

Association for Information Systems AIS Electronic Library (AISeL)

ICIS 1993 Proceedings

International Conference on Information Systems
(ICIS)

1993

INTERORGANIZATIONAL COOPERATION: THE ROLE OF INFORMATION TECHNOLOGY AN EMPERECAL COMPARISON OF US AND JAPANESE SUPPLIER RELATIONS

M. Bensaou
INSEAD

Follow this and additional works at: <http://aisel.aisnet.org/icis1993>

Recommended Citation

Bensaou, M., "INTERORGANIZATIONAL COOPERATION: THE ROLE OF INFORMATION TECHNOLOGY AN EMPERECAL COMPARISON OF US AND JAPANESE SUPPLIER RELATIONS" (1993). *ICIS 1993 Proceedings*. 46.
<http://aisel.aisnet.org/icis1993/46>

This material is brought to you by the International Conference on Information Systems (ICIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ICIS 1993 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

INTERORGANIZATIONAL COOPERATION: THE ROLE OF INFORMATION TECHNOLOGY AN EMPIRICAL COMPARISON OF US AND JAPANESE SUPPLIER RELATIONS

M. Bensaou
INSEAD

ABSTRACT

This paper investigates the comparative role of several factors, including information technology (IT), predicting the level of cooperation between two independent organizations. Drawing upon multiple theoretical perspectives, we develop five hypotheses about the impact on interorganizational cooperation of three sets of factors: (1) the characteristics of the environment within which the relationship operates, (2) the characteristics of the relationship itself, and (3) the characteristics of how IT is used within the relationship. Each of these conceptual constructs is operationalized and measured within the specific context of buyer-supplier relationships in the automobile industry. The hypotheses are tested across two national settings (the US and Japan) using multiple regression analyzes conducted on a data set of 447 distinct relationships. The results indicate that the use of IT and the characteristics of the environment do not play the same role in explaining interorganizational cooperation in the two country settings, while in both countries the characteristics of the relationship significantly contribute to change in R^2 .

1. INTRODUCTION

In recent years, many large firms have been undergoing profound transformations, streamlining their operations, typically moving away from vertical integration toward more external contracting of key activities. They are also transforming the nature of the relationships with their external business partners (Powell 1987, Jarillo 1988, Thorelli 1986). In particular, many manufacturers are changing their relationships with component suppliers away from traditional arm's length relations driven by a competitive logic toward new arrangements based on a cooperative logic. These take the form of complex *cooperative relationships*, also described as "value-adding partnerships" (Johnston and Lawrence 1988), or "alliances" (Heide and John 1990, Anderson and Narus 1990).

While there are several factors that explain this trend toward more cooperative relationships, we are concerned with the phenomenon of interorganizational cooperation that explicitly leverages IT capabilities — that has been variously described as "interorganizational systems" (Barrett and Konsynski 1982; Cash and Konsynski 1985), "information partnerships" (Konsynski and MacFarlan 1990) and "electronic integration" (Venkatraman and Kambil 1991) within a broader continuum of electronic markets and electronic hierarchies (Malone, Yates and Benjamin 1987).

In this paper, we propose to examine some of the factors that may influence the level of cooperation between two firms, with a particular interest in the comparative role of information technology. Specifically, we are interested in answering the question: does the use of IT support cooperation and does it have more explanatory power than other traditional predictors. Our theory building relies on (1) previous theoretical perspectives that suggest the characteristics of the environment within which the relationship operates and the characteristics of the relationship itself as the critical predictors of interorganizational cooperation and on (2) recent descriptions of the use of IT, especially EDI, to enable cooperation across organizational boundaries.

The paper is divided into four sections. First, we review recent developments, in particular in the automobile industry, that justify why cooperation is an important dependent variable for the analysis of interorganizational relationships. In the second section, we draw upon transaction costs economics and descriptive theories from organizational and MIS research and derive some conceptual predictors of inter-firm cooperation. Specifically, we develop five hypotheses relating interfirm cooperation, the dependent variable, to environmental characteristics, partnership characteristics (we analytically distinguish between the structural characteristics of the relationship and its socio-political climate) and the interorganizational use of informa-

tion technology, the independent variables. The third section describes how these conceptual constructs are operationalized and measured in the specific context of the automobile industry in the US and Japan. The final section discusses the analysis of the data collected about 447 buyer-supplier relationships, the key findings, the conclusions and implications of the study.

1.2 Interorganizational Cooperation as a Dependent Variable

The selection of the auto industry as the empirical setting is based on the following factors. Recent studies (see especially, Cusumano and Takeishi 1991; Nishiguchi 1989; Helper 1987; Lamming 1989) have documented that supplier relationships in the auto industry have been undergoing major changes, "indicating far reaching transformations in the way automobile production and automobile companies themselves are organized" (Sabel, Kern and Herrigel 1989).

Traditionally, US automakers were characterized by a high degree of vertical integration having designed the car, manufactured nearly all the necessary core components and coordinated final production. The trend, however, is toward a car company becoming the "*electronic*" *coordinator* of an intricate IT-mediated production network, typically purchasing more core components from outside, thus reducing its level of vertical integration and at the same time reducing its total number of suppliers. The emerging relationships tend to be longer term, based on mutual trust and benefits, and involve higher levels of cooperation.

Despite the importance of these changes, no study has yet reported on the factors, including information technology, affecting the level of cooperation between an auto assembler and its suppliers, nor has any study compared these factors systematically across countries. We believe that such an extension is timely and important: one, the interorganizational level of analysis has become attractive in view of the emergence of hybrids or partnership-like arrangements as opposed to traditional, pure forms — market and hierarchy — and the growing use of IT applications to support coordination across organizational boundaries (e.g., EDI, electronic JIT, CAD/CAM transfer).

Underlying these new relationships is a notion that recognizes benefits to cooperation with fewer selected suppliers over the traditional system of arm's length relationships and competitive bidding within a large pool of suppliers (Dore 1983). *At a basic level, our theoretical argument is that interorganizational cooperation corresponds to a shift away*

from market-based exchange toward more bilateral and cooperative governance (Williamson 1985). As for IT, researchers have been more concerned with developing frameworks linking IT and competitive strategy (see, for instance, Porter and Millar 1985; Johnston and Vitale 1988) or based on new institutional theories (such as agency and transaction costs) of economics (see, for instance, Malone, Yates and Benjamin 1987; Gurbaxani and Whang 1991).

Two, the international dimension in information systems research needs to develop greater momentum in light of the vigorous internationalization and globalization of business. Thus, a systematic comparison of the importance of various predictors of cooperation at the interorganizational level of analysis across different countries (i.e., the US and Japan) within the same auto industry would offer significant insights.

We define interorganizational cooperation as the degree to which focal activities to the relationship are carried out jointly. Implicit in this definition is "the interpenetration of organizational boundaries" (Heide and John 1990, p. 25; see also Guetzkow 1966) which implies more than just the sequential division of labor and tasks conducted within a cooperative climate. In the traditional competitive model, the responsibilities for key tasks are allocated along a clear division of labor and a strong relational asymmetry in terms of ownership of a product or rents appropriation. In partnership-like relationships, cooperation can occur over a large set of activities, including long range planning, development and product design, quality and delivery coordination, training and education.

2. PREDICTORS OF INTERORGANIZATIONAL COOPERATION

In this paper, we wish to determine what exogenous and endogenous factors lead to greater cooperation between two independent business partners: an auto assembler and its component supplier. Specifically, we identify and empirically test for the relative importance of four types of predictors: the *environmental uncertainty* surrounding the relationship; the uncertainty about the partner or *partnership uncertainty* analytically decomposed in two elements: one related to the governance structure of the relationship and the other related to the socio-political climate of the relationship; and finally the use of IT applications to support interorganizational coordination.

Transaction cost analyses argue that, under ceteris paribus conditions, firms will adopt a transaction cost minimal arrangement that would not only involve the choice between markets or hierarchies but also various forms of

hybrid arrangements (Richardson 1972, Williamson 1979). An important factor that affects the choice between these various interorganizational options is uncertainty. We consider inter-organizational cooperation as one component of such a design decision and thus derive its predictors by drawing upon theoretical perspectives that recognize uncertainty as a critical design contingency factor. These are:

- (a) *transaction cost economics* (Coase 1937; Williamson 1975, 1985). As noted by Williamson: "When transactions are conducted under conditions of uncertainty ...the bounded rationality constraint is binding and an assessment of alternative organizational modes, in efficiency respects, becomes necessary" (1975, p. 23);
- (b) *organization theory* where uncertainty has long been viewed as a dominant contingency as noted by Thompson: "Uncertainty appears as the fundamental problem for complex organizations and coping with uncertainty, as the essence of administrative process" (Thompson 1967, p. 159);
- (c) *political economy* (Benson 1975) where a social system is viewed as "comprising interacting sets of major economic and socio-political forces which affect collective behavior and performance" (Stern and Reve 1980, p. 53).

Rooted in this line of reasoning, we focus on two sources of uncertainty: uncertainty about the environment surrounding the relationship and uncertainty about the partnership itself.

2.1 Environmental Uncertainty: Technological Unpredictability

On the basis of transaction cost reasoning, uncertainty is a critical factor that evokes shifts from market-based relationships toward more cooperative relationships. At a basic level, uncertainty about the environment creates adaptation and information processing problems for a firm (Galbraith 1973; March and Simon 1958). Specifically, in a manufacturing context, one key source of environmental uncertainty is *technological unpredictability*. In particular, the inability to forecast accurately new technical or design requirements for the products exchanged within the relationship may be managed more efficiently through no or loose coupling (i.e., source selection can be done by competitive bidding based only on price between a large number of suppliers provided with detailed design specifications) and therefore less investment in joint efforts, such as joint planning, joint process and product design, joint testing and tool development, education or technical assistance. By not engaging in

such expensive cooperation, firms retain the flexibility to terminate a relationship and switch to partners with more appropriate technological capabilities (Balakrishnan and Wernerfelt 1986). This reasoning leads to the following hypothesis:

Hypothesis 1: Greater the technological unpredictability associated with the component exchanged between the two firms, lesser the cooperation between the buyer and its supplier.

2.2 Partnership Uncertainty: Governance and Climate of the Relationship

The characteristics of the partnership itself also constitute an important source of uncertainty. We define partnership uncertainty as the "uncertainty a focal firm perceives about its relationship with a business partner." This uncertainty about the partner has been traditionally subsumed under two other sources of uncertainty but we wish to distinguish it in this stream of research. For instance, when market-like transactions are predominant, environmental uncertainty is the critical thrust; for predominantly hierarchical transactions, task uncertainty is the relevant thrust. Under conditions where transactions occur through these pure modes (market or hierarchy), partnership uncertainty is of secondary importance. However, in view of the emergence of hybrids or partnership-like arrangements (Williamson 1991), partnership uncertainty should be distinguished from the broader environmental uncertainty and the narrower task uncertainty. We contend that there are two primary sources of partnership uncertainty: (i) the governance structure of the relationship, and (ii) the climate of the relationship.

Governance Structure of the Relationship. These two sources of uncertainty about the partner are consistent with the theoretical arguments in the resource-dependency stream of organization theory (Pfeffer and Salancik 1978) and the transaction cost economics perspective (Williamson 1985). In our manufacturing context, for instance, the auto assembler's asset specificity represents investments highly specific to the relationship, i.e., investments considerably of less value outside the focal relationship, through which the supplier may hold the buyer hostage. These specific investments make it costlier and more difficult for the buyer to switch to another supplier, thus tending to encourage cooperation. Moreover, when these investments represent direct capital participation by the assembler, i.e., a higher ownership ratio, the incentives are even greater for cooperation. Hence, the hypothesis:

Hypothesis 2a: Higher the assembler's switching costs and higher its ownership ratio, greater the cooperation between the two firms.

Several researchers have described continuity as another factor affecting the emerging type of buyer-supplier relationships (Joskow 1988, Spekman 1988). We define continuity as the expectation of repeat transactions and future interaction. Whereas traditional arm's length relationships are based on discrete or short-term transactions, the new cooperative forms tend to be continuous or open-ended (Macneil 1980). Our basic axiom is that continuity, operationalized as contract length, encourages cooperation. Hence, hypothesis 2a':

Hypothesis 2a': Higher the continuity, i.e., longer the contract, greater the cooperation between buyer and supplier.

Climate of the Relationship. Some researchers have strongly argued that other factors besides assets specificity may also affect the uncertainty about the opportunistic behavior of the partner (Axelrod 1984, Dore 1983). Reve and Stern (1986), for instance, introduce the concept of transaction climate as "the sentiments that exit between the parties to the transaction" (p. 76). These sentiments arise due to "the extent to which inter-firm transactions are based on mutual trust, whereby the parties share a unit bonding or belongingness" (p.78). In essence, these reflect the socio-political processes embedded in the relationship (Arndt 1983) that contribute to reducing partnership uncertainty. For instance, we argue that mutual understanding and commitment to the relationship contribute to lower partnership uncertainty, hence increase cooperation:

Hypothesis 2b: Greater the mutual understanding and the assembler's commitment to the relationship, greater the inter-organizational cooperation.

2.3 Role of Information Technology: Reduce Uncertainty

Cooperation introduces more uncertainty into a firm's decision-making as it sees its activities more directly influenced by its partner's role performance and it must concede some greater degree of organizational autonomy (Pfeffer and Salancik 1978). In addition, as proposed by Galbraith (1973) and other proponents of the information processing view of organizational design (Tushman and Nadler 1978, Daft and Lengel 1986), uncertainty gives rise to information processing needs that firms need to match with appropriate information processing capabilities for greater performance. Information technology represents one of the mechanisms used to increase interorganizational information processing capabilities and reduce task uncertainty. Venkatraman (1991), for instance, proposes *electronic integration*, the interconnection and integration of the business processes of two or more independent organizations through IT applications, as an alternative to traditional vertical integration.

Electronic integration strategies may range from the mere electronic exchange of standardized documents between two business partners, to the integration and redefinition of fundamental management processes within and between the partners. American Airlines' SABRE systems, Baxter's ASAP system and GM's MAP program are some of the more popular and vivid examples of systems that support such an electronic integration strategy. A key role for information technology is therefore to increase the information processing capabilities of a relationship, thereby enabling or supporting greater inter-firm cooperation (in addition to reducing uncertainty). In particular, in the manufacturing sector, the use of EDI applications across multiple functions (such as design, purchasing, production control, delivery or payment) provides greater information processing capabilities that support greater cooperation:

Hypothesis 3: Greater the scope of information technology use within the relationship, greater the buyer-supplier cooperation.

3. METHODS

3.1 Research Design

The data used to test the previous hypotheses was collected from managers responsible for supplier relationships in automobile firms in the USA and Japan. Our field work proceeded as follows. First, we conducted a set of seventeen interviews primarily in the Detroit and Tokyo areas with senior managers responsible for purchasing or engineering in the USA and Japan. These interviews were focused at two boundary-spanning functions that were considered to be most critical for buyer-supplier relationships in the auto industry: purchasing and design. The interviews were exploratory in nature but focused on clarifying the following issues: (a) a preliminary corroboration of the applicability and appropriateness of the constructs and hypotheses developed to capture the antecedents and measures of interorganizational cooperation; (b) assessing the role and importance of information technology mechanisms and partnership uncertainty within the model as these were the two distinguishing dimensions of this study; and (c) ensuring that we have an adequate basis to sample the relationships covering a vast array of suppliers and components.

Subsequently, we developed a structured questionnaire to measure the variables — both in English and Japanese for the two samples (an initial English version was first translated into a Japanese version by the author, then independently translated back into English to check for and correct inconsistencies). Pre-tests of the instruments were conducted in four companies and eight focus groups were conducted with potential respondents to ensure that the target informants in both settings understood the wording consistent with the researcher's.

Table 1. Operationalization of the Constructs

Construct	Variables	items (α US; α Japan)	Illustrative Questions and Scaling
Interorganizational Cooperation	Cooperation (the dependent variable)	7 (.85; .79)	Extent to which exists joint effort and cooperation between the two companies in the following areas; long range planning, product planning, product engineering (component design) process engineering (for the manufacturer), tooling development (for the supplier), technical assistance, training/education. These seven indicators were measured using 7-point interval scales ranging from: no or minimal joint effort, to extensive joint effort.
Environmental Uncertainty	Technological Unpredictability	4 (.79; .85)	— product technological unpredictability — how likely will major changes occur in the component in four areas (i.e., functionality improvements, major product innovations, major manufacturing innovations, price/performance ratio improvements) during the next five years — was measured using 7-point interval scales ranging respectively from very unlikely to very likely
Partnership Uncertainty	Ownership ratio	1 (na)	— indicate whether your firm owns all or part of this supplier — five point scale ranging from independent supplier, we own 1% to 10%; 11% to 50%; 51% to 99% and one of our divisions or subsidiaries
Governance Structure	Asset Specificity (switching costs)	1 (na)	— if your firm decided to terminate the current contract with this supplier, how easy would it be for you to switch to another supplier to provide you with the same component — was measured using a 7-point interval scale ranging from very easy to very difficult
	Continuity (contract length)	1 (na)	— how long is this supplier's current contract for the production and delivery of this component — measured on a 6-point interval scale ranging from no contract, less than a year; 1 year; 2 to 3 years; 4 to 5 years; more than 5 years
Climate of the Relationship	Mutual Understanding	4 (.87; .75)	— extent to which both firms understand each others goals and priorities; products and processes; roles and responsibilities — was measured using a 7-point interval scales ranging respectively from strongly disagree to strongly agree
	Commitment	3 (.65; .82)	Extent to which there exists an equal sharing between the two firms of risks, burden, and benefits. This indicator is measured using a 7-point interval scale ranging from your firm has more of the share to this supplier has more of the share
IT use	Scope of EDI use	1 (na)	This indicator is the sum of 6 dichotomous items measuring each whether data is exchanged in electronic form with this supplier in this function. The six functions are: purchasing, engineering, quality, production control, transportation and payment.

Table 2. Results from Multiple Regression Analysis

US Sample: n = 140

Independent Variables	R ²	F	Sig F	ΔR ²	F change	Sig ΔR ²	β	t	Sig t
Environmental Characteristics Technological Unpredictability	.0001	.01	.90	.0001	.015	.90	-.004	-.05	.96
Governance Structure of the Relationship Ownership Contract length Switching costs	.08	2.45	.05	.08	3.26	.02	-.036 -.050 .219	-.40 -.58 2.50	.69 .56 .01
Climate of the Relationship mutual understanding commitment	.18	4.21	.001	.10	7.19	.001	.311 -.144	3.50 - 1.59	.001 .11
Information Technology Scope of IT use	.19	3.80	.001	.01	1.27	.26	.10	1.13	.26

Japanese Sample: n=307

Independent Variables	R ²	F	Sig F	ΔR ²	F change	Sig ΔR ²	β	t	Sig t
Environmental Characteristics Technological Unpredictability	.05	13.8	.000	.05	13.77	.000	.137	2.61	.01
Governance Structure of the Relationship Ownership Contract length Switching costs	.24	21.7	.000	.19	23.24	.000	.312 .085 .189	5.87 1.61 3.63	.000 .10 .001
Climate of the Relationship mutual understanding commitment	.29	18.6	.000	.05	9.65	.000	.159 -.172	3.06 - 3.30	.01 .001
Information Technology Scope of IT use	.30	16.4	.000	.01	2.50	.1	.083	1.58	.1

3.2 Sampling Procedures

Sampling followed the same process in all three US and all eleven Japanese auto companies. A purchasing and engineering senior manager at the central division were first asked to select a set of car components under their responsibility from the stratified list of fifty components prepared by the author (i.e., to prevent from selection bias). Then, for each of the selected components, these senior managers helped identify the purchasing agent/engineer to whom we could send the questionnaire. The final decision about which specific supplier and which part number to choose was at the respondent's discretion (all kept anonymous).

In summary, each questionnaire represents a data point, that is a unique component-dyad-task triplet, where the controlled range of components included in the sampling contributes to variance in environmental uncertainty, the variety of manufacturer-supplier dyads in both countries contributes to variance in partnership uncertainty, and finally where the presence of two different boundary spanning functions dealing with different products and suppliers contributes to variance in uses of information technology. In sum, the hypotheses proposed above are tested on the basis of a sample of $n = 447$ independent buyer-supplier relationships (43% response rate; $n = 140$ in the US and $n = 307$ in Japan) across different assemblers, different supplier firms, and different vehicle components.

3.3 Operationalization of the Variables

Following Venkatraman and Grant (1986), we paid particular attention to issues of operationalization and measurement in this study. Operationalization of the variables was achieved in two ways: (1) for those variables that have been previously employed in research settings, we adopted the measures as long as they satisfied acceptable measurement quality; and (2) for those variables that were unique to the hypotheses developed here, we developed operational measures; these were assessed for content validity through interviews and discussions with managers in Detroit and Tokyo. In addition, some key constructs are operationalized along multiple dimensions most of which were measured using multi-item scales. The detailed operationalization scheme for each construct is described in Table 1 with examples of the specific indicators and the anchors used to calibrate them. The reliability statistics (Cronbach α ranging from 0.65 to 0.87) provide strong support that the measures used are reliable and can be used to test the hypotheses developed in the previous section.

4. RESULTS

4.1 Test of Hypotheses and Discussion

To test the hypotheses, we conducted multiple regression analyses on the data set for each country separately. As the primary objective of the paper is to test the comparative influence of several types of predictors of interorganizational cooperation, we entered the independent variables into stepwise regressions in blocks. Each block groups together operationalizations of the same conceptual construct (e.g., ownership ratio, contract length and switching costs are operationalizations for the governance structure of the relationship). The influence of each individual construct and the collective influence of its operational measures are assessed by the significance of the change in R^2 when the block of variables is entered in the regression.

The sequence in which the seven independent variables were entered into the regression is consistent with the conceptual logic of the paper, i.e., explore the effect of the characteristics of the environment within which the relationship operates, then the characteristics of the partnership itself and finally the way information technology is used within the relationship. The first block therefore consisted of technological unpredictability, the second included ownership ratio, contract length and switching costs, as operationalizations of the governance structure of the relationship, the third block included mutual understanding and commitment as operationalizations of the climate of the relationship and finally the fourth block consisted of the scope of IT use.

Table 2 gives the results from the multiple regressions conducted with the US sample ($n = 140$) and the Japanese sample ($n = 307$). The R^2 scores for both countries indicate that the seven variables used in this study collectively constitute good predictors of buyer-supplier cooperation in both countries (multiple $R = 0.44$; $R^2 = 0.19$ in the US and multiple $R = 0.55$; $R^2 = 0.30$ in Japan).

The role of IT (hypothesis 3). The data indicate that Japanese auto manufacturers are making a greater use of information technology to coordinate with their suppliers than is usually expected. However, the key results of this study, as summarized in Table 2, show that the use of IT does not play the same role in explaining buyer-supplier cooperation. R^2 change (i.e., ΔR^2) for the scope of EDI use is not significant in the US sample (F change = 1.27), while it is significant at .11 level in the Japanese sample (F change = 2.5 and significant at 0.11).

Clearly US firms rely more heavily on information technology (as indicated by additional t-test differences conducted across the two countries) and as some information systems managers view it "EDI is the *strategic* weapon that should allow them to get data from suppliers faster, with less errors and at a lesser cost." US manufacturing companies, lead by auto assemblers established a consortium, the Automotive Industry Action Group (AIAG) to develop industry-wide standards for the electronic exchange of data and documents. The objective is to build an information technology infrastructure for the standard and common use of EDI with all potential suppliers across multiple functional areas. All manufacturers would then coordinate electronically with any supplier and vice versa, eventually creating an electronic market for components. However, the findings of this study clearly indicate that this ambitious use of IT has not yet translated into more cooperative relationships.

On the other hand, the use of IT in Japan, mostly limited to the exchange of tapes and disks (as indicated by other data collected in the survey) seems to be significantly associated with cooperation (yet, the analysis presented here does not allow us to make any claim about direction of causality between the use of IT and cooperation). In addition, results about the level of data and process integration between the two firms (i.e., is the data exchanged electronically used at all, is it re-entered manually, translated by special software or is it directly used by the partner's information systems without any human intervention) indicate a greater integration in the Japanese sample (t-test across countries $t = 3.44$; $p < .001$).

A Japanese manager commented, "we are not looking for a quick [technological] fix...it is more important for us to first make sure we have compatible assessment methods and technologies, a common language, and that our scheduling and production processes are well integrated...once this is accomplished a tool like the fax can be added to the process if people think we can gain in operational efficiency." He insisted the main objective is to detect and correct problems as early as in the design process, integrate the production processes between the two companies, and at the same time ensure the perfect execution and coordination of these processes *within* each company first. This is corroborated by the sign of β for scope of IT use, i.e., in the direction of hypothesis 3 (in Japan $\beta = +.083$, $t = 1.58$ and t-significance = .11).

Hypothesis 1: As for the role of IT, the findings from the multiple regressions conducted with both samples indicate that technological unpredictability also plays a different role in predicting interfirm cooperation in the two countries. It is a highly significant factor in the Japanese sample (multi-

ple $R = 0.22$; $R^2 = 0.05$; F change = 13.8 and significant at $p = .000$), but it does not seem strong in explaining cooperation in the US sample (multiple $R = 0.01$; $R^2 = .0001$; F change = .01 and not significant). Coefficient β for technological unpredictability in the Japanese sample is highly significant, though positive, i.e., in contradiction with hypothesis 1 ($\beta = .14$, $t = 2.65$ and t-significance = .01; while the sign in the US is negative, consistent with hypothesis 1). This may imply that Japanese auto firms tend to establish tight and highly cooperative relationships with suppliers for those components that are likely to undergo major technological innovations. In contrast, US manufacturers may tend to avoid tying themselves too closely to suppliers on products with high unpredictability.

Hypothesis 2a and 2a': In both countries, variables for governance structure of the relationship strongly and highly significantly contribute to R^2 change. In particular, switching costs seem to strongly predict, *in Japan as well*, interorganizational cooperation (in the US $\beta = .22$, $t = 2.5$ and t-significance = .01 and in Japan $\beta = .19$, $t = 3.63$ and t-significance < .001). The signs of β coefficients for ownership ratio and contract length are, however, different across the two countries. In particular, Japanese firms tend to cooperate with those suppliers in which they have invested some capital ($\beta = .31$, $t = 5.87$ and t-significance = .000 for ownership ratio).

This is consistent with other data collected in this study (see Bensaou 1992) and previous research that shows that, for each category of products Japanese manufacturers invest into and nurture only a few potential suppliers who typically have developed the skills and capabilities to design and manufacture a wide range of related components (Asanuma 1988). As Asanuma explains, Japanese auto makers rarely practice sole sourcing and usually share the business for a given component among two to three suppliers perpetually competing and emulating each other in areas of technology development, improvement in process, product, quality and cost. The importance of the effect of ownership on cooperation also reflects the cohesiveness of the supplier groups associated with individual Japanese manufacturers. For instance, our findings may indicate that Japanese assemblers cooperate more importantly with these "group" suppliers who also generally get longer-term contracts ($\beta = .08$, $t = 1.61$ and t-significance = 0.1).

Hypothesis 2b: In both countries, variables for the climate of the relationship strongly and highly significantly contribute to R^2 change. In the US as well as in Japan mutual understanding ($\beta = .31$, $t = 3.50$ and t-significance < .001 in the US, and $\beta = .16$, $t = 3.06$ and t-significance < .01 in Japan) and commitment ($\beta = -.14$, $t = -1.6$ and t-significance = .1 in the US, and $\beta = -.17$, $t = -3.3$ and t-signifi-

cance = .001 in Japan) are good predictors of buyer-supplier cooperation. This result emphasizes the importance of the predisposition of the partners and their existing predilection in favor of the partnership (Henderson 1990).

5. IMPLICATIONS AND CONCLUSIONS

The findings of this study show that not only factors proposed by transaction cost analysis (e.g., environmental uncertainty, asset specificity), but also factors proposed by political economy and organization theory (e.g., mutual understanding and commitment) and more importantly information technology applications can influence the level of cooperation that a buyer may engage in with its suppliers. The effect of IT is found to be significant in the Japanese context but not in the US one, indicating that the large investments made by individual US firms and the manufacturing industry as a whole (i.e., the AIAG consortium) to build an industry-wide electronic market for components or an IT platform to facilitate the electronic exchange of information between any manufacturer and any supplier have not translated into higher cooperation.

Japanese firms, on the other hand, as corroborated by other variables collected in this study, rely on firm proprietary VANs (i.e., value added networks) and leverage IT capabilities to enhance the cooperation with those closer suppliers (i.e., members of the company group) and for products with higher technological unpredictability. In other words, cooperation "precedes" information technology, i.e., Japanese firms will use technology to further support the coordination activities of their most cooperative relationships.

Although this study provides insight into factors influencing interorganizational cooperation, in particular into Japanese auto companies' leveraging of information technology, it does not inform about the volume of exchange between the buyer and the supplier. In other words, while we have been able to explore the role of IT among other factors on "process" aspects of the relationship (i.e., cooperation) further research is needed to explore the role of IT on "structural" aspects of the relationship (e.g., volume of business involved in the relationship).

6. ACKNOWLEDGMENTS

The author acknowledges the financial support for this research made available by Alfred P. Sloan Foundation under the MIT *International Motor Vehicle Program*, the *Management in the 1990s Research Program*, and by the MIT Center for Information Systems Research (CISR). I

also thank the managers in the leading firms in the auto industry both in the USA and Japan for spending time with us and providing the data and interpretations.

This paper is based on the Ph.D. dissertation submitted in 1992 by the author to the Information Technologies group at the MIT Sloan School of Management. It was awarded the 1992 best dissertation award in the field of information systems at the 1992 International Conference on Information Systems, Dallas.

7. REFERENCES

- Anderson, J. C., and Narus, J. A. "A Model of Distributor Firm and Manufacturer Firm Working Partnerships." *Journal of Marketing*, Volume 54, January 1990, pp. 42-58.
- Arndt, J. "The Political Economy Paradigm: Foundation for Theory Building in Marketing." *Journal of Marketing*, Volume 47, Fall 1983, pp. 44-54.
- Asanuma, B. "Manufacturer-Supplier Relationships in Japan and the Concept of Relation-Specific Skill." *Journal of the Japanese and International Economies*, Volume 3, 1988, pp. 1-30.
- Axelrod, R. *The Evolution of Cooperation*. New York: Basic, 1984.
- Balakrishnan, S., and Wernerfelt, B. "Technical Change, Competition and Vertical Integration." *Strategic Management Journal*, Volume 7, 1986, pp. 347-359.
- Barrett, S., and Konsynski, B. "Inter-Organizational Information Sharing Systems." *MIS Quarterly*, Special Issue, 1982.
- Bensaou, M. *Interorganizational Coordination: Structure, Process, Information Technology. An Empirical Study of Buyer-Supplier Relationships in the US and Japanese Auto Industries*. Unpublished Ph.D. dissertation, Massachusetts Institute of Technology, 1992.
- Benson, J. K. "The Interorganizational Network as a Political Economy." *Administrative Science Quarterly*, Volume 20, 1975, pp. 229-249.
- Cash, I. J., and Konsynski, B. "IS Redraws Competitive Boundaries." *Harvard Business Review*, Volume 64, Number 2, 1985, pp. 134-142.
- Coase, R. H. "The Nature of the Firm." *Economica N.S.*, Volume 4, 1937, pp. 331-351.

- Cusumano, M. A., and Takeishi, A. "Supplier Relations and Management: A Survey of Japanese, Japanese-Transplant and US Auto Plants." *Strategic Management Journal*, 1991, pp. 563-588.
- Daft, R. L., and Lengel, R. H. "Organizational Information Requirements, Media Richness and Structural Design." *Management Science*, Volume 32, Number 5, 1986, pp. 554-571.
- Dore, R. "Goodwill and the Spirit of Market Capitalism." *The British Journal of Sociology*, Volume 34, Number 4, 1983, pp. 459-482.
- Galbraith, J. R. *Designing Complex Organizations*. Reading, Massachusetts: Addison-Wesley, 1973.
- Guetzkow, H. "Relations Among Organizations." In R. Bowers (Ed.), *Studies in Behavior in Organizations*, 1966.
- Gurbaxani, V., and Whang, S. "The Impact of Information Systems on Organizations and Markets." *Communications of the ACM*, 1991.
- Heide, J. B., and John, G. "Alliances in Industrial Purchasing: The Determinants of Joint Action in Buyer-Supplier Relationships." *Journal of Marketing Research*, February 1990, pp. 24-36.
- Helper, S. *Supplier Relations and Technical Change: Theory and Application to the US Auto Industry*. Unpublished Ph.D. Dissertation, Harvard University, 1987.
- Henderson, J. C. "Plugging into Strategic Partnerships: The Critical IS Connection." *Sloan Management Review*, Spring 1990, pp. 7-18.
- Jarillo, C. J. "On Strategic Networks." *Strategic Management Journal*, Volume 9, 1988, pp. 31-41.
- Johnston, H. R., and Lawrence, P. "Beyond Vertical Integration: The Rise of the Value-Adding Partnership." *Harvard Business Review*, July-August 1988, pp. 94-101.
- Johnston, H. R., and Vitale, M. "Creating Competitive Advantage with Interorganizational Systems." *MIS Quarterly*, 1988.
- Joskow, P. L. "Asset Specificity and the Structure of Vertical Relationships: Empirical Evidence." *Journal of Law, Economics, and Organizations*, Volume 4, Number 1, 1988, pp. 95-117.
- Konsynski, B., and MacFarlan, W. "Information Partnerships: Shared Data, Shared Scale." *Harvard Business Review*, September-October 1990, pp. 114-120.
- Lamming, R. "The International Automotive Components Industry: The Next 'Best Practice' for Suppliers." MIT-IMVP International Policy Forum, mimeo, 1989.
- Macneil, I. R. *The New Social Contract: An Inquiry into Modern Contractual Relations*. New Haven, Connecticut: Yale University Press, 1980.
- Malone, T. W.; Yates, J.; and Benjamin, R. I. "Electronic Markets and Electronic Hierarchies." *Communications of the ACM*, Volume 30, 1987, pp. 484-497.
- March, J., and Simon, H. *Organizations*. New York: John Wiley & Sons, 1958.
- Nishiguchi, T. *Strategic Dualism: An Alternative in Industrial Societies*. Unpublished Ph.D. dissertation, University of Oxford, 1989.
- Pfeffer, J., and Salancik, G. R. *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper & Row, 1978.
- Piore, M., and Sabel, C. *The Second Industrial Divide*. New York: Basic Books, 1984.
- Porter, M. E., and Millar, V. E. "How Information Gives You Competitive Advantage." *Harvard Business Review*, Volume 63, Number 4, 1985, pp. 149-160.
- Powell, W. "Hybrid Organizational Arrangement: New Form or Transitional Development?" *California Management Review*, Fall 1987, pp. 67-87.
- Reve, T., and Stern, L. W. "The Relationship between Interorganizational Form, Transaction Climate, and Economic Performance in Vertical Interfirm Dyads." In L. Pellegrini and S. K. Reddy (Eds.), *Marketing Channels: Relationships and Performance*, Lexington, Massachusetts: Lexington Books, 1986.
- Richardson, G. B. "The Organization of Industry." *The Economic Journal*, 1972, pp. 883-896.
- Sabel, C. F.; Kern, H.; and Herrigel, G. "Collaborative Manufacturing: New Supplier Relations in the Automobile Industry and the Redefinition of the Industrial Corporation." MIT-IMVP International Policy Forum, mimeo, 1989.

- Spekman, R. E. "Strategic Supplier Selection: Understanding Long-Term Buyer Relationships." *Business Horizons*, July-August 1988, pp. 75-81.
- Stern, L. W., and Reve, T. "Distribution Channels as Political Economies: A Framework for Comparative Analysis." *Journal of Marketing*, Volume 44, 1980, pp. 52-64.
- Thompson, J. D. *Organizations in Action*. New York: McGraw-Hill, 1967.
- Thorelli, H. B. "Networks: Between Markets and Hierarchies." *Strategic Management Journal*, Volume 7, 1986, pp. 37-51.
- Tushman, M. L., and Nadler, D. "Information Processing as an Integrating Concept in Organizational Design." *Academy of Management Review*, 1978, pp. 613-624.
- Venkatraman, N. "IT-induced Business Reconfiguration." In M. S. Scott Morton (Ed.), *The Corporation of the 1990's: Information Technology and Organizational Transformation*, Oxford: Oxford University Press, 1991.
- Venkatraman, N., and Grant, J. "Construct Measurement in Strategy Research: A Critique and Proposal." *Academy of Management Review*, Volume 11, 1986, pp. 71-86.
- Venkatraman, N., and Kambil, A. "The Check's Not in the Mail: Strategies for Electronic Integration in Tax Return Filing." *Sloan Management Review*, Volume 32, Number 2, 1991, pp. 33-43.
- Williamson, E. O. "Comparative Economic Organizations: The Analysis of Discrete Structural Alternatives." *Administrative Science Quarterly*, Volume 36, 1991, pp. 269-296.
- Williamson, E. O. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. New York: Free Press, 1985.
- Williamson, E. O. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press, 1975.
- Williamson, E. O. "Transaction-Cost Economics: The Governance of Contractual Relations." *Journal of Law and Economics*, Volume 22, 1979, pp. 233-263.
- Womack, J. P.; Jones, D. T.; and Roos, D. *The Machine That Changed the World*. New York: Rawson Associates, 1990.