

The Influence of Interfirm Trust on Monitoring and Performance in Uncertain Environments

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Abstract

An important question for manufacturers is the extent to which control over the suppliers should be maintained when the interaction occurs in an uncertain environment. It is proposed in this paper that the level of trust (high and low) affect the manufacturer's level of monitoring and perceived supplier performance in uncertain environments. The empirical results from US manufacturers indicate the following: 1) When the trustworthiness of exchange partners is questionable, manufacturers tend to increase the level of monitoring over the supplier as they feel environmental uncertainty. On the other hand, those who place a high level of trust in a partner may need to rely on monitoring to a lesser extent regardless of environmental uncertainty. 2) Supplier performance, as perceived by manufacturers, is negatively associated with environmental uncertainty when a manufacturer's trust in its supplier is low, but it has no relationship with environmental uncertainty when there is high trust.

Keywords: trust, monitoring, performance, environmental uncertainty

INTRODUCTION

Manufacturers face many sources of environmental uncertainty in the relationship with their suppliers (Scott 1992). They experience uncertainty when the relevant contingencies are too numerous or unpredictable to be specified (Stump and Heide

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1996). For example, a volatile supply of component parts creates uncertainty for a manufacturer that requires a steady procurement of parts from its supplier. The manufacturer would therefore need to consider applying a certain level of interfirm control over the supplier to deal with uncertain supply (Celly and Frazier 1996). Interfirm control is based on monitoring the output of a partner and eventually encouraging the desired performance level. (Bello and Gilliland 1997; Stump and Heide 1996; Celly and Frazier 1996; Heide 1994).

The question that must be answered is: what level of control over the supplier should be maintained in uncertain environments? A few studies provide ample evidence that environmental uncertainty is positively associated with interfirm control (Celly and Frazier 1996; Sachdev, Bello, and Pilling 1994; Klein, Frazier, and Roth 1990). However, some researchers suggest that social context in which exchange parties are deeply embedded should play a part in the consideration of relevant control levels (e.g., Hagen & Choe 1998; Hill 1990; Shapiro 1987; Granovetter 1985). Since exchange parties as a social entity interact with their channel partners, they are more likely to develop a social relationship represented by relational norms or trust (Dwyer, Schurr, and Oh 1987). These social factors are a major influencing factor over the inter-organizational relationship and its performance (e.g., Doney and Cannon 1997; Ganesan 1994; Noordewier et al. 1990). Existing literature offers a limited explanation on the influence of the social context on a firm's choice of interfirm control, as well as on the efficiency of economic performance in uncertain environments. Transaction cost analysis (TCA), for instance does not explain why two firms with the same perception of the level of uncertainty within environments exercise different levels of interfirm control over their exchange partners (Chiles & McMackin 1996).

This study proposes that the inclusion of trust which is a social context variable, may explain different levels of monitoring over the exchange partner in uncertain environments. Interfirm trust has emerged as a central focus of literature on channels of distribution and business-to-business relationships (e.g., Wilson 1995; Morgan and Hunt 1994; Andaleeb 1992). Researchers have found that the benefits of placing trust in a supplier include the reduction of negotiation costs (Zaheer, McEvily, & Perrone

1998), an increase in the firm's willingness to candidly discuss needs(Zaltman and Moorman 1988), the enhancement of proprietary information exchange(Zand 1972) as well as cooperation(Schurr and Ozanne 1985), the facilitation of a long-term orientation (Doney and Cannon 1997; Geyskens et al 1996; Ganesan 1994), and finally, increased performance(Jap 1999). Thus, considering the effect of trust on transaction costs and performance, trust might be a crucial factor for interfirm monitoring and performance under uncertain environments.

This study seeks to examine the condition under which manufacturers that face various levels of uncertain environments adopt appropriate levels of monitoring over their suppliers and maintain various level of supplier performance. One major goal of this research is to investigate the extent to which a manufacturer's trust in its supplier affects its response(the level of monitoring over the supplier) to environmental uncertainty. Although trust is considered to be an important relational variable(Doney and Cannon 1997; Ganesan 1994), its influence on interfirm monitoring within uncertain environments has not been investigated enough. A second goal is to investigate the impact of a manufacturer's trust on perceived supplier performance in diverse levels of environmental uncertainty. Although the effect of trust on interfirm performance has been studied(e.g., Jap 1999; Zaheer, McEvily, & Perrone 1998), studies on the influence of trust on the relationship between uncertain environments and the manufacturer's buying performance are rare. The theoretical framework and research hypotheses are provided in the following section.

THEORETICAL BACKGROUNDS AND HYPOTHESES

Trust

Trust is defined as a willingness to rely on an exchange partner whose behavior is not under one's control(Mayer, Davis, and Shoorman 1995; Moorman, Zaltman, and Deshpande 1992; Swan, Trawick and Silva 1985; Zand 1972). The voluntary dependence of a manufacturer on its supplier is based on optimistic expectations about outcomes(Hosmer 1995). Thus,

there is a possibility that the manufacturer will be worse off if its trust is betrayed. Trust is therefore a manufacturer's belief that the supplier will not only execute actions that will result in positive outcomes but also avoid actions that would result in negative outcomes(Anderson and Narus 1990).

Trust embodies the feature of trustor's vulnerability due to the absence of direct control over the trustee(Coleman 1990). For instance, a manufacturer that expects the delivery of parts on time from its supplier might encounter problems in the case where the supplier fails to deliver the parts on time. Thus, the manufacturer that places trusts in its supplier for on-time delivery would be vulnerable. If the manufacturer can easily obtain the parts in a timely fashion from an alternative supplier, it would not need to rely on the incumbent supplier for delivery. In this instance, the parts would be delivered on time regardless of whether the manufacturer trusts the supplier or not. Thus, the direct result of trusting a supplier would be inconsequential to the manufacturer and the issue of vulnerability would be eliminated also. Trust therefore exists only when a manufacturer's expected outcome, such as the acquisition of parts on time at a reasonable price, is considered as fundamental(Das and Teng 1998).

The question as to where the vulnerability of manufacturer originates from must also be answered. When a manufacturer faces uncertainty within the environment as in the case of unstable supply of components or volatility in their prices, perfect information is difficult to come by. The manufacturer is therefore considered to be vulnerable as a result of lack of relevant information on the availability or price of component parts. If the manufacturer experiences no uncertainty regarding the purchase of parts, trust might not be necessary, as there would be complete information available.(Moorman et al. 1993). Environmental uncertainty therefore generates a condition in which inter-organizational trust can operate.

According to transaction costs theory(TCA), inter-organizational exchanges within uncertain environments are associated with transaction costs such as the monitoring of the supplier to prevent the inflation of prices, the taking of actions when deliveries are not made on time, and the collecting information on part prices in the market(Noordewier et al. 1990; Maitland et

al. 1985). Since these transactions costs are high, market exchange is not relevant to dealing with an uncertain environment. Thus, TCA suggests interfirm control mechanisms such as monitoring of the partner. However, interfirm control requires transaction costs such expenditures associated with the monitoring of outputs and behavior of the exchange partner.

Trust placed in an exchange partner reduces transaction costs (Chiles & McMackin 1996) as the supplier's record of credible performance gives the manufacturer a certain confidence that makes monitoring unnecessary (Barber 1983). Furthermore, the manufacturer's trust in the supplier's performance contributes to the reduction in enforcing costs, an expenditure for correcting poor performance (Chiles & McMackin 1996). A supplier's reputation for trustworthy behavior decreases negotiating costs as both parties are accommodating and quick to come to a resolution rather than adopt competitive stance in which parties are cautious and slow to come to a resolution (March 1988). Finally, trust reduces costs associated with the drafting of a contract, since contractual terms are more loosely specified rather than detailed when trust exists (Chiles & McMackin 1996). Trust generates an expectation that contingencies that are not addressed in the contract will be sufficiently dealt with by the benevolent partner. In the absence of trust, a prudent manufacturer should make detailed and specified terms to ensure that it is better prepared for every possible situation that could arise as a result of the possibility that its supplier would take advantage of obscure terms. A manufacturer's trust in its supplier therefore reduces transaction costs.

Low transaction costs involved with trust imply that trust could be an attractive mechanism for reducing interfirm control over the exchange partner in an uncertain environment. Several researchers imply trust could complement interfirm control (e.g., Moorman et al. 1992; Ouchi 1979). Moorman et al. (1992) propose that trust reduces perceived uncertainty. Since an exchange party tends to increase control to deal with environmental uncertainty, the reduced uncertainty could lead to the decrease in interfirm control. Ouchi (1979) argued that an exchange party must trust its partner, or it should closely monitor the partner. Although trust is not directly mentioned, John (1984) points out that it is insufficient to rely only on

interfirm control, so internalized social restraints must be cultivated to complement interfirm control.

Environmental Uncertainty, Monitoring, and Trust

Exchange parties face environmental uncertainty that stems from various sources(e.g., upstream or downstream) in decision-making situations(Scott 1992). The environmental uncertainty experienced by the buyer can be described as upstream as it includes attributes such as the supplier's unstable supply of component parts or the volatile nature of price changes of component parts. Therefore, the discussion will be centered mainly on the buyer's upstream environmental uncertainty.

An organization experiences uncertainty when it does not have relevant information(Argote 1982). Environmental uncertainty makes it difficult for exchange parties to make accurate predictions about future business conditions(Frazier and Antia 1995; Jaworski 1988; Achrol and Stern 1988). Unexpected fuel supply interruptions, raw material shortages and the like may prevent a supplier from fulfilling orders for manufacturing inputs. Exchange parties are forced to adopt an interfirm control structure best suited to conditions of high uncertainty in industries within which such uncertainty exists(Stump and Heide 1996).

Interfirm control is based on monitoring the performance of the other party, that is, measuring output performance(e.g., Heide 1994; Celly and Frazier 1996). Monitoring may involve either the review of the supplier's performance or the imposition of a formal evaluation program on vendor performance(e.g., Heide 1994; Celly and Frazier 1996). Monitoring therefore reduces information asymmetry between exchanges parties by revealing the degree to which the supplier has complied with terms previously agreed upon(Balakrishnan and Koza 1993; Lal 1990). By monitoring suppliers unilaterally, a manufacturer therefore can obtain the overt control necessary to accomplish its own ends(Rubin 1990). It therefore provides a good proxy for interfirm control.

The exchange party is likely to take advantage of the uncertain situation for its own interest(Klein, Frazier, and Roth 1990). Therefore, while exchange parties in stable environments are less

likely to engage in opportunistic behavior: self interest-seeking behavior with guile(Williamson 1975). For instance, when a manufacturer is not sure it can acquire the necessary amount of components due to an uncertain supply of parts in the market, its supplier may sell the parts to other buyers who could offer high prices for the parts while deceiving the current manufacturer that the parts are still in short supply. When a manufacturer's trust in its supplier is low, the manufacturer either places no credibility in its supplier's performance or benevolent intention. A manufacturer with a low level of trust in its supplier therefore should increase the level of monitoring over its supplier to prevent such opportunistic behavior, as environmental uncertainty increases.

When a manufacturer does not trust its supplier, it is less likely to reveal relevant information to the supplier or is on the other hand, more likely to distort information(Dirks & Ferrin 2001; Hedlund and Nonaka 1993). The supplier may respond in kind for the lack of information by not providing relevant information to the manufacturer. The manufacturer therefore may be suspicious of the information provided by its supplier. Thus, a manufacturer that does not place trust in its supplier is not equipped with relevant information to handle uncertain environments. The need for information is higher in highly uncertain environments than those in which low uncertainty prevails, since the relevant contingencies are too numerous to be specified or are unpredictable in nature(Stump and Heide 1996). Thus, the low level of trust that a manufacturer places in its supplier encourages the manufacturer to increase the level of monitoring over the supplier to reduce information asymmetry as environmental uncertainty increases. Since monitoring involves the manufacturer's supervision of the supplier's performance in relation to variables such as on-time delivery, price of delivered parts, or the supplier's inventory level, the manufacturer that operates within an uncertain environment can eliminate vulnerability supplier's betrayal. Thus, the first hypothesis is:

H1: When a manufacturer's trust in its supplier is low, as the manufacturer's perception of environmental uncertainty increases, the manufacturer's monitoring over the supplier increases.

The presence of trust in inter-organizational relationship leads to more accurate and timely information exchange(Lewis and Weight 1985; Zand 1972). Such information exchange affords a manufacturer a better understanding of the component parts, the supplier, and the component markets. The manufacturer equipped with information is less likely to allow its supplier to cheat on it. Furthermore, trust enables both parties to find productive solutions to disagreements that might occur (Moorman, Zaltman, and Deshpande 1992) and to adopt cooperative problem-solving approach(Schurr and Ozanne 1985). This suggests that the hazard of opportunistic behavior in uncertain environments can be mitigated substantially if trust exists.

While there is little chance for the supplier to cheat within low environmental uncertainty, there is a condition in which the supplier takes advantage of the uncertain situation for its own interest in high environmental uncertainty(Klein, Frazier, and Roth 1990). The manufacturer in highly uncertain environments should therefore prepare for the supplier's opportunistic behavior. However, a manufacturer's trusts its supplier allows the manufacturer not to worry about being ripped off by its supplier that could take advantage of environmental uncertainty. The manufacturer believes that the trustworthy supplier won't inflate the price in the situation of unexpected part shortage. A manufacturer's trust in its supplier therefore reduced the need for the manufacturer to monitor the supplier and instead, delegate the monitoring function to its supplier. The manufacturer that trusts its supplier is therefore less likely to perceive the hazard of the supplier's opportunistic behavior regardless of the level of environmental volatility, thereby leading to low level of monitoring exercised. The manufacturer with high trust in its supplier thus does not increase monitoring over its supplier, as it's perceived environmental uncertainty increases. Therefore:

H2: When a manufacturer's perceived trust is high, there is no relationship between environmental uncertainty and a manufacturer's monitoring over the supplier(see figure 1).

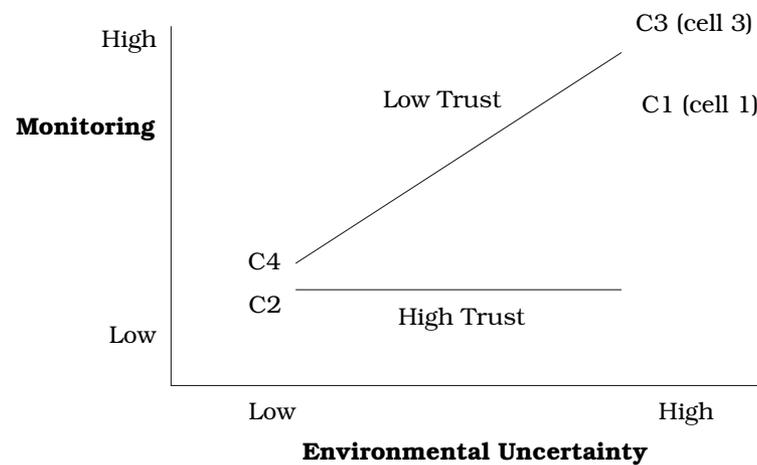


Figure 1. A Model for the Influence of Trust on Monitoring in Uncertain Environments

Environmental Uncertainty, Perceived Supplier Performance, and Trust

As environmental uncertainty increases, the information about the environment is likely to be asymmetrically distributed between exchange parties (Klein, Frazier, and Roth 1990). For instance, a manufacturer experiences uncertainty when the price of component parts changes rapidly. The manufacturer has disadvantage compared to its supplier, since the supplier has more information on the parts than the manufacturer. The information asymmetry between exchange parties allows the holder of the information to behave opportunistically (Klein, Frazier, and Roth 1990) to take advantage of its information superior position. Therefore, the manufacturer that places a low level of trust in its supplier is likely to be concerned about the supplier's opportunistic behavior as environmental uncertainty increases, which negatively influences the manufacturer's perception of the supplier's performance.

When trust in its supplier is low, the manufacturer in an uncertain environment spends a substantial amount of time and resources to monitor the product quality of the supplier, since the manufacturer does not count on its supplier for credible performance. There are costs involved with the possession and

inspection of products and with the processing of performance data(Stump and Heide 1996; Noordewier, John, and Nevin 1990). Delay in delivery and an inaccurate delivery may call for the manufacturer's efforts to put pressure on suppliers to ensure accurate delivery(Noordewier, John, and Nevin 1990). Similar efforts are required when product quality is lower than expected. Thus, these transaction costs for manufacturer with low trust in its supplier would negatively influence the manufacturer's perception of supplier's performance. Thus, the third hypothesis is:

H3: When a manufacturer's trust in its supplier is low, as the manufacturer's perception of environmental uncertainty increases, the manufacturer's satisfaction with the supplier performance decreases.

When manufacturer's trust in its supplier is high, a manufacturer believes that its supplier will deliver the product on time and with an expected quality and price in uncertain environments. Thus, a manufacturer that trusts in its supplier is less likely to feel the need to spend resource for monitoring or enforcement of the supplier to obtain component parts that show volatile supply. Thus, trust allows the manufacturer to maintain transaction costs at a low level in high environmental uncertainty, which leads to higher satisfaction with supplier performance.

An exchange party with trust in its partner is willing to share information(Lewis and Weight 1985; Zand 1972). Thus, a manufacturer that trusts its supplier in stable(low uncertainty) environments can provide the information on its expected demand for the component parts. This information can provide assistance to the supplier by manipulating the inventory in advance. The greater information exchange between the manufacturer and the supplier in stable environments therefore boosts the supplier's performance. In sum, information exchange and low monitoring costs under high trust leads to satisfaction with the supplier's performance regardless of the level of environmental uncertainty. The fourth hypothesis is therefore:

H4: When manufacturer's trust in its supplier is high, there is

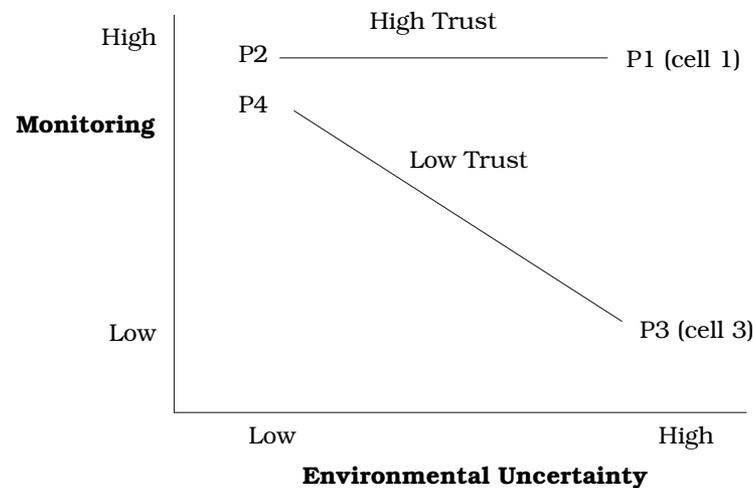


Figure 2. A Model for the Influence of Trust on Perceived Performance in Uncertain Environments

no relationship between a manufacturer's perceived environmental uncertainty and its satisfaction with the supplier performance(see figure 2).

METHODOLOGY

Research Setting and Data Collection

The context chosen for this study is the relationship between a manufacturer and its major supplier in the USA. The major supplier is the one from which the informant's company made the largest amount of purchases during the past year. This major supplier served as the referent for all questions in our mail survey. The above setting is selected because the major supplier is the one with whom the manufacturer is likely to have the most intense interactions and the opportunity to exercise monitoring.

Sample and Respondents

The manufacturers in this study were selected randomly from a Dun and Bradstreet mailing list: SIC codes from 3679

(electronic), 2399(textile), 3469(metal), and 3499(steel), representing manufacturing companies. Half of the manufacturers were chosen from the electric and electronic industries and the rest of the companies belonged to industries such as leather and rubber products. This way, I expected to eliminate industry specific influences on governance structure.

As this research is about buyers' governance structure, we chose as key informants the heads of purchasing departments of the manufacturing companies. Purchasing managers are responsible for securing materials from suppliers, hence they can be expected to be knowledgeable about the materials bought and to have a close relationship with suppliers(Hutt and Speh 2000).

To assess whether the key informants in this study had relevant knowledge, a pre-test was conducted. Pre-test respondents were asked whether they felt competent enough to respond to the survey questions(e.g., Kumar, Stern, and Achrol 1992). The pre-test results indicated that the respondent companies had an average of 18 years of relationship with their major suppliers. The average length of time each informant had occupied his or her current position was 5.8 years. Furthermore, our respondents appeared very knowledgeable about their supplier's products(mean knowledge level was 5.9 out of 7 where one meant "I do not have any knowledge", and seven meant "I do have great deal of knowledge"). This compares very well with the ratings that Kumar, Stern, and Achrol(1992) reported on similar items.

Procedure

Each purchasing manager in our sample was mailed 1) a questionnaire, and 2) a cover letter with a request to complete the enclosed questionnaire, as well as 3) a postage paid return envelope. Two weeks after the first mailing, a second mailing was conducted.

A total of 680 questionnaires were mailed, and 21 questionnaires were undelivered. 176 were completed and returned for a response rate of 26.70%. All returned questionnaires were reviewed for completeness. Two questionnaires with numerous missing answers were dropped from the sample. The remaining 174 questionnaires were used in

our analysis.

Nonresponse Bias

The test for nonresponse bias was conducted by comparing early respondents with late respondents (Armstrong and Overton 1977). The respondents were divided into two equal groups based on the date of response (i.e., early respondents, late respondents). The mean values for each scale and characteristics of company and key informants (i.e., years of relationship with the supplier, years of experience as a purchasing manager in the company, trust, environmental volatility) were compared across the two groups. The results of this comparison indicated no significant differences between two groups on those scales and characteristics, suggesting that the data are not skewed by non-response bias (The p-values for these comparisons ranged from .25 to .65).

Corporate Affiliations Plus (2004) was used for gathering secondary data on company's characteristics for both responding and nonresponding firms. Comparisons across the numbers of employees and total sales also produced no significant differences ($p < .72$ for employees, and $p < .50$ for sales volume). Finally response rates across industry groups (electronics, metal, textile, and steel) were examined, and found that they did not differ.

Measure Development

Measure development was carried out in two stages. In the first stage, existing measures for our constructs were gathered from the literature while in the second stage, depth interviews were conducted with three purchasing managers to check the relevance of the items developed in the first stage. The wording of some of the items was revised based on the inputs from the interviewed purchasing managers. All items used a 7-point Likert scale where 1 meant "strongly disagree" and 7 meant "strongly agree".

The first part of the development process had to do with the dimensions of *trust* being assessed with the items adapted from Doney and Cannon (1997). The scale addresses a supplier's

Table 1. Construct Measurement Summary

	Reliability
Environmental Uncertainty	.73
Availability of major product in the market is highly uncertain.	.74
Volatility in the production of major product is a real problem in the market.	.79
The supply of major product is not stable.	.52
Price for major product in the market is volatile.	*
Trust	.95
When making important decisions, the supplier is concerned about our welfare.	.91
When it comes to things that are important to us, our firm can depend on the supplier's support.	.85
Our firm can count on the supplier to consider how its decisions and actions will affect us.	.81
Our firm can count on the supplier to be sincere.	.73
Monitoring	.85
Our firm regularly conducts performance review of the supplier.	.80
Our firm monitors the supplier's inventory level.	.77
Our firm monitors the supplier's product quality regularly	.85
The relationship our firm has with the supplier makes use of many controls.	.70
Our firm regularly monitors the price of parts supplied by the supplier.	.72
Supplier Performance	.75
Our firm is satisfied with the Supplier's product quality.	.79
The service provided by the Supplier is satisfactory.	.56
Our firm is satisfied with the overall supplying of the Supplier.	.37
Our firm is satisfied with the on-time delivery performance of the Supplier.	.52

Fit statistics: $\chi^2 = 157.99$ df = 98 (p=.001), GFI = .91 CFI = .94, IFI = .94, RMSEA = .066

trustworthy behavior such as keeping its own promises as well as a supplier's concerns about business success of the manufacturer. The scale for *monitoring* assesses manufacturer's monitoring over various supplier decisions (Noordewier, John, and Nevin 1990). The scale of *environmental uncertainty* mainly captured the manufacturer's perception of various aspects of the supplied product (Noordewier, John, and Nevin 1990). *Supplier's Performance* measures manufacturer's evaluation of its supplier's product quality, services, and speed of delivery (Doney and Cannon 1997).

Construct validity

Each variable that was measured with multiple items was subjected to a scale development and purification procedure. On the basis of item-total correlations, ill-fitting items were dropped. The subsequent reduced sets of items were subjected to confirmatory factor analysis using LISREL 8.3. Then reliability analyses were run for each construct to see if all the measures demonstrate satisfactory coefficient reliability.

First, convergent validity was tested. Based on the results, one of the items with low loading with intended factors was removed from the scales. Among the items for environmental uncertainty, volatility in price (UNCER4) was deleted due to higher cross loading to the latent variable of supplier performance. After deleting this item, an acceptable fit of factor model for the four latent variables, trust (TRUST), environmental uncertainty (UNCERT), supplier performance (PERFORM), and monitoring (MONITOR), adequately fit the data ($\chi^2 = 157.99$ df = 98 (p < .01), GFI = .91 CFI = .94, IFI = .94 RMSEA = .066). All the factor loadings were highly significant (p < .01), which shows unidimensionality of the measures (Anderson and Gerbing 1988). Further, reliability tests were done for each construct to see if all the measures demonstrate satisfactory coefficient reliability. All the reliabilities of the constructs were above .70 (between 0.73 and 0.95). Thus, these measures demonstrate adequate convergent validity and reliability.

Discriminant validity of all 4 latent constructs through χ^2 difference tests. All the constructs in pairs (6 tests altogether) were tested if the restricted model (in which the correlation was

fixed as one) was significantly worse than the freely estimated model (in which the correlated was estimated freely). All the χ^2 differences were highly significant, which shows the evidence for discriminant validity (Anderson and Gerbing 1988). For example, the comparison regarding environmental uncertainty and trust yielded a $\chi^2(1) = 25.65(p < .01)$, suggesting these two constructs are distinct. Taken together, these results show that the measures in this study possess adequate reliability and validity (Anderson and Gerbing, 1988). The results of CFA such as goodness-of-fit index, factor loading, reliability are reported in table 1.

Control Variables: industry, firm size, and power asymmetry were used as control variables. Industry was coded as a dummy variable: electronic and electric industries = 1, other industries = 0. Firm size was indicated by the logarithm of the number of employees. Third, manufacturer's power over supplier was assessed by supplier replaceability, supplier switching costs, difficulty in changing supplier, and overall dependence on supplier (Frazier, Gill, and Kale 1989, Kumar, Scheer, and Steenkamp 1995, and Lusch and Brown 1996). The rationale behind including testing models with manufacturer's power over supplier is that the power allows a manufacturer to potentially control its supplier (Frazier and Antia 1995; Gaski 1984). The

Table 2. Correlation Matrix

	1	2	3	4	5	6	7
1. Environmental Uncertainty	1.000						
2. Trust	-.134	1.000					
3. Monitoring	.196	.105	1.000				
4. Performance	-.323	.707	-.103	1.000			
5. Power Asymmetry	.045	-.154	.192	.011	1.000		
6. Relationship Length	.023	.104	.033	.072	.058	1.000	
7. Industry	.014	-.054	.007	.062	-.027	.092	1.000
Mean	3.153	5.052	3.362	5.794	-1.04	15	0.51
Standard Deviation	.225	.028	.152	.044	1.22	13.23	0.50
Number of Items	3	4	5	4	6	1	1

Note: sample size = 174

correlation matrix of all the variables in the test model is presented in table 2.

ANALYSIS AND RESULTS

Tests of Hypotheses

A linear model for two dependent variables (monitoring, supplier performance) was estimated. Partition each condition of trust and environmental uncertainty into high (above 66%), middle (33% - 66%), and low (below 33%) groups using 3 group splits. Since the average value of trust is relatively high (average = 5.02) and the average value of environmental uncertainty is relatively low (average = 3.15), high trust (average = 6.05) and low trust (average = 3.87) groups and two groups for high (average = 4.78) and low (average = 2.25) environmental uncertainties were used to form the dummy variables. To eliminate potential problems associated with multicollinearity, a statistical test with mean-centered variables was done with variance inflation factors (VIF) outcomes (Aiken and West 1991). The statistical output shows that VIFs were well below the cutoff value of 10, suggesting that multicollinearity is not present.

$$(1) \text{ MONITOR} = b_0 + b_1 D_1 + b_2 D_2 + b_3 D_4 + b_4 \text{ LENGTH} + b_5 \text{ INDUSTRY} + b_6 \text{ INTASY}$$

The dummy variables D_1 , D_2 , and D_4 represent the combinations of values of uncertainty and trust magnitude corresponding to cells 1(C1), 2(C2), and 4(C4) respectively (see Table 3). The critical theoretical predictions, stated in terms of cells' control differences ($D1 - D2$) and ($D3 - D4$), are tested in the following manner. The estimated coefficient corresponding to each effect is first pinpointed.

The control difference between cell 4 and cell 3 ($D4 - D3$) is provided by the coefficient of D_4 ($b_4 = -3.886$, $t = -2.288$, $p < .05$) which reflects the deduction of Cell 4 from Cell 3 regarding the level of control, since $D3$ is not included in the regression model (Aiken and West 1991). The result shows that the manufacturer's perception of increasing environmental uncertainty under low

trust raises the manufacturer's reliance on monitoring over the supplier, thereby supporting hypothesis 1.

Regarding the (C2 - C1) effect that is estimated by $b_1 - b_2$, Table 3 shows estimate size of this effect as .657, which is calculated from coefficient estimates ($b_1 - b_2 = 4.327 - 3.670 = .657$). The effect is not different from that produced by zero. To get specific statistical output for the difference between D1 and D2, another multiple regressions was run without D1 and including D2, D3, D4, and control variables(Aiken and West 1991). b_1 this model reflects the difference between D1 and D2, since D1 is not included in the regression model ($b_1 = .657$, $t = .441$, $p = .660$). These results support hypothesis 2 and indicate that the pattern of effects consists of two nonparallel lines, as was shown in figure 2. This result shows that the perception of increasing environmental uncertainty under high trust does not increase manufacturer's monitoring over the supplier.

$$(2) \text{ PERFORM} = b_0 + b_1 D_1 + b_2 D_2 + b_3 D_4 + b_4 \text{ LENGTH} + b_5 \text{ INDUSTRY} + b_6 \text{ INTASY}$$

The dummy variables D_1 , D_2 , and D_4 represent the combinations of values of uncertainty and trust corresponding to cells 1(P1), 2(P2), and 4 (P4) respectively. The critical theoretical predictions, stated in terms of cell differences of the extent of perceived performance ($D_2 - D_1$) and ($D_4 - D_3$), are tested. The effect of $D_4 - D_3$, the deduction of Cell 3 from Cell 4 regarding the level of the perceived performance, is provided by the b_3 in Table 3 (1.740; $t = 2.325$, $p < .01$), thereby supporting hypothesis 3.

With regard to the $D_2 - D_1$ effect, the difference between cell 2 and cell 1, was assessed by $b_2 - b_1$. The effect is calculated from coefficient estimates ($b_2 - b_1 = 2.492 - 2.243 = .249$), which is not different from zero. More specific statistical output for the effect was derived by another multiple regression without D_4 and including D_2 , D_3 , and D_4 as predictors. b_1 coefficient in this model reflects the difference between D_2 and D_1 ($b_1 = .249$, $t = .386$, $p = .700$). These results support hypothesis 4, and indicate that the pattern of effects consists of two nonparallel lines, as shown in figure 3. These results show that manufacturer's perception of increasing environmental uncertainty under high

Table 3. Results of OLS Regressions on Monitoring and Perceived Performance

Independent Variables	Dependent Variables	
	Monitoring	Performance
Constant	9.428 (5.709)	22.426** (31.764)
D1	3.670* (2.004)	2.243** (2.791)
D2	4.327* (2.497)	2.472** (3.307)
D3	Not in equation	Not in equation
D4	-3.886* (-2.288)	1.740* (2.325)
LENGTH	-.0354 (-.931)	-.089 (.629)
INDUSTRY	.929 (.868)	-.444 (-.950)
POWASY	.246* (2.467)	-.439 (-.992)
Adj. R ²	.124	.324

Note: t-tests are one-tailed for hypothesized effects and two-tailed for controls.

** p < .01 * p < .05

trust does not decrease manufacturer's perceived supplier performance.

The Effects of Control Variables: Power asymmetry has positive impacts on manufacturer's adoption of monitoring over the supplier. It appears that manufacturer that has asymmetrical power advantage over its supplier tends to rely on monitoring over the supplier(see table 3).

DISCUSSION

Theoretical Implications

This study shows that interfirm trust is a critical factor for

manufacturers that should decide on a relevant level of monitoring in uncertain environments. Manufacturers in an environmental uncertainty would have to maintain a high level of monitoring over the supplier when they do not trust their exchange partners. However, those with a high level of trust in its supplier may rely less on monitoring over the exchange partner. The manufacturer can therefore adapt to an uncertain environment without resorting to a high level of monitoring when it trusts its supplier. In contrast, supplier performance, as perceived by manufacturers, is negatively associated with environmental uncertainty when a manufacturer's trust in its supplier is low, but it has no relationship with environmental uncertainty where the manufacturer trusts the supplier.

Transaction cost analysis(TCA) acknowledges that exchange parties often act on the basis of trust, but the difficulty in identifying trustworthy partners was so great that parties had to structure themselves as if all exchange partners could not be trusted(Williamson 1991). Thus, TCA framework does not include trust as a critical factor that influences inter-organizational governance structure. Instead, TCA proposes that exchange parties tend to behave opportunistically if they are given the chance. Although all parties may not be opportunistic, it is again costly to sort out those who are opportunistic from those who are not(Williamson and Ouchi 1981). Since the transaction costs in market exchange to prevent such opportunism is so high, TCA suggested interfirm control structures, such as vertical integration or interfirm control.

However, a recent view of TCA relaxed the assumption of opportunism, thereby allowing the existence of trust in the interfirm relationship(e.g. Atuahene-Gima and Li 2002; Wathne and Heide 2000; Williamson 1991). The TCA model acknowledges that opportunistic behavior can take place under any circumstances, but certain vulnerable conditions facilitate opportunism: information asymmetry(Atuahene-Gima and Li 2002; Wathne and Heide 2000). Information asymmetry regarding a party's actions limits one party's ability to detect opportunism. Wathne and Heide(2000) therefore do not treat opportunism as a constant level, and varies depending on situation. Nooteboom(1996) thus argues that it is unreasonable to ignore the formation of perceptions about the propensity

towards opportunism, and the possibility of building trust.

This study shows that the introduction of trust in the TCA model could shift the comparative cost and performance of interfirm governance, which eventually alters the choice of governance structures between hierarchical (vertical integration or high interfirm control) and market (or low interfirm control) governances. Market governance relying on trust incurs relatively low transaction costs than does hierarchical governance. Thus, exchange parties that should exercise a high level of interfirm control according to TCA prediction might choose market governance when they consider their trust in their suppliers. Therefore, the inclusion of trust in the TCA model will enhance the predictive power of TCA.

The result of this study is consistent with the other empirical study that attempts to integrate the economic approach of TCA with behavioral approach. Heide & John (1992) showed that relational norms between exchange parties allow a buyer to gain control over its supplier. Since relational norms are the way exchange parties should behave for mutual benefits (Heide & John 1992), relational norms are an influencing force on the parties' behavior. Thus, relational norms contribute to increased control over the partner. In contrast, trust is an exchange party's unilateral belief that its partner will behave in the party's interest, which actually does not influence the partner's behavior much. As the definition of trust itself shows, trust is a willingness to rely upon the supplier whose behavior is not under its control. Trust therefore has a feature of vulnerability that comes from the absence of control over the exchange partner. Thus, trust is not relevant for gaining control over the exchange partner, but it is a mechanism through which exchange parties reduce control and improve transaction performance.

This study shows that power asymmetry is another factor for influencing the level of monitoring over the exchange partner. This is consistent with the prediction of bilateral deterrence theory which argues that the more asymmetrical power is, the more likely the party with greater power would be to use its relative power (Lawler and Bacharach 1987). This is so because the more powerful party in an asymmetrical relationship can more easily obtain the other's compliance (Kumar, Scheer, and Steenkamp 1995), and the less powerful party has a lower ability

to deter its partner from exercising its own power(Lawler and Bacharach 1987). Therefore, manufacturer that has asymmetrical power advantage over its supplier is likely to depend on monitoring.

Managerial Implications

When manufacturers face volatile price changes for component parts, or uncertain parts supply, a high level of monitoring is not always the best option they can depend on. Since monitoring supplier's inventory or checking product quality incurs costs, manufacturers should find a way to reduce monitoring. Since a manufacturer can estimate how much it can trust its supplier (Madhavan & Grover 1998; Doney and Cannon 1997), it can reduce control over the supplier when the estimated trust on its supplier is high. The manufacturer can therefore reduce transaction costs, thereby increasing the efficiency of buying performance. Trust is therefore a valuable economic asset that exchange parties can rely on when they face uncertain environments. The manufacturer should consider the level of trust(high or low) in their suppliers and decide on the level of monitoring over the suppliers.

An exchange relationship characterized by a high level of monitoring could not flexibly respond to changing environments (Andaleeb 1995). Since a manufacturer unilaterally influences its supplier's inventory level through vendor evaluation programs, there might not be much room for the supplier to make its own decision. Thus, when a manufacturer with high level of monitoring over its supplier has to change an order for components, the supplier would be very reluctant to respond to the request due to the lack of autonomy. In contrast, a supplier with a low level of monitoring would flexibly respond to the request for the change of an order, because the inventory control is mainly the supplier's responsibility. Therefore, manufacturers should find a way to develop trust in the relationship with its supplier.

Limitations & Future Study

This study uses perceptual performance measure like most

interfirm studies(e.g., Jap 1999; Kumar, Stern, and Achrol 1992), and does not measure factual performance data(e.g., Noordewier John & Nevin 1992; Buchanan 1992). It seems that factual data such as percentage of late delivery or the ratio of defected products is a direct way to measure supplying performance. However, respondents are reluctant to reveal factual data to researchers(Siguaw, Simpson, Baker 1998). Thus, the ideal way to measure channel performance is to measure both perceptual and factual performance data to increase the reliability. The future study should assess both performance measures.

Future research may be directed towards the investigation of the influence of trust on the firm's control over its exchange partner when it has transaction specific asset(TSI). TSI is a specific investment that is specialized to a particular exchange relationship, so it cannot be used for other relationships (Williamson 1991). TSI therefore creates a hostage situation in which a partner exploits the TSI holder through opportunistic behavior. TSI thus could lead to lower level of satisfaction due to the opportunistic behavior that tries to exploit the TSI holders. Thus, according to TCA, TSI is another key factor that forces the investing firm to control its partner as a safeguard. It would be interesting to study whether or not trust could work as a mechanism for reducing control against TSI.

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