Interorganizational Information System Technology Adoption
Effects on Buyer-Seller Relationships in the Retailer-Supplier Channel:
An Exploratory Analysis

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Abstract

Interorganizational information system (IOS) technology adoption in channels leads to modified exchange partner interactions and channel structures. Companies implementing IOS technology create electronic buyer-seller information exchanges and business transactions that increase efficiency, competitiveness and profitability.

Universal Product Code (UPC) bar coding, an IOS technology, was researched in the context of effects on retailer-supplier channel relationships. UPC bar coding allows retailers to point-of-sale (POS) scan merchandise at customer checkout and is an essential tool for inventory control and management. Successful POS implementation is contingent upon supplier adherence to UPC symbology guidelines and coordination with customers. With few exceptions, POS capable retailers require vendors to provide UPC bar coded products.

An exploratory analysis of the U.S. home center retail and wood products industries was conducted in the Spring of 1993 to assess the influence of UPC bar coding on home center buyer-wood products supplier channel relationships. Study results support the proposition that adopters of IOS technology experience relationship disruptions in the short-term and strengthened relationships in the long-term. Primary reasons for channel relationship disruptions identified for suppliers include: 1) low value received relative to investments made and; 2) pressure from customers to implement previously non-requisite and unfamiliar technologies. Retailer short-term dissatisfaction with suppliers stems from: 1) frustration from a lack of urgency in supplier technology implementation and; 2) lack of supplier understanding of IOS technologies and implementation procedures.

IOS Technology and Channel Relationships

IOS technology adoption changes the way channel members interact. Before addressing specific relationship impacts due to IOS technology adoption, a brief review
of buyer-seller relationship research is presented. Generalized models describing relationship interactions have been proposed which discuss antecedent conditions and processes for buyer-seller exchange relationships (see Dwyer, Schurr & Oh 1987; Heide & John 1990; Han 1992; Han & Wilson 1993; Mummalaneni & Wilson 1991). In addition to generalized models, specific channel dyadic interactions and relationships have been studied. For example, in the manufacturer-distributor context, models and conceptual frameworks were developed that investigate relationship structures and success factors (see Anderson and Narus 1984,1990; Calantone and Gassenheimer 1991; Butaney & Wortzel 1988). In the manufacturer-retailer arena, Wortzel and Venkatraman (1991) examine relationship linkages that support retailer competitive strategies and performance and manufacturer support activities. IOS technology adoption is, in many cases, a tool in the development of strategic business alliances. Although not specifically addressing IOS technology influences, buyer-seller alliances and partnerships have been researched from a theoretical perspective with resultant models (see Spekman & Wilson 1991; Johnston & Lawrence 1988; Cardozo, Shipp & Roering 1992; Frazier 1983).

With regard to effects of IOS adoption on relationships in channels, Clemons and Row (1993) found that new IOS based coordinative interfirm activities are often met with distrust, ambivalence and open resistance by exchange partners. They believe that for some channel segments, potential benefits of cooperation, coordination and supply or buyer base rationalization may never be realized. Taking a longer-term perspective, Han & Wilson (1993) and Han (1992) posit the notion of technology as a construct in development of structural bonding which, in addition to social bonding, constitute the inputs to relationship development (figure 1). They suggest that the level of technology of the relationship partner is positively related to the level of structural bonding between the buyer and the seller. Han (1992) describes structural bonding as exchange partners being closely tied together in terms of economic, strategic and organizational reasons regardless of personal or emotional factors. We believe that the adoption of IOS
technology can have profound effects on the development and sustenance of channel relationships particularly in the development of structural bonds.

[INSERT FIGURE 1 ABOUT HERE]

Strategic Implications of IOS Adoption

Parsons (1984) describes a "strategic gap" which exists from non-implementation of advanced information technologies. In addition, he suggests that competitively, firms in industries where channel relationships are being altered by technology must be concerned with consequent effects on relative power; how technology affects the rate of new entry into industries by negating existing entry barriers or creating new ones and; how technology changes industry structures by affecting rivalry bases among competitors within an industry. Konsynski & McFarlan (1990) suggest that IOS technology empowers companies to compete by facilitating cooperation and partnership development. Partnerships may provide for shared investments in hardware and software, lead to reduced risk in leading-edge technology adoption and serve as a new basis for supplier differentiation. Porter (1985) cited technological change as one of the principal drivers of competition and competitive advantage in the value chain. In addition, he suggested that technology can shift the bargaining relationship between an industry and its buyers, create buyer-seller interdependencies and generally modify industry and channel structures. Stern and El-Ansary (1992) point out that as a result of adoption of channel technologies, 'electronic marketplaces' are evolving which allow companies to extend their in-house computer systems into the offices of their customers and suppliers. Electronic marketplaces are networks that allow customers to compare offerings of competing suppliers and often evolve from single-source sales channels. Heide and John (1990) argue that closer relationships in the industrial buyer-supplier context correspond to a shift away from market-based exchange toward more bilateral

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governance. In their model, purchasing relationships differ on three dimensions: joint
action, which can include design of quality control and delivery systems; expected
continuity, the perception of the bilateral expectation of future interaction and;
verification of supplier. We believe that IOS technology adoption can impact all of these
dimensions.

Vlosky & Smith (1993) suggest that IOS technology represents a means by which
products may be differentiated and business relationships enhanced and may serve as the
basis for long-term and sustainable competitive advantage. However, as exchange
partners make the transition from paper-based to electronic-based communication, we
believe that a number of events take place. IOS technology impacts all functional areas
in channel organizations including documentation requirements, business procedures,
personnel role modification, communication channels and modes and transaction cost
structures (figure 2). As channel and business procedure practices progress to an
electronic environment, these changes can create short-term system stresses, both
psychologically for participants and on intracompany and channel structures.

[INSERT FIGURE 2 ABOUT HERE]

The Model

We believe that distinct short- and long-term effects on channel relationships occur
in different stages of IOS technology adoption (figure 3). The relationship in the pre-
technology adoption phase (t0) is assumed to be stable and to have gone through the
expansion phase in the relationship development process, as described by Dwyer, Schurr
and Oh (1987), with accompanying establishment and clarification of exchange partner
roles and performance requirements and establishment of mutual satisfaction. An initial
benchmark level of commitment (C0) exists at this stage. The length of the relationship,
account criticality and degree of social and structural interfirn bonding are posited to be
determinants of pre-IOS technology relationship strength. We propose that IOS
technology introduction into the relationship leads to disequilibrium and reduces relationship satisfaction and level of commitment ($C_1$) for both parties ($t_1$). The same factors that determine pre-IOS relationship strength, countered by relationship stressing impacts, determine the width and duration of the 'relationship satisfaction gap' depicted as the trough in $t_1$. Figure 4 depicts IOS induced relationship stresses that create the 'relationship satisfaction gap' and gap counter forces. It is not until later in the IOS technology-impacted relationship process ($t_2$) do realized expectations of long-term relationship stability lead to strengthened structural bonding. Adjustment and accommodation typify the process toward re-establishment of trust, interfirm bonding and commitment ($C_2$) at or above pre-IOS adoption levels. We propose that, with the introduction of IOS technology into the relationship, commitment drops and then regains ground in the long-term ($C_0 > C_1 < C_2$). Benefits from participating in IOS technology are acknowledged at this stage, further strengthening the relationship.

A number of possibilities exist that may explain short-term relationship disruptions. First, both retailers and their suppliers make investments solely to accommodate linking technology requirements. Specific investments, such as those made in this scenario, are investments made by a firm that are of considerably less value outside the focal relationship (Heide and John 1990). Anderson and Weitz (1992) discuss the difficulty or inability to redeploy these idiosyncratic investments to other channel relationships and cite Williamson's (1985) suggestion that idiosyncratic investments stabilize relationships by altering the firm's own incentive structure (realigning its self-interest). By making idiosyncratic investments in a relationship, channel members create incentives to maintain the relationship (Anderson and Weitz 1992). With the adoption of IOS technology, retailers make specific technology investments by installing point-of-sale (POS) bar code
scanning capabilities which require supplier support to function effectively. Suppliers also make idiosyncratic investments (develop UPC bar code application capabilities) as a prerequisite to satisfy customer requirements which afford them consideration as viable vendors. Specific IOS technology investments for both buyers and suppliers are made for capital needs and managerial overhead creating additional costs of doing business.

In addition to financial implications of adapting to customer requirements, having to implement an unfamiliar technology may likely have a negative effect on suppliers. Modification of supplier behavior to accommodate customers is an example of exercised power, as distinguished from latent or potential power. The customer pushing the supplier to meet their IOS technology needs is consistent with the definition of channel member power given by El-Ansary and Stern (1972) as the ability of a channel member to control marketing strategy decision variables of another member in a given channel at a different level of distribution. Scheer and Stern (1992) suggest that in a commercial exchange, when one party attempts to influence another to take specific actions, a dynamic ensues that can change the course and content of their relationship. This dynamic encompasses four elements affecting target attitudes, target compliance or enactment, performance outcomes of actions taken by the target and how target attitudes are altered or reinforced as a result of these outcomes.

From the buyer's perspective, short-term relationship stresses stem from a sense of frustration that suppliers are not reacting swiftly or efficiently enough in implementing IOS technology, indicating a possible disparity in reciprocal skills. For example, many companies that initiate another IOS technology, electronic data interchange (EDI) channel linkages, are shocked to find partners unable to assimilate even modest data technologies and applications (Konsynski and McFarlan 1990). Buyers are also frustrated at supplier lack of understanding regarding IOS technical fundamentals and implementation.
Hypotheses

Short-term relationship disruption is hypothesized to be due to differences in buyer-supplier perceptions of how IOS technology adoption should influence the relationship. These perceptual differences are reflected in tested hypotheses H₁, H₂, and H₃. First, initiators of technology, in this case the buyer, may perceive themselves to be "in the driver's seat" in regard to power in the relationship as suppliers attempt to respond quickly to their technical requirement mandates. However, suppliers that accommodate customer IOS requirements early in the technology adoption process may believe that the scales are tilted in their favor because the bar coded products they provide are available in the short-term from only a few suppliers.

P₁: Short-term IOS technology induced channel relationship deterioration is caused by differences in buyer-supplier perceptions of interdependence that exist from IOS technology adoption.

H₁: The greater the difference in perception of interdependence, the greater the relationship deterioration.

Significant idiosyncratic investments may be incurred for both parties when IOS technologies are adopted. These investments may be a means for generating efficiencies that, in turn, make a positive profit contribution or may simply be strategic costs of doing business incurred to maintain or develop market position. In any event, they are not readily redeployable to alternative business activities. One issue that complements the specific investment issue is the question of value that should be received for making these investments. One measure of value, incremental service price for implementing a customer mandated IOS technology, was examined.

P₂: Short-term IOS technology induced channel relationship deterioration is caused by disparate buyer-supplier perceptions of value of IOS technology adoption to the other partner.
H2: The greater the difference in buyer-seller perception of IOS value, the greater the relationship deterioration.

IOS technology implementation can be an exasperating experience for companies that have little or no prior experience. Frustration can be compounded for suppliers if technology adoption is customer mandated with seemingly impossible deadlines or if the technology is in the early phase of adoption in an industry. Suppliers in this study face both circumstances.

P3: Short-term IOS technology induced channel relationship deterioration is caused by disparate buyer-supplier perceptions of appreciation by the other exchange partner for the effort required to implement IOS technology.

H3: The greater the difference in perception of effort required to implement IOS, the greater the relationship deterioration.

Although unbalanced specific cost-value expectation fulfillment and relationship power imbalances contribute to exchange partner frustration in the short-term, the reward often is the expectation of long-term strengthening of the relationship. The seller industry in this study is characterized by commodity products offered by many suppliers in a intensely competitive environment. Those firms that adapt to customer technology requirements believe that their market position will eventually be secured and anticipate subsequent future relationship stability. Buyers also initiate IOS technology with preconceived expectations of long-term relationship stability.

P4: In the long-term, after periods of disruption and relationship readjustment, IOS technology impacted channel relationships strengthen (t2 in figure 2)

H4: The longer the time that passes since IOS implementation, the stronger the relationship becomes.

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The home center retail industry is but one customer base for wood products suppliers. Most wood products are used for construction and industrial applications that do not require the application of UPC bar codes. In addition, not all home centers require wood product suppliers to bar code their products. Buyers and sellers that continue to conduct business in a non-IOS environment do not experienced technology induced relationship disruptions and, as such, should have better short-term relationships with exchange partners.

H5: Short-term relationship quality is lower for technology adopter buyers-suppliers than for non-technology adopter buyers-suppliers.

Overview of the Buyer-Seller Environment

These hypotheses were tested using data collected from the wood products supplier-retail home center buyer industries. In the home center industry, a number of interorganizational system (IOS) technologies that create linkages with suppliers are being adopted resulting in shortened order cycles and improvement in inventory replenishment and management. Suppliers products to these home center retailers are expected to adopt IOS technologies to remain competitive. Many home center retailers have reduced the number of suppliers for wood product commodity items where possible due in part to selecting only IOS technology capable suppliers and also due to incremental startup and maintenance costs for each new linked supplier.

An IOS technology important to home center channel linkages with suppliers is Universal Product Code (UPC) bar coding of individual products for point-of-sale (POS) scanning at the cash register. Vlosky and Smith (1993) report that retailers have implemented UPC bar code POS scanning for a number of reasons, all of which are intended to increase efficiency, profitability and competitiveness. They cite primary benefits of POS scanning including: 1) A reduction in errors due to manually keying in
prices and product data at the cash register; 2) Checkout line throughput improvement; 3) Inventory control and management improvement; 4) Enhanced communication between buyer and seller and; 5) Improved data for consumer market research.

Home center suppliers have been encouraged to UPC bar code their products or face the prospect of being replaced by UPC capable competitors. Although suppliers are forced to react to changing customer requirements, positive attributes of implementing UPC for suppliers include product differentiation and development of stable business relationships resulting from direct linkage of company information systems.

METHOD

Data Collection Procedure and Response Rates

The study sample consisted of the 500 largest (by sales) home center retail companies in the United States. The National Home Center News Annual Retail Scoreboard (1992) was used to identify and select sample frame members. The Directory of Home Center Operators and Hardware Chains (1991) was used to identify key informants for sample frame members. The sample design was determined to be most appropriate due to the studied opinion that larger, more influential home centers are early adopters of IOS technologies (Widman 1990; Vlosky and Smith 1993), a premise that was found to be statistically significant (Vlosky and Smith 1994a). The sample of the 500 largest firms represents 67 percent of the $67 billion home center industry in 1992 with the range of sales revenue by firms in this group from $7,148 million (the largest firm) to $12 million (the 500th largest firm) (National Home Center News 1993).

On the supplier side, the sample consisted of the 597 largest (by sales revenue for distribution intermediaries and by volume for manufacturers) wood products companies in North America taken from eight supplier populations (manufacturers of seven major product groups and distributors-wholesalers). Industry directories were used to identify and select sample frame members and to identify key informants. As is the case with

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home center retail buyers, the purposive (judgment) sample design was determined to be most appropriate (Vlosky and Smith 1994b).

The study was conducted using mailed surveys. Survey development and implementation followed methods and procedures recommended by Dillman and described as the Total Design Method (TDM) (Dillman 1978). Accordingly, the mail questionnaire procedures, including pre-testing, pre-survey notification of the initial mailing, a post-survey reminder and two additional survey mailings resulted in an adjusted response rate for home centers of 35 percent or 177 usable surveys from 500 firms and an adjusted response rate for wood products suppliers of 50 percent or 272 usable surveys from an adjusted sample size of 540 firms.

Key informants and titles were identified for most survey recipients through the use of industry directories and industry association contacts. In addition, nearly 400 phone calls were made prior to the initial survey mailing to improve the key informant data base. The focused efforts in the pre-notification stage of data collection are credited with the relatively high response rate reported.

Profile of respondents

The 1992 average sales for the 177 home center retail respondents was $177 million and ranged from $12 million to $7.1 billion. The 177 responding home center companies represented $30.3 billion in total sales in 1992 or 33 percent of the entire home center industry (National Home Center News 1993). To illustrate the importance of large multi-store companies in the home center industry, just 15 percent of home center respondents (26 companies) account for 88 percent ($28.3 billion) of total 1992 respondent sales. Point-of-sale scanning home centers are characterized as large (sales >$100 million) multi-store chains. While 73 percent of home center industry respondents (by revenue), representing $22.2 billion in 1992 sales, point-of-sale scanned UPC bar coded products (in general) in 1992, 61 percent of home center industry respondents (by
Respondents for the seven wood products manufacturing sectors surveyed represented an unweighted average of 47 percent of total North American production in 1992 across all sectors. Distribution intermediary respondents represented over $18 billion in revenue in 1992. As is the case with home center retailers, large wood products supplier companies lead in implementing UPC bar code technology to serve the home center customer base with respondent UPC bar coding company production being 218 percent higher on average than that of non-UPC bar coding companies in 1992.

Measures

Buyers and suppliers responded to questionnaire items to assess short- and long-term effects of technology adoption on channel relationships. The following measures were used: dependence-power, short-term commitment, long-term commitment, supplier adaptation to customer technology requirements, and sensitivity to supplier technology implementation challenges and customer technology needs. Items used 5-point scales indicating varying levels of agreement: 1=strongly disagree to 3=neither disagree or agree to 5=strongly agree.

Paired questions were asked of buyers and suppliers for each of the key measures and although these pairs conceptually are parallel, question wording was problematic. An attempt was made to minimize confusion by presenting results in a paired format.

Results

In testing hypotheses related to short-term IOS influenced channel relationship disequilibrium, the items in table 1 were used. (All results in table 1 are for technology adopter respondents.)
P1: Short-term IOS technology induced channel relationship deterioration is caused by differences in buyer-supplier perceptions of interdependence that exist from IOS technology adoption.

H1: The greater the difference in perception of interdependence, the greater the relationship deterioration.

Interdependence was measured with questions regarding exchange partner relative importance in the relationship, dependence and specific investments made in developing a technology based relationship. Except for the degree of importance that buyers-sellers ascribe to themselves due to the volumes of product they buy-sell to technology capable exchange partners, all measures are statistically significant at \( \alpha = .05 \) for 1-tailed t-tests. Differences are greatest in perceptions of supplier adaptation to customer IOS requirements and in the degree of specific technology investment.

P2: Short-term IOS technology induced channel relationship deterioration is caused by disparate buyer-supplier perceptions of value of IOS technology adoption to the other partner.

H2: The greater the difference in buyer-seller perception of IOS value, the greater the relationship deterioration.

Perception of value to the other partner was measured by asking whether a premium should be paid by customers for bar coded products. Buyers-supplier disagreement on whether such a premium should be paid is strongly significant at \( \alpha = .05 \) for a 1-tailed t-test.

P3: Short-term IOS technology induced channel relationship deterioration is caused by disparate buyer-supplier perceptions of appreciation by the other exchange partner for the effort required to implement IOS technology which can lead to relationship conflict.

H3: The greater the difference in perception of effort required to implement IOS, the greater the relationship deterioration.
Buyers were asked if they appreciate the technical challenges that suppliers face in supplying bar coded products to them and suppliers were asked if they believed their customers in fact appreciated the challenges they face. The difference in buyer-supplier perception is significant at \( \alpha = .05 \) for a 1-tailed t-test.

**[INSERT TABLE 1 ABOUT HERE]**

**P4:** In the long-term, after periods of disruption and relationship readjustment, IOS technology impacted channel relationships strengthen \( (t_2 \text{ in figure 2}) \)

**H4:** The longer the time that passes since IOS implementation, the stronger the relationship becomes.

We tested \( H_4 \) in two ways. First, by using both summary and detailed measures found in tables 2 and 3, and second, by doing an analysis of variance (ANOVA) for an index of relationship measures for four successive time periods of implementation. In the first analysis, table 2 shows that there is no statistical difference between buyers and suppliers perceptions of short- and long-term relationships with technology capable exchange partners. For \( H_4 \) to be supported, we tested *within group* perceptions of short- vs. long-term relationships with technology capable vs. non-technology capable exchange partners and found that they differ (table 3). Buyers believe that short-term relationships with non-technology suppliers are better vis a vis suppliers of bar coded products. Although the difference is not significant at \( \alpha = .05 \), a p-value of .08 and t-value of -1.45 give directional support to our hypothesis. Supplier perception of short- and long-term relationships with technology capable customers differ significantly at \( \alpha = .05 \). On the buyer side, the lack of significance is attributed to a lack of statistical power due to a small sample size \( (n=16) \). However, we are encouraged that differences were discovered and are directionally as hypothesized.

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ANOVA (table 4) resulted in a significant relationship between relationship strength and age of IOS technology relationship for both buyers and suppliers at α=.05. Relationship strength was measured by indices of relationship factors for both buyers and suppliers over four time periods of implementation (table 5). Due to relationship complexity, indices were constructed using representative measures used to test previously stated hypotheses in addition to other measures contained in the study. Even with small sample sizes, a strong positive linear relationship exists between the indices and relationship strength. In addition, as seen in figure 5, illustratively, the pattern of means for relationship measures over the four successive time periods, further support our model of relationship strength related to time since implementation of IOS technology. In some cases, relationship strength declines and rebounds over time (figure 5f, 5g, 5i and 5l), while in the balance of cases relationship strength is positively related to measure responses over time (figures 5a, 5b, 5c, 5d, 5e, 5h, 5j and 5k).

H5: Short-term relationship quality is lower for technology adopter buyers-suppliers than for non-technology adopter buyers-suppliers.

In testing H5, the items in table 6 were used. Except for suppliers investing more time and effort in developing relationships with non-technology customers, no additional statistically significant differences were found between technology adopter buyers-suppliers and non-technology adopter buyers-suppliers. Although differences were detected and all are directionally as hypothesized, H5 was rejected.
Discussion

Results support the pattern of IOS technology impacted relationship strength over time in the model and the proposition that short-term relationship disequilibrium results from IOS technology adoption in channel relationships. It is clear from broader study results and personal interviews with channel participants that UPC bar coding is important to retailers and is often a criteria in vendor selection.

Both buyers and suppliers believe they are important to their channel partners because of the volumes of product that they buy or sell to them. A disparity in power-dependence perceptions is detected by buyer responses indicating that they believe that technology capable suppliers are not dependent on them, perhaps because buyers believe that technology capable suppliers have opportunities to supply bar coded products to other point-of-sale bar code scanning home center customers. Suppliers believe however that customers are somewhat dependent on them possibly due to increased supplier leverage resulting from a short-term scarcity of UPC bar coded product suppliers. An additional indication of differences in power perceptions is the belief by suppliers that they generally give in to customer technology requirements contrasted with the perception by buyers that suppliers do not readily adapt to these requirements.

Suppliers have made efforts to meet buyer IOS technology implementation deadlines under difficult circumstances but the suggestion that buyers are frustrated at a perceived lack of urgency on the part of suppliers in technology adoption appears to be legitimate. By implementing a customer driven technology, suppliers elevate their importance as key targeted partners in technical cooperation with customers. Retailers, however, believe these linkages to be a necessity for remaining competitive and do not attribute any particular importance to vendors as key technical partners.
Retail buyers perceive that the specific investments made by suppliers are not significant contrasted to the belief by suppliers that they have made significant investments in time and expense to satisfy customer technology requirements. Because adoption of UPC bar coding in the wood products industry is a recent phenomena (since 1988), there are a number technical challenges associated with bar coding wood products including modification of supplier production processes. Suppliers clearly feel that customers do not appreciate the challenges they face in adapting to customer needs but the customer claims that these challenges are appreciated.

Another issue is the dissimilarity in the perceived value of bar coded products. Comments received in the broader study indicate that suppliers perceive that retailers profit from point-of-sale scanning bar coded products and strongly believe that customers should pay a premium for this value-added service. However, retail customers believe that supplier-specific investments in IOS technology are simply a cost of doing business and are not willing to pay any additional charge for bar coded products. We propose that these incongruent perceptions between buyers and suppliers contribute significantly to short-term relationship deterioration.

As channel members become accustomed to the modified IOS technology-impacted relationship, the shocks to the relationship system dissipate (t2 in figure 3). A realization that IOS technology is not extraordinary and that it is becoming a requirement for doing business leads to the anticipation of a higher quality relationship in the future. Both buyers and suppliers feel that they will indeed have better business relationships with their technology-capable exchange partners in the long-term than they have with them today.

Buyers and suppliers believe that non-technology exchange partners currently have a higher degree of dependence on them than technology capable partners. Both exchange partners also believe they have invested more time and expense in developing relationships with non-technology exchange partners. A lower level of relationship quality is also
indicated by the lower confidence in proficiency of technology adopting exchange partner representatives. Although most of the differences were not statistically significant in testing relationship quality differences between technology capable and non-technology capable exchange partners, t-value signs indicate a consistently negative short-term perspective on IOS technology implementation for both suppliers and buyers, an encouraging result considering the post-hoc, small sample nature of this study.

Implications

The results from this study suggest a number of implications for IOS technology impacted channel relationships. Four of the hypotheses were supported reasonably well by the data indicating that channel relationship deterioration does occur during early stages of IOS technology adoption. We believe that the data reveals a number of factors which contribute to this disequilibrium. The primary reason for relationship disruption is the chasm between buyer and supplier perceptions of the relationship status. In the short-term, there appears to be little sensitivity and understanding regarding exchange partner efforts to adopt this channel technology. Buyers are wary of supplier commitment to developing solutions in a timely manner and suppliers feel pushed to quickly adopt an unfamiliar technology without adequate customer support. Financially, suppliers think customers should compensate them for their efforts, but customers are vociferous in their opposition and are steadfast in not paying a premium for bar coded products. Over the course of time, relationship strength and satisfaction increase as exchange partners adjust to IOS technology influences.

Limitations and Future Research

Although this exploratory analysis identified a number of issues, limitations exist in the study. First, the analysis was conducted post-hoc using data collected as part of a broader research study. Second, a single IOS technology was studied in one channel. In
order to generalize our stated conclusions, parallel studies should be conducted that examine other IOS technologies in this and other channels. Third, IOS technology in the wood products supplier-home center buyer channel is in the early stage of adoption which does not allow for confirmation that long-term relationships eventually stabilize or exhibit relationship strength higher than found at pre-implementation. As technology adoption diffuses to other channel members, a temporal study might be conducted to examine long-term relationship stability. As a result of this channel being in the early stage of technology adoption, there is a small home center retail buyer sample size. Buyer data supported our hypotheses but this small sample size (n=16) has low statistical power.

There are significant opportunities to build on this exploratory research such as studies to investigate if other industries and channels experience short-term relationship disruption as a result of IOS technology adoption and to identify underlying reasons for differences in buyer-supplier perceptions identified in this study. We believe that although this study generates a number of questions, it has shed new light on implications for IOS technology adoption in channels.
Literature cited


Figure 1.

Hypothetical Model of the Antecedents of Buyer-Seller Long-Term Relationships

Technology

Evaluation of Alternative Exchange Relationships

Adaptation to the Exchange Relationship

Importance of the Exchange Relationship

Perceived Environmental Uncertainty

Commitment (Long-Term Relationship)

Social Bonding

Satisfaction

Trust

Han and Wilson (1993)
Transition To Technology Based Channel Transactions

**GOALS**
- Electronic enhancement/replacement of business transaction procedures
- Increased competitiveness
- Improved efficiency

**IMPACTS**
- Documentation
- Procedures
- Personnel roles and duties
- Communications requirements
- Transaction costs
Interorganizational System (IOS) Technology Influences on Buyer/Supplier Relationships

Figure 3.
Figure 4.

IOS Technology Induced Relationship Satisfaction Gap

Gap Creation Factors
- Non-Transferable Resource Commitment
- Power/Dependence Imbalance
- Unmet Expectations Of Support and Value Creation
- Internal Corporate Stresses

Gap Mitigating Factors
- Evolved Trust
- Historical Relationship Structure
- Account Criticality
- Stable Power/Dependence Parameters
Figure 5. Relationship Strength vs. Relationship Measures

b. Suppliers
Our UPC customers are dependent on us.

Recent —> TIME —> Early

4.5 4.0 3.5 3.0 2.5 2.0 Recent

—> Early

c. Suppliers
In the short-term, we have better relationships with UPC customers than non-UPC customers.

Recent —> TIME —> Early

4.5 4.0 3.5 3.0 2.5 2.0 Recent

—> Early

d. Suppliers
In the short-term, we have better relationships with UPC suppliers than non-UPC suppliers.

Recent —> TIME —> Early

4.5 4.0 3.5 3.0 2.5 2.0 Recent

—> Early

e. Buyers
Our UPC suppliers are dependent on us.

Recent —> TIME —> Early

3.1 3.0 2.9 2.8 2.7 2.6 2.5 2.4 2.3 Recent

—> Early

f. Buyers
In the short-term, we have better relationships with UPC suppliers than with non-UPC suppliers.

Recent —> TIME —> Early

3.1 3.0 2.9 2.8 2.7 2.6 2.5 2.4 2.3 Recent

—> Early

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Figure 5. Relationship Strength vs. Relationship Measures

**e. Buyers**
Our UPC suppliers are committed to long-term relationships with my company.

**f. Suppliers**
UPC customers are committed to long-term relationships with my company.

**g. Buyers**
My company is committed to long-term relationships with our UPC suppliers.

**h. Suppliers**
My company is committed to long-term relationships with our UPC customers.
Figure 5. Relationship Strength vs. Relationship Measures

i. Buyers
Our UPC suppliers are key partners in technological cooperation.

j. Buyers
Suppliers appreciate my company's need to purchase UPC bar coded products.

k. Suppliers
Our company is more inclined to share production forecasts with UPC customers than non-UPC customers.

l. Suppliers
We are important to our customers because they buy a significant volume of product from us.
Table 1. Tests of Hypotheses 1, 2 and 3.

<table>
<thead>
<tr>
<th>Perceptions of Interdependence (H1)</th>
<th>BUYERS (n=16)</th>
<th>SUPPLIERS (N=73)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Our company is important to our UPC bar coded product wood suppliers/customers because we...</strong></td>
<td>Mean</td>
<td>S. D.</td>
</tr>
<tr>
<td>buy/sell significant volumes of products from/to them.</td>
<td>3.69</td>
<td>1.20</td>
</tr>
<tr>
<td>are key targeted partners in technical cooperation.</td>
<td>3.06</td>
<td>1.18</td>
</tr>
<tr>
<td><strong>Our UPC bar coded wood products suppliers/customers...</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>are dependent on us.</td>
<td>2.75</td>
<td>1.00</td>
</tr>
<tr>
<td>mostly give in to customer UPC bar coded product requirements.</td>
<td>2.81</td>
<td>1.11</td>
</tr>
<tr>
<td>have invested considerable time and expense in developing UPC bar coding relationships with my company.</td>
<td>2.88</td>
<td>1.31</td>
</tr>
<tr>
<td><strong>Perception of Value to the Other Partner (H2)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>My Company/Our Customers...</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>will pay/should pay a premium for UPC bar coded products.</td>
<td>2.63</td>
<td>1.26</td>
</tr>
<tr>
<td><strong>Perception of Relationship Effort (H3)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>My Company/Our Customers...</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>appreciates the technical challenges associated with UPC bar coding wood products.</td>
<td>3.63</td>
<td>1.02</td>
</tr>
</tbody>
</table>

*a: Significant at p<.05 (1-tailed test).*
Table 2. Test of Hypothesis 4: Perceptions of Buyers and Suppliers: Perceptions of Short- and Long-Term Commitment Between Technology and Non-Technology Exchange Partners

<table>
<thead>
<tr>
<th></th>
<th>BUYERS (n=16)</th>
<th>SUPPLIERS (N=73)</th>
<th>T-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-Term Commitment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our UPC bar coded wood products suppliers/customers... have better business relationships with my company than non-UPC bar coded suppliers/customers in the short-term.</td>
<td>3.19</td>
<td>1.28</td>
<td>3.47</td>
</tr>
<tr>
<td><strong>Long-Term Commitment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our UPC bar coded wood products suppliers/customers... will have better business relationships with my company than non-UPC bar coded suppliers/customers in the long-term.</td>
<td>3.88</td>
<td>1.41</td>
<td>3.85</td>
</tr>
</tbody>
</table>
### Table 3. Test of Hypothesis 4: Differences Between Short- and Long-Term Commitment For Technology Capable Exchange Partners

#### Buyer Perceptions of Short- and Long-Term Commitment to Technology Capable Suppliers

<table>
<thead>
<tr>
<th>Question Asked</th>
<th>Observation</th>
<th>Mean</th>
<th>S.D.</th>
<th>t-value</th>
<th>P(T&lt;=t) one-tail</th>
<th>t Critical one-tail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term Commitment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Technology Adopter Suppliers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our UPC bar coded wood product suppliers have better relationships with my company than non-UPC bar coded product suppliers in the short-term.</td>
<td>16</td>
<td>3.19</td>
<td>1.28</td>
<td>-1.45</td>
<td>0.08</td>
<td>1.70</td>
</tr>
<tr>
<td><strong>Long Term Commitment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Technology Adopter Suppliers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our UPC bar coded wood product suppliers will have better relationships with my company than non-UPC bar coded product suppliers in the long-term.</td>
<td>16</td>
<td>3.88</td>
<td>1.41</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Supplier Perceptions of Short- and Long-Term Commitment to Technology Capable Customers

<table>
<thead>
<tr>
<th>Question Asked</th>
<th>Observation</th>
<th>Mean</th>
<th>S.D.</th>
<th>t-value</th>
<th>P(T&lt;=t) one-tail</th>
<th>t Critical one-tail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term Commitment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Technology Adopter Customers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our UPC bar coded wood product customers have better relationships with my company than non-UPC bar coded customers in the short-term.</td>
<td>73</td>
<td>3.47</td>
<td>1.08</td>
<td>-2.15a</td>
<td>0.02</td>
<td>1.66</td>
</tr>
<tr>
<td><strong>Long Term Commitment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Technology Adopter Customers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our UPC bar coded wood product customers will have better relationships with my company than non-UPC bar coded customers in the long-term.</td>
<td>73</td>
<td>3.85</td>
<td>1.08</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a: Significant at p<.05 (1-tailed test).*
### Table 4.

**ANALYSIS OF VARIANCE FOR SUPPLIER RELATIONSHIP INDEX ON AGE OF IOS TECHNOLOGY RELATIONSHIP**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEN IMPLEMENTED</td>
<td>3</td>
<td>3.500</td>
<td>1.167</td>
<td>2.94</td>
<td>0.045</td>
</tr>
<tr>
<td>ERROR</td>
<td>39</td>
<td>15.490</td>
<td>0.397</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>42</td>
<td>18.990</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV**

**LEVEL**

<table>
<thead>
<tr>
<th>N</th>
<th>MEAN</th>
<th>STDEV</th>
<th>Mean</th>
<th>Std Dev</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECENT</td>
<td>2</td>
<td>2.9286</td>
<td>0.3030</td>
<td>(--<em>-**--</em>)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>3.2679</td>
<td>0.3536</td>
<td>(--<em>-**--</em>)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>3.5762</td>
<td>0.7033</td>
<td>(--<em>-**--</em>)</td>
<td></td>
</tr>
<tr>
<td>EARLY</td>
<td>3</td>
<td>4.3810</td>
<td>0.2974</td>
<td>(--<em>-**--</em>)</td>
<td></td>
</tr>
</tbody>
</table>

**POOLED STDEV = 0.6302**

**ANALYSIS OF VARIANCE FOR BUYER RELATIONSHIP INDEX ON AGE OF IOS TECHNOLOGY RELATIONSHIP**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEN IMPLEMENTED</td>
<td>3</td>
<td>5.314</td>
<td>1.771</td>
<td>3.94</td>
<td>0.036</td>
</tr>
<tr>
<td>ERROR</td>
<td>12</td>
<td>5.393</td>
<td>0.449</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>15</td>
<td>10.707</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV**

**LEVEL**

<table>
<thead>
<tr>
<th>N</th>
<th>MEAN</th>
<th>STDEV</th>
<th>Mean</th>
<th>Std Dev</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECENT</td>
<td>5</td>
<td>2.5000</td>
<td>0.5893</td>
<td>(--<em>-**--</em>)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3.2000</td>
<td>0.9309</td>
<td>(--<em>-**--</em>)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.5556</td>
<td>0.3849</td>
<td>(--<em>-**--</em>)</td>
<td></td>
</tr>
<tr>
<td>EARLY</td>
<td>3</td>
<td>4.1111</td>
<td>0.3469</td>
<td>(--<em>-**--</em>)</td>
<td></td>
</tr>
</tbody>
</table>

**POOLED STDEV = 0.6704**

2.0 3.0 4.0 5.0
### Table 5. Relationship Index Measure Correlations

#### Supplier Relationship Index

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. We are important to our customers because they buy a significant volume of product from my company.</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Our UPC customers are dependent on us.</td>
<td>0.59</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. In the short-term, we have better relationships with UPC customers than with non-UPC customers.</td>
<td>0.36</td>
<td>0.52</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Our company is committed to long-term relationships with UPC customers.</td>
<td>0.49</td>
<td>0.66</td>
<td>0.52</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. We are more inclined to share production forecasts with UPC customers than with non-UPC customers.</td>
<td>0.27</td>
<td>0.51</td>
<td>0.38</td>
<td>0.28</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Our company generally gives in to UPC customer requirements.</td>
<td>0.24</td>
<td>0.28</td>
<td>0.20</td>
<td>0.46</td>
<td>0.31</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Our company is more important to our UPC customers than they are to us.</td>
<td>0.14</td>
<td>0.16</td>
<td>0.20</td>
<td>0.02</td>
<td>0.30</td>
<td>0.10</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>8. When did your company first implement UPC bar coding with home center customers?</td>
<td>0.23</td>
<td>0.35</td>
<td>0.18</td>
<td>0.23</td>
<td>0.30</td>
<td>0.33</td>
<td>0.27</td>
<td>1.00</td>
</tr>
</tbody>
</table>

#### Buyer Relationship Index

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Our UPC suppliers are dependent on us.</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Our suppliers generally give in to our UPC requirements.</td>
<td>0.32</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Our suppliers have invested considerable time and expense in developing UPC relationship with my company.</td>
<td>0.33</td>
<td>0.67</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Our UPC suppliers are committed to a long-term relationship with my company.</td>
<td>-0.11</td>
<td>0.31</td>
<td>0.61</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. In the short-term, we have better relationships with UPC suppliers that with non-UPC suppliers.</td>
<td>0.56</td>
<td>0.54</td>
<td>0.81</td>
<td>0.53</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. My company is committed to a long-term relationship with our UPC customers.</td>
<td>0.38</td>
<td>0.29</td>
<td>0.39</td>
<td>0.15</td>
<td>0.61</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>7. When did your company first implement UPC bar coding with wood product suppliers?</td>
<td>0.24</td>
<td>0.31</td>
<td>0.66</td>
<td>0.72</td>
<td>0.66</td>
<td>0.44</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Table 6. Test of Hypothesis 5: Comparison of Relationship Quality Between Technology Capable and Non-Capable Exchange Partners

<table>
<thead>
<tr>
<th></th>
<th>Technology Capable Buyer Responses</th>
<th>Non-Technology Capable Customers Responses about All Suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=16)</td>
<td>(n=161)</td>
</tr>
<tr>
<td>Buyers</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Our Suppliers...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>are dependent on us</td>
<td>2.75</td>
<td>1.00</td>
</tr>
<tr>
<td>My Company...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>has invested a lot of time and expense on developing relationships with suppliers</td>
<td>3.50</td>
<td>1.03</td>
</tr>
<tr>
<td>is committed to long-term relationships with our suppliers</td>
<td>3.88</td>
<td>1.15</td>
</tr>
<tr>
<td>has confidence in the people representing our wood products suppliers</td>
<td>3.38</td>
<td>1.09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suppliers</th>
<th>Technology Capable Supplier Responses</th>
<th>Non-Technology Capable Suppliers Responding about All Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=73)</td>
<td>(n=143)</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Our customers...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>are dependent on us</td>
<td>3.27</td>
<td>1.08</td>
</tr>
<tr>
<td>My Company...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>has invested a lot of time and expense developing relationships with customers</td>
<td>3.81</td>
<td>0.96</td>
</tr>
<tr>
<td>is committed to long-term relationships with our customers</td>
<td>4.38</td>
<td>0.72</td>
</tr>
<tr>
<td>has confidence in the proficiency of the people representing our customers</td>
<td>3.82</td>
<td>0.75</td>
</tr>
</tbody>
</table>

a: Significant at p<.05 (1-tailed test).