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The Impact of I.T. on the Degree of Outsourcing, the Number of Suppliers and the Duration of Contracts

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Abstract: It has long been accepted within the information technology (IT) research community that IT should have a profound impact on industrial organization. However, there has been as yet on the changes to be expected in the design of firms or industries; rather, there is an apparently inconsistent collection of conjectures and analyses. We are now able to offer an integrative framework for describing the impacts of IT on an industrial organization. Our analyses generally support the "move to the middle" hypothesis that states that the impact of IT on the organization of economic activity is to lead to a greater degree of outsourcing where this increased outsourcing is done from fewer suppliers with whom the buyer has long-term relationships.

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Abstract

It has long been accepted within the information technology (IT) research community that IT should have a profound impact on industrial organization. However, there has been as yet no consensus on the changes to be expected in the design of firms or industries: rather, there is an apparently inconsistent collection of conjectures and analyses.

We are now able to offer an integrative framework for describing the impacts of IT on industrial organization. Our analyses generally support the "move to the middle" hypothesis that states that the impact of IT on the organization of economic activity is to lead to a greater degree of outsourcing where this increased outsourcing is done from fewer suppliers with whom the buyer has long term relationships.

1.0 Introduction

There is growing evidence that large manufacturing companies in the U.S. and elsewhere are downsizing. The pressure to downsize has been attributed to a variety of reasons including the increasing intensity of competition and an increased emphasis on cost-cutting. Coupled with this increased trend to smaller organizational size, where the firm procures more of its requirements from outside suppliers instead of satisfying these requirements in-house, there is a noticeable emphasis on using fewer long-term partnerships with suppliers and customers to conduct business. This is a shift away from shopping among a large number of suppliers based purely on price. The reasons that are normally suggested to explain this trend of using fewer suppliers, and long-term relationships, include suggestions that firms are placing an increased emphasis on product quality and hence by using fewer suppliers, the suppliers will have an incentive to invest in improving the quality of the products they supply and share in the surplus they help create.

Though many of the reasons commonly put forth to explain this trend of more outsourcing and an increased reliance on fewer and longer-term suppliers are probably true, they fail to provide a complete picture. Many of these reasons were probably as important in the previous years as they are today. Further, though some of these factors are more important in some industries and some countries than in others, the trend towards more outsourcing to fewer longer-term suppliers seems to be present in many different industries and in many different countries. This suggests that a factor that is critical to the whole issue of the economics of organization, and one that has undergone revolutionary transformations in recent years, must be responsible for the changes occurring in many organizations. We believe that the factor responsible for facilitating these dramatic organizational changes is information technology (IT).

Researchers in the IT community have recognized that IT, and the changes occurring in the price/performance characteristics of IT, plays an important role in the organization of economic activity. Numerous authors have examined the ways that information technology affects search costs (e.g., Bakos U]: Malone, Benjamin and Yates [13]), coordination costs (e.g., Malone, Benjamin, and Yates [13]; Malone and Rockart [14]: Gurbaxani and Whang [10]), transaction risks (e.g., Clemons and Row [9]; Clemons, Reddi, and Row [8]), and the incentives of buyers and suppliers (e.g., Clemons and Kleindorfer [5], Bakos and Brynjolfsson [2]). All have attempted to infer the strategic implications for firms. Sometimes the findings have been mutually supportive — both Clemons, Reddi, and ROW ([8]) and Bakos and Brynjolfsson ([2]) observe that it is reasonable to expect a reduction in the number of suppliers even when outsourcing is increasing; that is, a move towards virtual vertical integration, away from use of pure markets. Sometimes however, findings appear to be in direct conflict — Clemons, Reddi, and Row ([8]) predict a move away from pure markets, while Malone, Benjamin, Yates and Rockart ([13], [14]) predict more extensive use of markets.

Malone et al. ([13]) suggest that the net effect of IT's impact is that firms will increasingly rely on the "market" over the "hierarchy". That is, firms will outsource more where they satisfy their requirements by shopping around for the best price in the market instead of satisfying their requirements in-house. Clemons et al. ([8]) suggest that between the two polar options of the market and the hierarchy there are modes of organization that involve outside suppliers in long-term cooperative relationships with the buyer. These modes of organization are neither pure markets nor pure hierarchies. Clemons et al. suggest that these long-term cooperative modes will increasingly become the dominant choice of method of organizing economic activity. The contribution of this paper is to analytically demonstrate the conditions under which a firm would increasingly prefer the market option when procuring from outside suppliers and the conditions under which the firm would increasingly prefer "partnerships" or cooperative long-term relationships when procuring from outside.

We are now able to offer an integrative framework for describing the impacts of IT on industrial organization:

Ž Under conditions of high product complexity, where vertical integration had been preferred, we find that the advantages of vertical integration are reduced.

Ž Under conditions of lower product complexity, where outsourcing had been preferred, we find a change in the nature of outsourcing.

Ž Under conditions of lower product complexity and when the supplier behaves opportunistically, a reduction in the unit cost of IT leads to increased long term contracting and partnership arrangements; that is, a move *away* from the spot market.

Ž Under conditions of lower product complexity and when the supplier behaves opportunistically, a reduction in the relationship-specificity of investments in IT leads to increased long term contracting and partnership arrangement; that is, again a move *away* from the spot market.

Our analyses generally support the "move to the middle" hypothesis that states that the imptact of IT on the organization of economic activity is to lead to a greater degree of outsourcing where this increased outsourcing is done from fewer suppliers with whom the buyer has long term relationships.

In Section 2 we discuss some of the earlier work on IT's impact on the organization of economic activity. In Section 3 we develop a model which incorporates the factors suggested as being important by Malone et al. and Clemons et al. and others, and identify the precise impact of IT. The analysis of the model is done in Section 4. Section 5 presents the implications of our analysis and also contains directions for future research.

2.0 Literature review

Transaction cost economics considers the cost of dealing with outside suppliers as an important factor in deciding whether to manufacture a required part in-house or obtain the part from outside suppliers. The transaction cost includes the cost of searching for an appropriate supplier, contracting with the supplier for the part, coordinating with the supplier for the delivery of the part, monitoring the performance of the supplier, and the related risks associated with depending on someone else for one's requirements. Williamson ([15]) uses transactions costs to explain why firms choose a particular method of organization. Transaction cost economics provides an explanation for why large vertically integrated organizations, such as those documented by Chandler ([3]), flourished in the U.S. in the nineteenth and early twentieth century.

A primary focus of economic research has been the risk arising from investments that are specific to the relationship with another firm, say a supplier or a customer. Once such a relationship-specific investment is made for example by the buyer with a supplier, the supplier may attempt to re-negotiate its contract or otherwise behave opportunistically to exploit the buyer whose investment is "sunk". This risk from relationship-specific investments has been investigated by Williamson ([15]), Klein et al. ([11]), and others.

Since transactions costs are composed of various information-based activities such as search (searching for an appropriate supplier), monitoring (evaluating the performance of the selected supplier and comparing it to that of other available suppliers), and coordination (exchanging information with the supplier including order placement and obtaining order status), it is normal to expect that IT would have an influence on the size of transactions costs.

Database technology and the ability to access remotely located information resources has greatly increased the ability of firms to search for appropriate suppliers and services at a significantly lower cost. Scanner technology

and barcoding are examples of technologies that permit firms to improve their monitoring capability. For example, these technologies allow manufacturers of consumer goods track the flow of their products through the distribution channels, thereby allowing them to evaluate the performance of agents in the channel and design effective incentives to improve pricing and distribution.

Ciborra ([4]) recognized that IT reduces transctions costs, thereby improving both internal production as well as outside procurement. The work does not suggest whether IT will affect one mode of economic organization more than the other.

Gurbaxani and Whang ([10]) combine transaction cost arguments with agency theory arguments to suggest that IT's ability to reduce both transaction costs and agency costs will affect the size of the firm in opposite ways. IT's ability to reduce transaction costs suggests that IT will lead to smaller firms (more outsourcing perhaps) whereas IT's ability to reduce agency costs would lead to larger firms. Their work does not attempt to predict the net effect of IT on firm size, that is whether we should witness an increased degree of outsourcing. Further, they do not address the issue of how IT may affect inter-firm relationships.

Bakos and Brynjolfsson ([2]) demonstrate analytically that if IT increases the importance of the intangible aspects of quality, then IT is responsible for causing firms to reduce the size of their supplier base. Their arguments are based on providing incentives to the suppliers to invest in quality improvement; the smaller the number of suppliers that the firm works with, the greater the incentive to each supplier to invest in the relationship.

Malone, Benjamin, and Yates ([13]) argued that transactions costs are greater when using the market (outside procurement) than when satisfying the firm's requirements through internal production. This is because when producing in-house, the firm typically does not need to search for a supplier, or monitor its own manufacturing unit very closely for under-performance, or worry that the internal manufacturing unit will exploit its dependence on it. Since IT reduces transactions cost, whether external or internal, and since the external transactions cost is significantly greater than the internal transactions cost, it is reasonable to assume that IT will benefit external procurement more than internal production. Malone et al. suggest that the net effect of IT's ability to reduce transactions cost is to favor market procurement over interred production in more cases than before.

Clemons, Reddi and Row ([8]) agree with the basic argument that a reduction in the transactions cost due to IT will cause firms to outsource more. However to understand the manner in which this increased outsourcing will be done, it is necessary to distinguish between the different methods by which outside procurement may be done. They consider the two polar modes of external procurement; the third mode of interest is in-house manufacture, or the vertical integration mode:

Ž**market suppliers:** Procure from outside using a number of short-term suppliers where the buyer shops for the best price each time it requires a part.

Ž**partnership:** Procure from outside by selecting a small number of suppliers from the pool of available suppliers and building long-term cooperative relations with these few suppliers.

Ž**vertical integration:** Manufacture the required part in-house.

If the three-way distinction in the organization of economic activity is made, the Malone et al. ([13]) argument points to a "move to the market", that is the increased outsourcing due to IT will be done by using market suppliers. Clemons et al. ([8]) argue that since IT investments are still idiosyncratic and their benefits involve a learning curve, long-term cooperative arrangements will be preferred to short-term market supplier arrangements so that firms can fully benefit from their IT investments. They suggest that IT will cause a "move to the middle", that is the increased outsourcing due to IT will be conducted using partnerships rather than market suppliers.

3.0 The model

This paper proposes a model that builds upon the earlier work by Malone et al. ([13]) and Clemons et al. ([8]). The model identifies the conditions under which the "move to the market" hypothesis is true and the conditions under which the "move to the middle" hypothesis is true. The analysis in this paper summarizes the interaction between important factors. Using earlier classifications of costs and risks of inter-firm cooperation (Clemons, Reddi and Row [8]), we construct a mathematical model of these costs and risks, as functions of product complexity, product price variability, and contract duration, and of unit costs of IT and the relationship-specificity of IT investments. The detailed

supporting analysis can be found in Clemons and Reddi ([7]).

We will consider a situation where there are a large number of suppliers who can provide a certain part. Since the number of suppliers is large, the buyer is not exposed to any risk from small numbers bargaining—that is, there are enough alternative sources of supply that the buyer is not totally dependent on any one supplier. The buyer requires this part to assemble a product that is finally sold in the open market. The part is not "core" to the buyer's operations and the buyer must decide whether to produce this part in-house or obtain the part from outside suppliers. The buyer requires the part for M periods.

To produce the part in-house the buyer must make a fixed cost investment K at the beginning of the first period when the part is required. After the investment is made, the buyer can produce the part at an average price c_f in each period.

If the buyer decides to obtain the part from outside, it must use one of the N available suppliers. The available suppliers can be ranked in order of the mean price at which they can provide the required part. Let the N suppliers have mean prices c_1 to c_N, where $c_1 \leq c_2 \leq \ldots\ldots c_N$. The actual price at which supplier i can provide the part in any given period is a random variable X_i with mean c_i and variance σ_i^2. We denote $c_{min} = E[\min(X_i), i = 1, N]$.

Thee decision problem of interest is to decide among the following three alternatives

(1) in-house manufacture

(2) market suppliers: procure from the lowest price supplier in each period

(3) partnership: select the lowest average price supplier and procure from that supplier for all the M periods

Whichever alternative the buyer chooses, it must make an investment in IT to coordinate with the unit supplying the part, whether the unit is in-house or external to the buyer.

We would like to understand the conditions under which the buyer chooses each of the three methods of organizing economic activity. Further, we would like to examine how the changing characteristics of IT investments may affect the firm's choice of appropriate economic organization.

3.1 Important factors

Some notation is necessary at this point. The two characteristics of IT that are important to the analysis are described below:

α: Denotes the relationship-specificity of IT investments. As discussed earlier, the risk from making relationship-specific investments is an important economic in understanding economic organization. Borrowing from Kleindorfer and Knieps ([12]), if a firm makes an investment "I" to do business with its supplier, and the **relationship-specificity of the investment is α then if the** buyer decides not to do any business with that supplier, **the buyer loses an amount αI of its original investment.**

ß: Denotes the cost-effectiveness of IT. It is the "amount" of IT that can be purchased for one dollar.

It is clear that both α and ß have undergone dramatic changes over the last decade. The cost of hardware has seen a decrease that is of many orders of magnitude. Also, the degree to which IT investments are specific has reduced greatly. Many computing platforms are gradually moving to common standards. Software is now available to facilitate running systems developed on one platform on other platforms. There is pressure from the marketplace on software firms to adopt open systems standards and write applications that are compatible with those of other firms.

The primary thrust of our analysis is to understand how **the decreasing α and the increasing ß have affected the** relative advantages of using in-house production, market suppliers, and partnerships.

Other factors important to our analysis are listed below:

θ: Denotes the attributes of the product being procured or produced. Attributes of interest include the complexity of the product and uncertainty of the demand for the product.

I: Size of the investment in IT.

M: Number of periods for which the buyer needs a certain product.

p: Price at which the final product is sold in the market.

q: Quality of the product being contracted for.

D: Demand for the final product, where D(p, q).

d: Discount rate.

ω: Denotes the degree of opportunism and hence the fraction of the relationship-specific investment made by the buyer that can be appropriated by the supplier. Since α denotes the degree to which the IT investment is relationship-specific, the opportunism risk to the buyer who makes an investment I is ω(t)αI. We shall later derive the bounds of ω in the market supplier case and the partnership case.

3.2 Decomposition of transactions cost

Clemons, Reddi and Row ([8]) decompose transactions cost into three components: coordination cost, operations risk, and opportunism risk. We shall adopt that classification here. The three terms are briefly explained below:

Coordination cost is the cost of coordinating for the delivery of a product. It includes both the direct cost of exchanging information such as production schedules and product designs as well as the indirect costs such as inventories. IT clearly can reduce the coordination cost.

$$C(\bullet) = C(\theta, \beta I, t)$$

C is an increasing function of θ, the product's attributes such as complexity and demand uncertainty. C is a decreasing function of βI which is the amount of IT in use for coordination. C is also a decreasing function of the duration for which the systems have been in use. There is a learning curve associated with the use of systems and this is captured by the relationship between C and t.

Operations risk is the risk that the supplier under-performs; the under-performance could be intentional to exploit the buyer without being detected by providing a lower quality product, or the under-performance could be due to factors beyond the supplier's control such as poor weather. In the first case where the under-performance is intentional, operations risk arises because the complexity of the contract terms makes it difficult to detect the under-performance. IT may be able to reduce operations risk in such situations by improving the buyer's ability to monitor the supplier. In the second case where the under-performance is not intentional, IT may have no effect on operations risk.

$$P(\bullet) = P(\theta, \beta I, t)$$

P is similar in behavior to the coordination cost function C except that a portion of the operations risk is not affected by the use of IT.

Opportunism risk can arise from two sources. One, if the buyer must make an investment with the supplier and this investment is relationship-specific then the buyer is exposed to the risk that after the investment is made, the supplier reneges on the agreement and attempts to re-negotiate the contract or act in other ways detrimental to the interests of the buyer. This investment could be in IT either to coordinate with the supplier or it could be other capital investments such as m production equipment. The second type of opportunism risk is due to small numbers bargaining, where doing business with a supplier creates a situation where the firm has few alternative sources of supply. IT may have little effect in preventing a small numbers bargaining situation. We do not explicitly consider small numbers bargaining here. But making a relationship-specific investment to coordinate with one supplier may lead to a small numbers bargaining situation. If firms make an investment in IT to coordinate with the supplier, then the changing characteristics of the relationship-specificity of the IT investment will play a role in determining the opportunism risk to which the firm is exposed.

$$O(\bullet) = O(\alpha, I, \omega(t))$$

3.3 Modes of economic organization

Here we derive the profit functions for each of the three modes of economic organization.

Vertical Integration (In-house): If the firm decides to manufacture the required part in-house it does not suffer from opportunism risk. That is, its own manufacturing unit will presumably not attempt to exploit it after the investment to manufacture in-house is made. Similarly, we assume that the firm's own unit will not attempt to under-perform to maximize its own profit, that is we assume that the operations risk in the vertical integration ease is zero. The profit function for the vertical integration case is given by:

$$\Pi_v = \Sigma_{t=1,M} [1/(1+d)^t][p-c_f-C(\theta, \beta I, t)] D(p, q)$$

$$-I -K \qquad (1)$$

Market Suppliers: If the firm decides to procure from the spot market, it essentially shops around for the

lowest price in each of the M periods. It will obtain the part at an average price c_{min} = E[min(X_i), i= 1, N]. Given that in each period the firm must make an investment in IT, say I, to coordinate with the selected supplier, it faces the risk that in the next period it may lose αI of this investment if it decides to procure from a different supplier.

The profit function if the firm decides to procure from the spot market suppliers is given by:

$$\Pi_m = \Sigma_{t=1,M} [1/(1+d)^t][p-c_{min}-C(\theta, \beta I, 1) - P(\theta, \beta I, 1)] D(p, q) - \Sigma_{t=1,M}[1/(1+d)^t]\alpha I - I \quad (2)$$

Partnership: If the firm decides to use a partnership when procuring from an outside supplier, it selects the lowest average cost supplier who can provide the part at average price c_1 and procures from that supplier for all the M periods that it requires the part.

The profit function in the partnership case is given by

$$\Pi_p = \Sigma_{t=1,M} [1/(1+d)^t][p- c_1/R(\beta I, t) -C(\theta, \beta I, t) - P(\theta, \beta I, t)] D(p, q) - \Sigma_{t=1,M}[1/(1+d)^t]\omega(t)\alpha I - I \quad (3)$$

ω(t) represents the degree of opportunism exhibited by the supplier in a multi-period contract. Since there is no accepted mathematical model of supplier opportunism in muiti-period contracts of fixed duration, we assume that it is bounded by that of a well-behaved partner who observes the terms of the contract until the final period, at which point he behaves like a short term contractor (that is, ω(t)=0 for t=1, M-1 and ω(t)=1 for t=M) and that of a greedy supplier who reprices immediately in an attempt to appropriate almost the full value αI of the idiosyncracity of the buyer's investment in coordination (that is, ω(t)=1-ε for all t=1, M). The results of the model will demonstrate that the actual value of ω will affect not only the size of the effect predicted but, in some cases its direction.

R(βI, t) is the benefit to the buyer from exchanging demand and production schedule information with its supplier. The supplier can incorporate this information into its own production schedules to cut down its own production costs and thereby be positioned to offer the product to the buyer at a lower cost. The degree to which the supplier can benefit from this exchange of information depends on the amount of information exchanged between the buyer and the supplier, as well as the duration for which the relationship has existed. Here again, as in the cases of coordination cost and operations risk, the learning curve effect of IT use plays an important role in the utilization of IT and deriving benefits from its use.

4.0 The analysis

The detailed analysis of the model can be found in Clemons and Reddi ([7]). Here we present an overview of the analysis and a summary of our findings. The analysis of the model consisted of varying α and ß and examining how this affects the relative attractiveneas of three modes of organizing economic activity. The profit functions derived earlier are compared and the effect of a decreasing α and an increasing ß is evaluated.

To evaluate the profit functions and to examine the role of the changing characteristics of IT, we make the following assumptions:

(1) The discount rate d=0.

(2) $R(\beta I, t) = \beta I t$

$C(\theta, \beta I, t) = C(\theta)/\beta I t$

$P(\theta, \beta I, t) = P(\theta)/\beta I t$

We simplify the profit functions (1)-(3) by making the above assumptions and solve for the optimal IT investment in each of the three modes of economic organization. We then substitute these optimal values of IT investments in the profit functions to derive the optimal profit functions for the three modes of organization.

The analysis examines the point at which the buyer is initially indifferent between two modes of organization and then examines the relative rates at which the optimal profit functions change with respect to α and ß. The mode for which the profit function increases at a faster rate when α decreases or ß increases will then be preferred over the other mode if IT's cost-effectiveness or relationship-specificity were to change in those directions.

The results of the analyses can be summarized tersely in the following three diagrams.

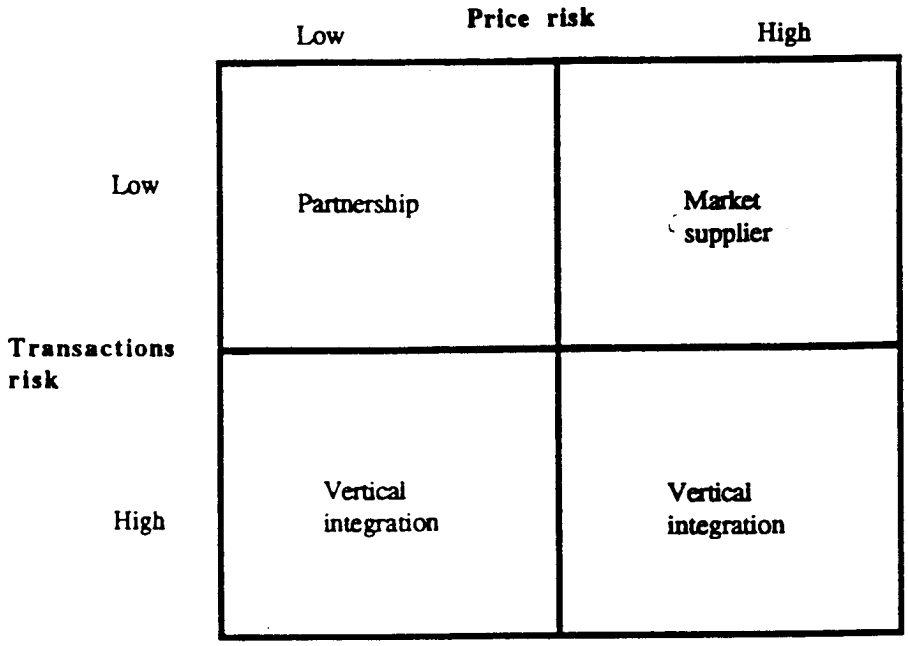

Figure 1 : The base case preferred mode of economic organization

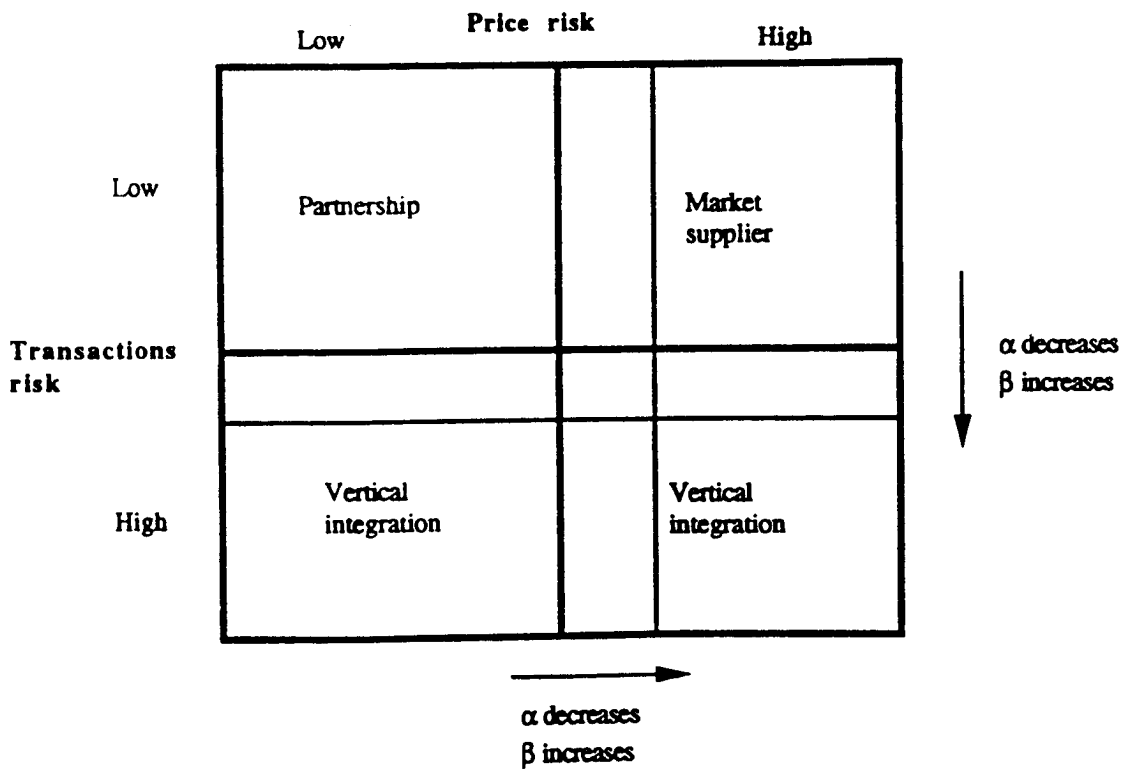

Figure 2 : Results of analysis when $\omega = 1$

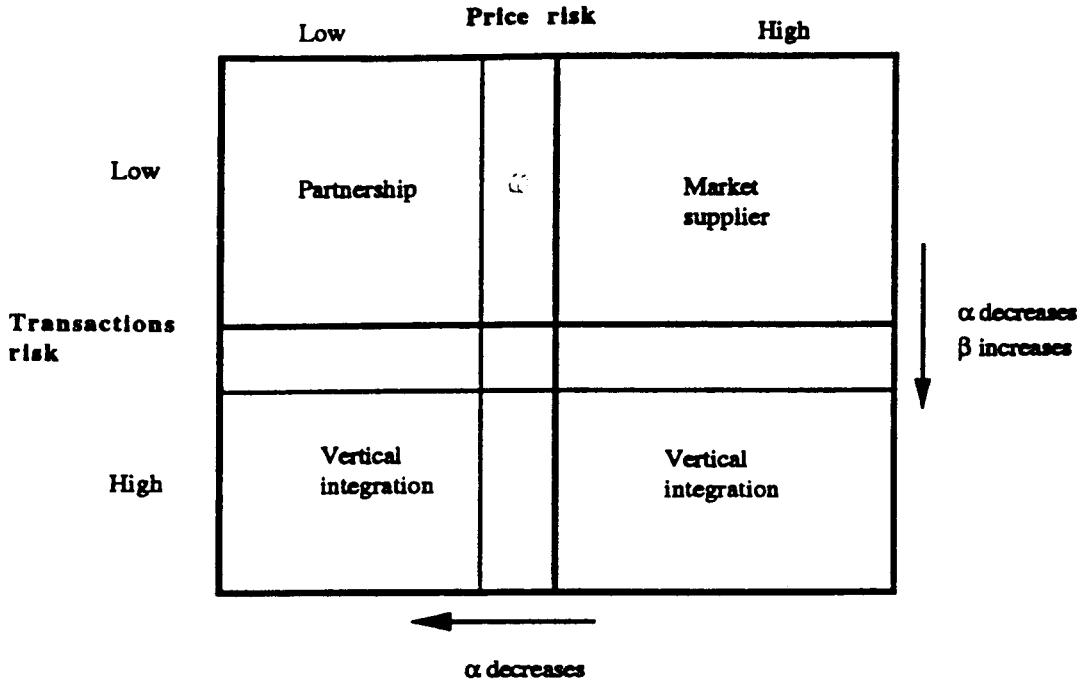

Figure 3 : Results of analysis when ω=0

Figure 1 illustrates initial conditions. With high variance in prices (high price risk) and with low product complexity and low uncertainty in demand (low transaction risk) the preferred organizational design entails use of the spot market; this enables the firm to shop for the best price, and consistent with Williamson ([15]) with low θ there is little incentive for vertical integration. As price risk decreases the benefits from searching among suppliers to locate the best price decrease, and thus long term purchasing arrangements and partnership begin to replace use of spot markets. But (again consistent with Williamson) for very high θ, that is, for high uncertainty in demand and high product complexity, vertical integration is the preferred structure, and internal production is preferred to procurement.

Figure 2 and Figure 3 show the impact of a decreasing α and an increasing ß. Figure 2 presents the case where the degree of opportunism exhibited by suppliers that is where ω=1. Figure 3 presents the case where ω=0.

Our results are explained and summarized below. At the margin, or boundary of the firm, where a firm would previously have been indifferent between competing organizations of production or procurement, the following changes are driven or enabled by changes in information technology:

- **Increasing ß, high θ**

Under conditions of high product complexity or high demand uncertainty (high θ), where in the past vertical integration had been favored, the marginal impact of improving the cost/performance ratio of IT (increasing ß) is to decrease vertical integration. This is true regardless of the degree of opportunism actually exhibited by suppliers (that is, it is independent of ω). This is supportive both of the "move to the market" predicted by Malone, Benjamin, and Yates ([13]) and the "move to the middle" predicted by Clemons, Reddi and Row ([8]).

- **Increasing ß, low θ**

Under conditions of high price variability and low θ, where use of the market would have been preferred, increasing the cost/performance of IT (increasing ß)

decreases the importance of the market and increases reliance upon partnerships. This runs directly counter to predictions of a move to the market, while supporting the move to the middle and the increased importance of stable partnerships predicted by Bakos and Brynjolfsson ([2]). However, this is true under conditions where a high degree of opportunism is actually exhibited by suppliers; under lower opportunism, the effect of increasing ß remains indeterminate.

- **Decreasing α, high θ**

Under conditions of high product complexity or high demand uncertainty (high θ), where in the past vertical integration had been favored, the marginal impact of improving the idiosyncracity of IT investments is to reduce the attractiveness of vertical integration increasing the attractiveness both of the market and of partnerships. Again, this is supportive of Malone et al. and Clemons et al. This is true regardless of the degree of opportunism actually exhibited by suppliers (that is, it is independent of ω).

- **Decreasing α, low θ**

Under conditions of high price variability and low θ, where use of the market would have been preferred, when suppliers exhibit a high degree of opportunism (that is ω is high) decreasing the idiosyncracity of IT investments (decreasing α) increases the importance of partnership and reduces the attractiveness of the market. This is due to the greater marginal benefit to using partnership as compared to using the the market. This supports the move to the middle hypothesis.

However, under conditions where suppliers exhibit a low degree of opportunism (that is ω is low), decreasing α leads to the increased attractiveness of the market.[1] This supports the move to the market hypothesis.

5.0 Conclusion

Perhaps the most significant contribution of this paper is that it provides analysis that resolves the apparently contradictory predictions of Malone et al. ([13]), who proposed that IT's impact is a "move to the market", and Clemons et al. ([8]), who suggested that IT would cause a "move to the middle". We find that depending on the product complexity (θ) and the variability of product prices over time and among suppliers, the reducing relationship-specificity of IT (α) or the increasing cost-effectiveness of IT (ß) may produce either a "move to the market" or a "move to the middle". However, it is clear that IT will facilitate a greater degree of outsourcing and hence contribute to art evolution towards smaller organizations focused around their core activities.

Empirical studies are critical in conjunction with theoretical models of phenomena as complex as the changing nature of outsourcing, integration, and partnership. These effects may or may not be occurring in the ways we predict, at the rates we predict, or for the reasons we develop in the model. Other trends may be driving outsourcing, such as excess capacity due to the current global recession, so that the trend is occurring more rapidly than our model can explain. Alternatively, factors that inhibit firms' flexibility, like their existing fixed investment in in-house production capability, may result in trends towards outsourcing and partnerships moving more slowly than the model would indicate. We are therefore concurrently conducting empirical studies on changes in the organization of economic activity and the possible roles of IT in driving or facilitating these changes.

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l.This originally seemed paradoxical to us, but we now understand it as an artifact of the conditions assumed. It seems improbable that a high degree of price variability would be associated with no opportunism in the presence of idiosyncratic investments. However, under these **conditions, a reduction in α is unlikely to improve** partnerships, where opportunism is already low, and instead makes investments in coordination more appropriate even for one-off market mediated transactions. We include this result merely for completeness, and to demonstrate that when faced with unlikely combinations of conditions our model nonetheless sucessfully produces plausible and defensible results.