alignment in this relationship is more than a reliability-based relationship. The data reveals that while the *goals* are still set by the retailers, all manufacturers find that their goals as being compatible in the VRP and CMI initiatives.

For VRP[and CMI initiatives], the goals? It sounds to me a bit more like we share moderate common goal but the vision is still set by powerful party. Yes, I mean, it's a big step change in trust and collaboration, for, to give responsibility to the supplier to recruit the right people and put them in charge of doing the retailer's work and it's not just any work, it's key to the supplier's success. It directly influences how much they sell and the way they sell.
Supply Chain Director, Company D

In terms of *mutual benefits*, the participants from the manufacturers believe that the initiative is a little more advantageous to the retailers.

It is pretty equal. Because when you do stock out, we lose revenue, [Companies A and B] lose revenue. It might be a tad favouring Companies A and B, but we do get good benefits out of it. I mean when you

have a good service level too, there's less noise. Suddenly you're ranging and when it comes to range-review decisions and things like that, that's all factored into your service levels. So anything you can do to help get rid of that noise helps. Supply Chain Director, Company F

In terms of *communication and collaboration*, the CMI and VRP initiatives require a lot of interactions. VRPs need to communicate from daily to weekly basis with the replenishment teams of the two retailers.

In terms of dependence, the *criticality* does not change from a reliability-based relationship because it is related to how important the two trading parties are to each other. However, it must be noted that Companies A and B implemented EDI with more than 300 manufacturers while the VRP and CMI initiatives was implemented with only their top manufacturers.

We have put 60 vendors here to perform replenishment duties. They are here since 2001. e-Business Manager, Company A

Thus, the empirical evidence shows that the dyads have their collaborative ability level high enough to allow parties to ease the monitoring of each other's activities because they believe that their partners are honest and competent enough to perform the replenishment functions. Their partner alignment increased and they started to work together more than the previous relationship. Due to improved communication, the goals of parties become more compatible than the previous level. This relationship is characterised as a competency based-relationship and has enabled the dyads to adopt an Operational IOS. Therefore, proposition 3, which states that an operational IOS can be achieved only if a competency-based relationship is achieved has been supported in all eight cases.

DISCUSSION

All the three propositions have been supported by the data. The first proposition, that a Transactional level of IOS sophistication can be achieved *only if* a reliability-based relationship is achieved, was supported in all eight cases. The Transactional level of IOS sophistication aligned their procurement practices and the stakeholders involved were personnel that used the system for performing the day-to-day fulfilment of orders. The establishment of a reliability-based relationship helped them achieve a Transactional level of IOS sophistication. Surprisingly, benevolence, which is a sub-variable of collaborative ability, was found to be not applicable for a reliability-based relationship in all eight cases. This finding is inconsistent with the literature (for instance, Hart and Saunders 1997). Most of the participants from the manufacturers in the dyads of this study have viewed the EDI as only beneficial to the two retailers. This is because when first implementing the Transactional level of IOS sophistication the retailers have not collaborated and fully explained the benefits of the Transactional level of IOS sophistication to their manufacturers. They essentially mandated the implementation of a Transactional level of IOS sophistication.

Proposition 2, that a competency-based relationship can be achieved *only if* Transactional level of IOS sophistication is achieved, has been supported in all eight cases. The findings of this research project suggest that dyads adopting one level of IOS sophistication (in this case a Transactional level of IOS sophistication) help the two companies improve their level of dyadic relationship for implementing the next level of IOS sophistication. The implementation of a Transactional level of IOS sophistication (EDI system) creates the joint infrastructure for the two organisations in the dyad to streamline their procurement operations. A Transactional level of IOS sophistication gives the two trading parties in a dyad not only improved visibility of orders but also creates an environment for mutual discussion, improves communication and builds benevolence over time. It shows that both parties are committed to implementing future IOS initiatives. In other words, it improved their level of dyadic relationship and therefore able to achieve a competency-based relationship. This finding may be observed when looking at the time period of adoption of IOS in other industries. For instance, in the automotive industry, Toyota first implemented a Transactional level of IOS sophistication (EDI system) and then adopted an Operational level of IOS sophistication (VMI initiative) with their suppliers. Therefore, there may be grounds to believe that Toyota and its suppliers improved their relationship because of the implementation of a Transactional level of IOS sophistication that led to an operational level of IOS sophistication.

Proposition 3, that an Operational level of IOS sophistication can be achieved *only if* a competency-based relationship is achieved, has also been supported in all eight cases. The Operational level of IOS sophistication aligned the two organisations' short-term replenishment activities and the stakeholders involved were personnel that used information for replenishment of stock. The evidence indicates that there was an improvement in the levels of collaborative ability, partner alignment and dependence for all the dyads, which enabled them to achieve an Operational level of IOS sophistication. A competency-based relationship is characterised by having more compatible goals and mutual benefits and frequency of communication and collaboration between stakeholders than a reliability-based relationship. In terms of collaborative ability, the dyads had to have trained personnel who were capable of using the system and analysing the order patterns from the system to make the right replenishment decisions. The dyads also had a higher level reliability. Benevolence is important in this arrangement because the retailers are assigning their tasks to the manufacturers. In other words, the two

companies in the dyads are more open and required more sharing of information than previously. More specifically, the evidence from this study indicates that a competency relationship has a higher level of dyadic relationship than a reliability-based relationship. This competency-based relationship is necessary for achieving an operational level of IOS sophistication.

CONCLUSION

This study has introduced and examined the notion of *IOS adoption maturity*. This is an improvement to previous studies because they have assumed that different levels of IOS sophistication were adopted in isolation. More specifically, the concept of IOS adoption maturity has not been explicitly tested in any prior research. This study shows how IOS adoption progresses from one level to a higher level. Furthermore, this study demonstrated how the adoption of IOS at a particular level of sophistication affects the level of dyadic relationship positively, leading to the achievement of the next level dyadic relationship, which in turn facilitates the adoption of IOS to yet a higher level of sophistication, and so on. As such, by empirically investigating the concept of IOS adoption maturity this study provides new explanations to understand IOS adoption in general and IOS adoption maturity in particular.

Our research contributes to IOS adoption literature by providing empirical support for the IOS adoption maturity model. We have illustrated the applicability and validity of the two constructs and their indicators to investigate the concept of IOS adoption maturity. This is an important step because previous studies assume that IOS is one general type of system and they do not highlight the different characteristics of the technology, the relationship required and the two-way effect between them.

The longitudinal nature of this research has provided a rich understanding of IOS adoption maturity that occurs over time. The participants were interviewed at different points in time during the course of this research. This provided a better understanding of the dynamics of IOS adoption maturity. In addition, the empirical data goes back more than ten years (when the Transactional level of IOS sophistication was in place). The literature lacks IOS adoption studies that report findings over such an extended period of time.

The findings of this study increase the awareness of practitioners that IOS adoption is a complex phenomenon, which requires a careful assessment of their relationships with their trading partners. The levels of 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 their level of dyadic relationship. The IOS adoption maturity framework can help practitioners evaluate their dyadic relationship in order to move to the required level of IOS sophistication. Therefore, continuous assessment of the level of dyadic relationship and IOS sophistication should be done at different points of time to identify patterns and see if the dyads are able to reach the maturity adoption level required. This can help practitioners form new, or evaluate existing, strategies to facilitate future IOS use.

In addition, this study helps practitioners to understand the link between one level of IOS adoption maturity and the next. Each level of IOS adoption maturity should be considered a building block to attain subsequent levels of IOS adoption maturity. It is important for practitioners to be aware that implementing one level of IOS sophistication not only improves the next level of dyadic relationship but also creates an infrastructure that enables the attainment of the next IOS level.

The limitations of this study should also be noted. This study followed a dyadic approach, the learning effects between dyads were not taken into account. When two organisations implement an IOS, they gain knowledge from this implementation and this knowledge could be used in subsequent implementations with other trading parties. This spill over effect was not addressed in this research. Examining the influence of how achieving higher maturity levels with one partner could affect achievement of the next maturity level with another partner would be valuable for future studies.

Moreover, the reasons for the termination of CMI initiative (Operational IOS) by the dyads were not investigated in this study. Future studies are required to assess why and how organisations abandon their systems and regress back to lower maturity levels.

This research investigated two levels of IOS adoption maturity; future studies could investigate the possibility of higher levels. These studies are required to assess how the implementation of an operational IOS could further improve relationships and results in more sophisticated systems.

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