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Lawrence Loh
and
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Working Paper No. BPS 3271-91 March 1991

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# 'Outsourcing' as a Mechanism of Information Technology Governance: A Test of Alternative Diffusion Models


## ABSTRACT

Management of the information technology (IT) infrastructure has transcended the traditional 'within-organization' (or, the hierarchical mode of governance) to include governance mechanisms involving external organizations, especially IT vendors (or, the market mode of governance). This is made particularly visible in the recent outburst of outsourcing of some or all of the governance of the IT activities. Partly due to the recency of this phenomenon, there is a scarcity of theoretical and empirical research. This paper seeks to contribute to this emerging stream on outsourcing as a mechanism of IT governance by: (a) developing a definitional framework on outsourcing based on arguments from transaction cost economics to delineate the sources of costs and benefits of this governance mode; and (b) investigating the forces underlying the diffusion pattern of this governance mode based on our argument that outsourcing constitutes an administrative innovation. Specifically, we examine three traditional models of diffusion influence: internal, external, and mixed. Using a sample of 60 outsourcing contracts in the U.S. from April 1988 to August 1990, we test the relative importance of each influence type using nonlinear estimation techniques and a special class of specification tests. Results strongly suggest the relative importance of internal influence or *imitative behavior* in the diffusion of this mechanism of IT governance. In addition, due to the prominent impact of the Kodak outsourcing contract with IBM in July 1989, we divide the sample frame into two regimes: 'pre-Kodak' and 'post- Kodak' to test the stability (or differences, if any) in the results. Our analyses suggest that the Kodak-IBM outsourcing contract does give rise to a higher degree of imitation within the user community than before. The implications of the findings on imitative behavior, and on user-pull versus vendor-push as well as areas of future research are discussed.


**Keywords:** Governance of IT infrastructure; administrative innovations, diffusion models, outsourcing.

## Introduction

In recent years, the management of the information technology (IT) infrastructure has transcended beyond its traditional 'within-organization' (or, hierarchical mode of governance) to governance mechanisms that involve external organizations, such as joint-ownership of IT networks (e.g., electronic data interchange), co-development of software as well as strategic partnerships with vendors and systems integrators. Against the backdrop of such transformations, one governance mechanism has become increasingly important: 'outsourcing[1]' of the management of the IT infrastructure. Stated simply, it involves the transfer of ownership (in varying degrees) of the IT infrastructure by the focal organization to an external party such as a technology vendor.

As a viable IT governance structure, outsourcing is being aggressively marketed by a set of IT vendors. For instance, a catchy title of an outsourcing advertisement by Martin Marietta Information Systems Group in a major computer trade periodical reads: "You don't own a power plant for your electricity...Why own a data center for your information systems[2] ?" *Computerworld* and *Information Week* -- the two leading industry publications have, in fact, been devoting extensive coverage to this emergent phenomenon, which is best summarized by the following quote: "outsourcing suddenly went from a curious anomaly to a veritable craze[3]." Further, the Yankee Group estimated that all Fortune 500 would evaluate outsourcing and 20% will sign outsourcing deals during the 1990s[4], and projected an increase in the outsourcing market from $29 billion in 1990 to $49.5 billion in 1994. In this vein, Input, Inc. forecasted that outsourcing IT operations would continue to grow by a robust 17% annually through 1994[5], attesting to the importance of this

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[1] We recognize that the domain of outsourcing is broader than IS activities. However, for the purpose of this paper, we restrict our attention to only IS activities.
[2] *Computerworld*, June 4, 1990: 80
3 Wilder, C. 1990. Outsourcing: From Fad to Respectability. *Computerworld*, June 11: 1
[4] Eckerson, W. 1990. Changing User Needs Driving Outsourcing. *Network World*, July 2: 1.
[5] Wilder, C. 1989-90. Outsourcing: Fad or Fantastic? *Computerworld*, December 25-January 1: 8.

phenomenon. Some of the popular reasons attributing to the attractiveness of this governance mechanism include: streamlined costs of IT infrastructure; improved IT productivity; renewed focus on business strategies and operations rather than on operating IT infrastructure; better management of IT risks; mitigation of skilled labor requirements; and lessening of debt-financing needed for IT investments.

The hype around outsourcing was brought to a greater height when IBM announced "an unusual agreement under which it will build and operate a data center for Eastman Kodak Co[5]." According to this agreement, IBM "will take over the work done by four Kodak centers, and 300 Kodak workers will become IBM employees." Furthermore, "Kodak...hopes to cut costs as much as 50% by turning the operation over to IBM." Almost overnight, the hidden weapon of outsourcing became the hot talk of the information systems (IS) community, and in a survey of top IS executives "consider outsourcing" emerged as one of the top ten issues for success (or survival) in the 1990s[6]. It also seems that "in 1990 and beyond, the key question facing the IS department is not only *whether* to outsource, but also *what* to outsource[7]."

Although IT governance structure is an important component of IT strategy (Henderson and Venkatraman, 1990), the excitement about outsourcing as an attractive option to govern the IT activities is tempered by a lack of significant body of theoretical and empirical research. This could be partly attributed to the recency of this phenomenon, but there is an impressive body of work on 'make versus buy' or more generally, 'vertical integration' (see for instance, Perry, 1989; Williamson, 1989) that can be adapted to inform on this emergent phenomenon. Towards this end, we (a) develop a framework rooted in the transaction cost perspective to delineate the sources of costs and benefits for outsourcing; and (b) based on our premise that

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[5]*Wall Street Journal*. 1983. July 26: 3.
[6]Ludlum, D. 1989-90. 10 Tips for IS Survival in the 1990s. *Computerworld*, December 25-January 1: 14.
[7]Wilder, 1989-90,*op cit*.

outsourcing constitutes an *administrative innovation*, further investigate the forces underlying the *diffusion* of this administrative innovation. Using a sample of 60 outsourcing contracts in the U.S. from April 1988 to August 1990, this paper examines three traditional models of diffusion: internal, external, and mixed to test their relative importance using nonlinear estimation techniques and a special class of specification tests. In addition, due to the prominent impact of the Kodak outsourcing contract, we divide the entire time period into two regimes -- 'pre-Kodak' and 'post-Kodak' -- to test the robustness of our results. The implications of the results on imitative behavior, and on user-pull versus vendor-push are discussed. Research extensions in outsourcing as an IT governance mechanism are also presented.

## Modes of Outsourcing: A Transaction Cost Perspective

### A Definitional Framework

The term -- outsourcing -- has been loosely defined by vendors, users, and trade periodicals, and has attained a "buzzword status, leading to confusion, misunderstanding and fear[8]." In addition to the time- sharing concept practiced by some information- intensive organizations like banks, insurance carriers and others, new variations of outsourcing such as systems integration and facilities management relationships have rendered the domain of this concept to become further blurred.

The distinction between 'inhouse function versus outsourcing' is not a dichotomy but, in fact is a continuum representing the governance choices available to a firm for managing its IT infrastructure. Indeed, it falls within the broader class of 'market-versus-hierarchy' or 'buy-versus-make' choices underlying the transaction cost perspective (Williamson, 1975; Monteverde and Teece, 1982; Walker and Weber, 1984; Anderson, 1985). The 'make' choice represents the operations of

[8]Wilder, *ibid.*

the IT infrastructure using internal resources, i.e., the conduct of transactions within a corporate hierarchy; the 'buy' choice, on the other hand, represents the contracting of a significant domain of IT infrastructure to external parties, i.e., the conduct of transactions using a market-exchange. A firm's relative positioning along this 'make versus buy' continuum represents its degree of vertical integration of IT infrastructure. Outsourcing, thus, represents a major strategic decision of the firm. Hence, we adopt the transaction cost perspective, which has been previously used to study strategic decisions pertaining to vertical integration (Walker, 1988) to develop a definitional framework.

Further, instead of the traditional 'market versus hierarchy' linear continuum, we develop a framework using two dimensions: (1) the degree of internalization of *technological* resources, and (2) the degree of internalization of *human* resources. Internalization refers to ownership by the focal organization which takes on full control with profit and loss responsibility. Technological resources include the entire infrastructure involving hardware, software, and communication systems deployed, while human resources include managers, programmers, systems administrators, maintenance and related personnel involved in the design, maintenance, and operation of the overall IT infrastructure.

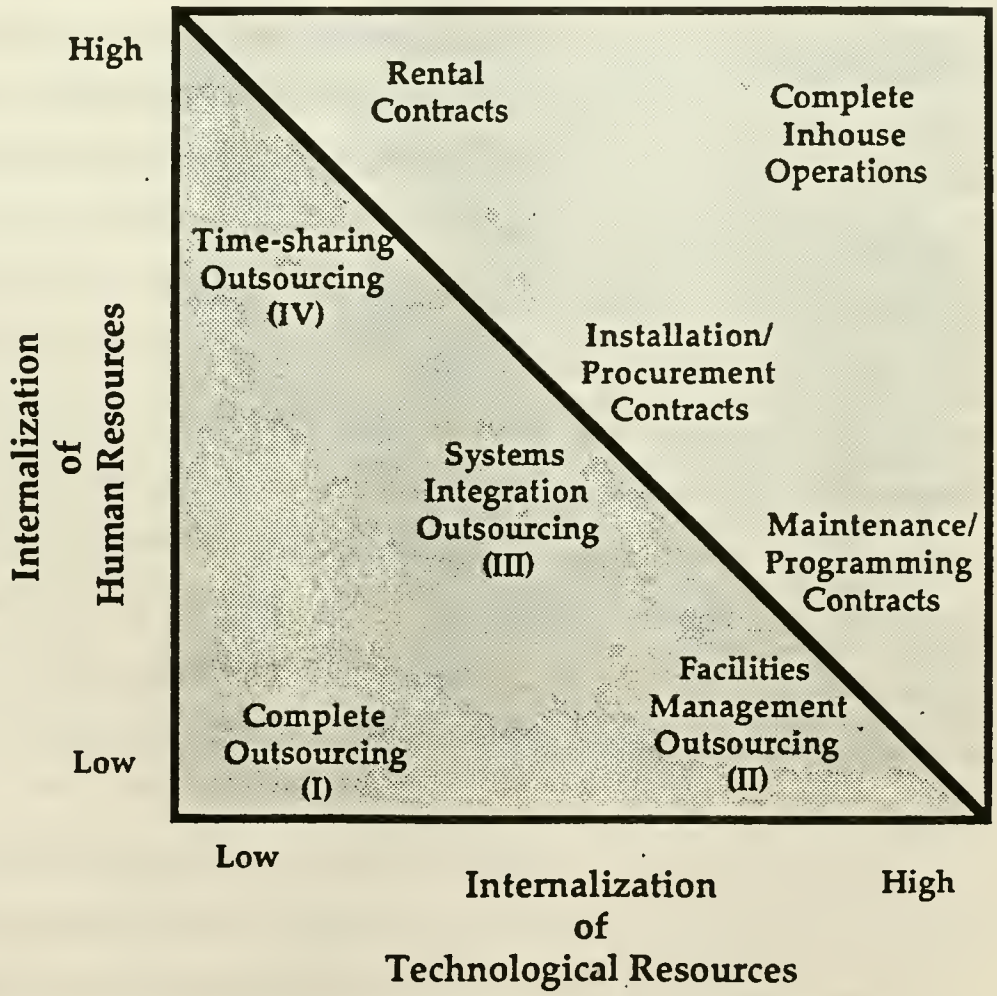
**Distinguishing Among Four Modes of Outsourcing**

Based on the above framework, we define outsourcing as "involving a significant use of resources -- either technological and/or human resources -- external to the organizational hierarchy in the management of the IT infrastructure." More specifically, we conceptualize it as a 'buy' strategy in terms of the following four modes as shown in the lower left triangle in Figure 1.

*(I) Complete Outsourcing.* This is a pure form with low levels of internalization of both resources -- technological and human. With a complete transfer of the key IT resources from the focal organization (also termed as the user) to the vendor, the user specifies the business requirements to the vendor. This form

is the closest to the 'buy' strategy or 'market-exchange' with the vendor being fully in charge of all phases of the technological implementation, including taking on the risk of resource ownership. Beside Eastman Kodak, prominent examples of users adopting this mode of outsourcing include American Standard, Copperweld, and Dial.

Figure 1: Alternative Modes of IT Governance




*(II) Facilities Management Outsourcing.* This mode refers to the engagement of human resources from the vendor in governing the IT infrastructure of the focal organization. In other words, positioned in the lower right hand corner of the framework, the user bears the full ownership of the required technological

resources, while exploiting the human resource skills and capabilities of an external organization to carry out the operations. A major driving force behind this mode of outsourcing is the need for specialized human resources which may be unavailable or expensive to develop internally. The notable examples of this mode include Cross, Ford, and Unilever.

*(III) Systems Integration Outsourcing.* This mode involves medium levels of internalization of human and technical resources. Typically, the user hires the vendor to take responsibility for the installation and operationalization of a large-scale information system project which usually comprises hardware and software from various suppliers. A single external organization, namely: the systems integrator is made accountable both technically and financially for an entire project, including the work -- if any -- of subcontractors. Under such an arrangement, the user can benefit from the access to vendor resources in the integration of multiple components of the overall IT infrastructure. A streamlined integration of the IT infrastructure has emerged as a necessity to respond effectively to increased competition and globalization of business operations. Some predict that there will be no distinction between a processing services company and a systems integrator in the future, and outsourcing is one step toward that[9]. Examples of users adopting this form of outsourcing include Allegheny International, American Airlines, and Boeing.

*(IV) Time-Sharing Outsourcing.* The upper left part of the framework depicts the mode that has been practiced since the advent of data processing on mainframe computers. Time-sharing has traditionally been popular due to the expensive mainframe computers. Small companies simply cannot afford to own such IT assets merely to run occasional batch processing jobs. With this scheme, the IT infrastructure of the user is simply assigned or delegated to fall within the capacity of a vendor. To further distinguish this mode from complete outsourcing, the level

[9]Ludlum, D. 1990. Systems Integration Today and Tomorrow. *Computerworld*, June 4: 72-73.

of human resources assigned by the vendor is kept to a minimum.

**Outsourcing as an IT Governance Mechanism: A Transaction Cost Perspective**

Following Williamson (1975), the nature of the relationship between a buyer and a supplier can be characterized by two human factors (namely: bounded rationality and opportunism) and two environmental factors (namely: uncertainty/ complexity and small numbers). Within a context of information impactedness or asymmetry, the combination of bounded rationality and uncertainty/ complexity with opportunism and small numbers give rise to transaction costs in the relationship. Transaction costs refer to the costs connected to the exchange of goods or services across the boundary of the firm. These include the costs of negotiation, monitoring, and enforcement in the contract between the participants of the relationship. The firm exists in instances where the transaction costs associated with the market alternative are too high (Coase, 1937). The transaction-cost paradigm is thus centered on the issue of selecting the best corporate governance mechanism to maximize the efficiency of economic exchange (Williamson, 1975; Walker and Weber, 1984). In the specific context of the IT infrastructure, transaction cost economics provides a theoretical lens to evaluate the relative advantages of performing the function inhouse and outsourcing it to outside vendors. This perspective has been adopted to explore related issues in the IS literature (see for instance, Malone, Yates, and Benjamin, 1987; Ciborra, 1987).

Outsourcing as an IT governance mechanism has the potential to minimize the various sources of transaction costs. Such benefits for the consideration of this governance mechanism are classified into three major categories – strategic, economic, and technological factors – as follows.

**Strategic Factors**

***Renewed Focus on Core Business.*** The management of the IT infrastructure in the information era is no simple task. Companies are often distracted from their fundamental business strategic thrusts in the marketplace by the ongoing

impediments associated with the operation of the increasingly complex IT infrastructure. To the extent that a firm's business strategic thrusts can be separated from its IT operations, it may be advantageous to contract out either a part or the whole of the management of the IT infrastructure.

*Enhanced IT Competence.* It is clear that in recent years, IT as a source of competitive advantage pervades the entire value chain (Porter and Millar, 1985). Outsourcing serves as an attractive IT mechanism for the user to leverage the competence of one or more IT vendors without internalizing all the required competences. For instance, in an uncertain marketplace, a key competence may be flexibility of the IT infrastructure, which may be best obtained through the user's position to negotiate for adapting the IT requirements with the vendors.

*Skilled Personnel Requirements.* Because of the specialized nature of IT, a critical problem is the staffing of required personnel. In addition, technological developments and specialization compel the constant retraining of these IT personnel. Outsourcing allows the user to shift this problem away from its hierarchy to the vendor community -- which is in a better position to select, train and manage its IT personnel than the user.

Economic Factors

*Scale and Scope Economies.* An outsourcing vendor is very often a specialist IT provider -- who caters to the needs of different users. While the project teams for these different users may be managed separately, the vendor is in a position to exploit economies of scale in human and technological resources by pooling across projects, with direct benefits to the user. Similarly, the variety of IT tasks carried out by a single vendor results in economies of scope which are not available to independent users.

*From a 'Service Center' to a 'Cost Center.'* Typically, the IT operations are viewed as necessary 'service centers' within an organization with fixed costs or overheads. In other words, during an era of minimal levels of IT investments, the

fixed-cost, service center view was appropriate. In contrast, with the escalating levels of IT investments (Strassman, 1985; Weill and Olson, 1989), there are increasing pressures to move away from a fixed, corporate overhead towards a more direct variable cost approach to controlling the IT operations. Outsourcing provides an unambiguous approach to arriving at the detailed cost structure of IT operations.

### Technological Factors

*Risk Bearing.* Given rapid changes in the nature of the IT infrastructure, the risk of obsolescence is high. A single user, attempting to manage this discontinuity, may consider it more appropriate to shift this risk to the vendor than bear it alone. This is because of the increased capability of the vendor to diversify these technological and human resource risks across a broader spectrum of users.

*Leapfrogging.* Outsourcing allows the users to leapfrog technological developments than otherwise possible under conditions of complete internalization of IT resources. This is because the vendors are usually at the leading edge of providing technological solutions with their human and technological resources updated to compete effectively in the marketplace for outsourcing contracts.

## Research Model

### Outsourcing as an Administrative Innovation

Traditionally, the management of IT infrastructure has been carried out entirely within the hierarchy. With increasing importance accorded to IT in the management of the enterprise, the expectation from IT has escalated, thus placing additional stress on the human and technological resources. Consequently, the hierarchical mode of IT governance is limited in terms of serving as the best alternative. Within the class of IT governance mechanisms, outsourcing in its various forms (Figure 1) is generally perceived to be novel by the community of user organizations. However, Eastman Kodak's outsourcing decision sparked a greater level of interest in this IT governance mechanism: "For the majority of

organizations, however, the idea became thinkable only when large and visible corporations such as Eastman Kodak Co.... began to publicize their plans to divest and openly discuss the cost benefits of outsourcing[10]."

Let us position outsourcing against the backdrop of other established administrative innovations. One is the consideration of the M-form organization structure as an administrative innovation. Teece (1980) and Mahajan, Sharma, and Bettis (1988) have argued that this form of organizational structure is an administrative innovation. This structure emerged as a new way of configuring the organizational processes to circumvent the control loss associated with the functional organizational form prevalent in the late 19th and early 20th century (Chandler, 1962). As Chandler (1962: 394) noted:

> "once the new type of organization became known, as it did during the 1930s, its availability undoubtedly encouraged many enterprises to embark on a strategy of diversification, for the ability to maintain administrative control through such an organizational framework greatly reduced the risks of this new [strategy]..."

The other administrative innovation is the case of joint venture. Within the class of strategic alliances, joint venture has been argued to be an administrative innovation (Koh, Loh, and Venkatraman, 1990). This is because, in recent years, firms have found it increasingly advantageous to form joint ventures due to the growing realization that significant benefits could be obtained via collaboration. The adoption of joint ventures is an attempt to capture the rents associated with this administrative mechanism.

Building upon these two innovations, we argue that the outsourcing of IT activities (as depicted in Figure 1) is an administrative innovation. This is consistent with the transaction cost perspective in the sense that the traditional mode of IT governance -- 'hierarchy'-- has now been extended to 'market' and the range of

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[10]Radding, A. 1990. The Dollars and Sense of Outsourcing: The Ride is No Bargain if You Can't Steer. *Computerworld*, January 8: 67.

institutional mechanisms falling in between. In addition, the adoption of outsourcing by an organization is an attempt to capture the economic rent associated with the tremendous cost-savings. The rent- generating capability via this entirely new mode of organizing further strengthens the consideration of outsourcing as an administrative innovation.

Consistent with Mahajan et al. (1988) and Koh et al. (1990), the level of analysis employed in this study is a 'macro-level' perspective which treats the diffusion of outsourcing as class of administrative innovation. This is in contrast to a 'micro-level' perspective (e.g. Cooper and Zmud, 1990) which is more concerned with the factors that determine or predict the adoption of a particular IT activity on a cross-sectional basis.

**Diffusion of Outsourcing: Internal or External Influence?**

Rogers (1983) defines innovation diffusion as the process by which the innovation is communicated through certain channels over time among the members of the social system. There are thus four critical elements in the diffusion process: (1) innovation; (2) social system; (3) channels of communication; and (4) time (Mahajan and Peterson, 1985). An innovation refers to any idea, object, or practice that is perceived to be new by members of the social system. Social system comprises the individuals or organizations that share a common 'culture' and are potential adopters of the innovation. Channels of communication are the means by which information is transmitted to or within the social system. Time is the rate or speed by which members of the social system adopt the innovation.

In this study, the *innovation* is the administrative practice of outsourcing, which in its present form, is a novel concept for many organizations. The relevant *social system* is the set of organizations which need to use IT in effectively achieving their objectives. *Channels of communication* in outsourcing take two forms: horizontal and vertical. Horizontal channels are the means by which members of the social system interact. This could be by direct interpersonal contacts, or by

indirect mutual observation amongst the potential and prior adopters of outsourcing. Vertical channels refer to the mechanisms by which members of the social system interact with agents outside the system. Such forms of communication can emanate mainly from the promotion efforts of outsourcing vendors. The inter-temporal pattern of outsourcing contract announcements represents the *time* element of the diffusion process.

The various benefits of outsourcing discussed earlier as mitigators of transaction and production costs could be communicated to the potential adopters through either horizontal and/or vertical communication channels. Thus, it is logical to adopt a diffusion modeling perspective to analyze the pattern of adoption of this governance mechanism. Specifically, we follow Mahajan and Peterson (1985) and consider three models of diffusion: internal-influence, external-influence and mixed-influence, discussed below.

***Internal-Influence Model.*** This paradigm of diffusion purports that diffusion takes place solely through horizontal channels of communication. Here, the diffusion rate is contingent only on the interaction between prior adopters and potential adopters. The driving force for diffusion is thus an imitative behavior within the social system. The diffusion model can be represented by the equation:

$$\frac{dN(t)}{dt} = qN(t)[m-N(t)] \qquad (1)$$

where N(t) is the cumulative number of adoptions at time period t, q is the coefficient of internal influence or imitation, and m is the potential number of adopters in the social system. In this model, the diffusion rate is a function of the number which has already adopted the innovation and the remaining number of potential adopters. Plotting N(t) with t will result in the characteristic S-shaped diffusion curve.

Imitative behavior as embodied in an internal-influence model is driven by the need to emulate seemingly successful organizations. Organizational theorists labeled this emulative behavior as isomorphism (e.g. DiMaggio and Powell, 1983;

Hannan and Freeman, 1977). Accordingly, there are two forms of isomorphism -- competitive and institutional-- each of which is based on a different causal mechanism. Competitive isomorphism is rooted in a socio-Darwinistic concept of 'the survival of the fittest,' in which the dictates of the environment drive certain organizations to perform better than others. Institutional isomorphism is anchored on the tendency of organizations to model themselves on others based on the need to legitimize certain behavior perceived to result in desired outcomes. One particular form of institutional isomorphism (DiMaggio and Powell, 1983) -- mimetic isomorphism -- is especially relevant in our context of outsourcing.

As DiMaggio and Powell (1983: 151-152) argue:

> "When organizational technologies are poorly understood...., when goals are ambiguous, or when the environment creates symbolic uncertainty, organizations may model themselves on other organizations. The advantages of mimetic behavior in the economy of human action are considerable; when an organization faces a problem with ambiguous causes or unclear solutions, problemistic search may yield a viable solution with little expenses...
>
> ..... The ubiquity of certain kinds of structural arrangements can more likely be credited to the universality of mimetic processes than to any concrete evidence that the adopted models enhance efficiency."

Accordingly, the argument is that organizations mimic others when the underlying [administrative] technology is complex and the environment is uncertain. The recent acceleration of developments in the IT environment -- hardware, software and communication technologies -- as well as the increasing importance of IT to business strategy and competitive advantage (see for instance, Keen, 1986; McFarlan, 1984; Porter and Millar, 1985) renders the management of IT infrastructure with increased complexity and uncertainty.

***External-Influence Model.*** Here, vertical channels of communication are the sole means of motivation for the adoption of the innovation. This model is based on the premise that the diffusion rate is dependent only on the role played by

external change agents. It is independent on the number of prior adopters. Mathematically, this model can be written as:

$$\frac{dN(t)}{dt} = p[m-N(t)] \qquad (2)$$

where p is the coefficient of external influence or innovation. Plotting N(t) with t will result in a curve that increases at a decreasing rate.

Under the external-influence model, the diffusion phenomenon is driven by information sources arising from outside the social system. It is not contingent on imitation between members of the system. In general, this model of diffusion is most appropriate when members of a social system are isolated, or for innovations that are not complex and/or subject to interpersonal communication, or when adequate information about the innovation is only available from sources external to the social system (Mahajan and Peterson, 1985).

*Mixed-Influence Model.* This is a combination of both the internal- and external-influence models. It can be represented by the following formula:

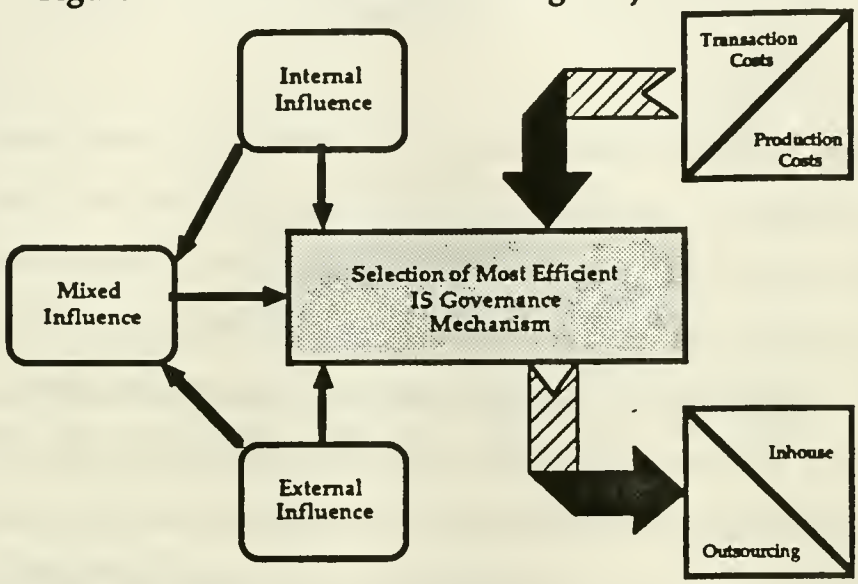
$$\frac{dN(t)}{dt} = [p+qN(t)][m-N(t)] \qquad (3)$$

This is the most general form for diffusion modeling. Like the internal- influence model, the cumulative adoption curve is S-shaped with respect to time. Here, the time-series pattern of outsourcing diffusion can be driven by internal influence or by external influence or by both influences at the same time.

A diagrammatic representation of the conceptual foundation which relates the various types to the selection of the most efficient IS governance mechanism is depicted in Figure 2. Within this framework, the decision to outsource by an organization is based on myriad factors affecting transaction and production costs. The benefits of outsourcing are communicated to the potential adopter internally through prior adopters, and/or externally through an outside agent such as a vendor. Thus, the first research question is:

*Research Question 1:* Is the diffusion of outsourcing driven by internal or external influences or both?

Figure 2 – Diffusion of Outsourcing: Major Influences




## Kodak's Outsourcing as a 'Watershed' Event

The imitation phenomenon has been purportedly greatly enhanced by the well-known Kodak case. In July 1989, Kodak outsourced its microcomputer systems operations to Businessland, and more dramatically its data center operations to IBM. This was followed by the farming out of its world-wide telecommunications and data networks to Digital Equipment Corp. (DEC) and IBM in January 1990. With Kodak serving as an example, the hot talk within the IS executive community has been outsourcing. In an interview, Howard Anderson, founder and managing director of The Yankee Group, attributed the enormous current interest in outsourcing to the Kodak saga: "The Kodak contract was really the watershed event. The fact that Kodak is doing this sends a message that it is OK to go to outsourcing." The Kodak incident thus serves as a natural dividing point to break out our entire sample time domain into two regimes. This will enable us to evaluate the differential impacts, if any, of imitation before and after the Kodak case. We thus used the time frame-- April 1988 to July 1989-- as our first diffusion regime, and the time frame-- August 1989 to August 1990-- as our second diffusion regime. Thus, our second research question is:

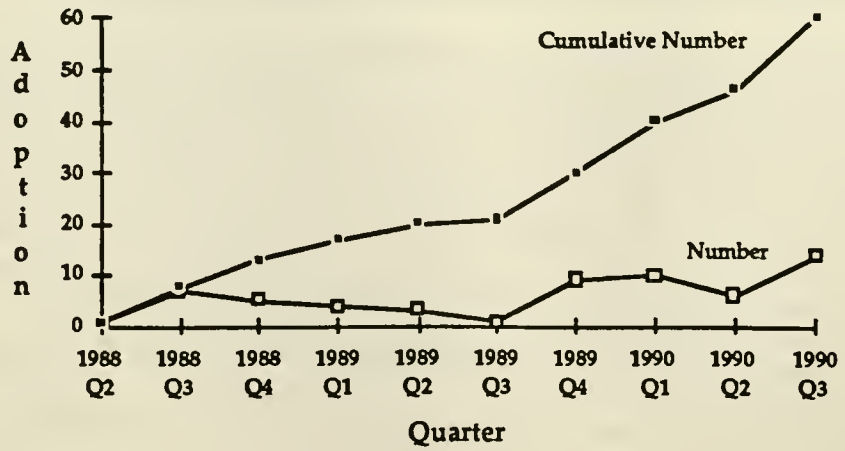
*Research Question 2:* Does internal influence become more pronounced in the diffusion of outsourcing after the Kodak contract?

## Methods

### Sample

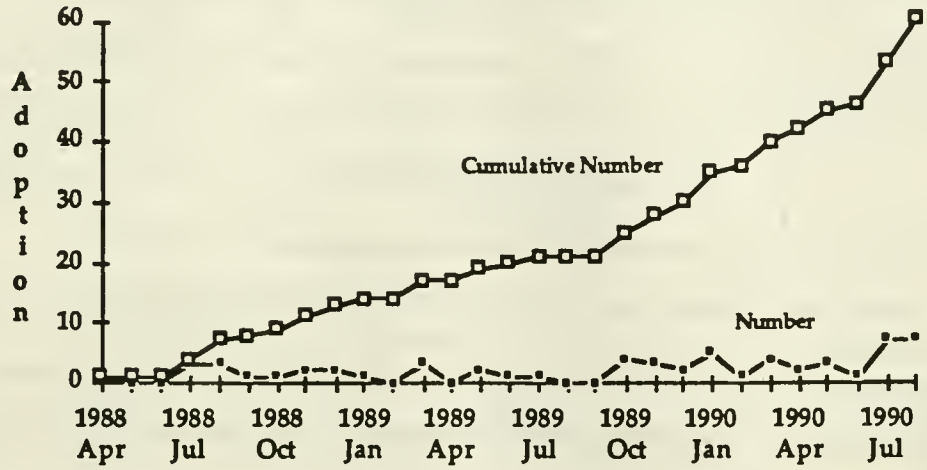
We generated a sample of outsourcing contracts by an electronic search of two CD-ROM databases -- *Newspaper Abstracts Ondisc* and *Business Dateline Ondisc* -- produced by University Microfilms International (UMI). The first contains indexes of seven major daily newspapers, while the second provides the full text of articles of nearly 180 regional magazines, daily newspapers, and wire services. We considered the time period January 1988 to August 1990[11] and identified a total of 60 outsourcing contracts. The average size of the contracts is $159.9 million, while the average duration of the contracts is 5.0 years. The time-series distribution of the data in both quarterly and monthly forms is in Figures 3 and 4.

**Figure 3: Diffusion of Outsourcing (Quarterly Data)**




[11]First, we conducted an exploratory search to discern the patterns of reporting for outsourcing contracts in the databases. Next, we generated our sample using a generalized search procedure which avoided any bias to any vendor or user. We used the following search commands to draw out all the contracts in the databases: term(contract) AND (computer OR system OR information) AND xxx, where we respectively used outsourcing, facilities management, systems integration, time-sharing, network management, systems management, information management, and data processing management for xxx. Throughout this procedure, we are confident that the sample is adequately random for the results to be generalizable.

Figure 4: Diffusion of Outsourcing (Monthly Data)

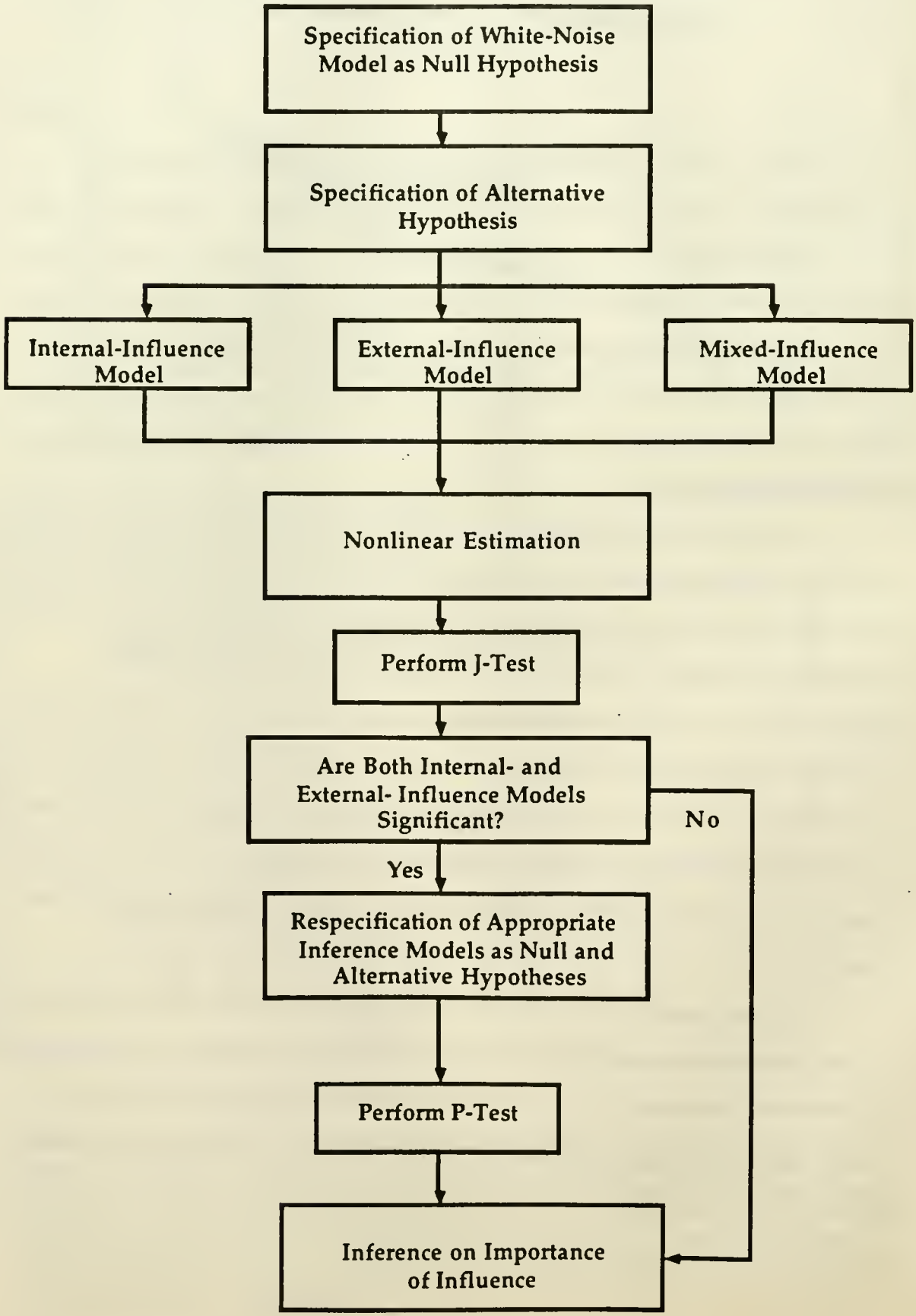



## Analytical Framework

In a study of the diffusion of the M-form organizational structure, Mahajan et al. (1988) use a linear analogue approach to test the imitation hypothesis. However, this method has its econometric limitations such as multicollinearity, and non-availability of standard errors for the crucial parameters-- p (coefficient of innovation), q (coefficient of imitation), and m (number of eventual adopters). Hence, we adopt nonlinear least squares (NLS) estimation of the internal- , external- , and mixed- influence models. Specifically, as shown in Figure 5, we first use the white-noise model as the null hypothesis, and the respective influence model as the alternative hypothesis. Next, we test the three influence models against one another.

The test procedures are based on a special class of model specification tests developed by Davidson and MacKinnon (1981) for the case of a non-nested nonlinear alternative hypothesis. In the first case of a linear null hypothesis vis-a-vis a nonlinear alternative hypothesis, we apply the J-test, and in the second case of nonlinear null and alternative hypotheses, we apply the P-test.

Figure 5: Analytical Framework



### The Null Hypothesis

A stringent null hypothesis is that the diffusion pattern follows a white-noise or random walk process (Mahajan et al., 1988). This specifies that the difference between the numbers of adopters at t and (t-1) is random, implying that the rate of diffusion will be driven by the error term only.

The mathematical form of the null hypothesis posits that the first differences in the noncumulative adoption time-series are random:

$$x(t) = x(t-1) + e(t) \tag{4}$$

where x(t) is the number of adopters at time t, and the residuals e(t) have a zero mean (e(t) is uncorrelated with e(t-k) for all nonzero k). The equation (4) specifies that the adoption time-series will proceed by a sequence of unconnected steps, starting each time from the previous value of the adoption time-series.

### The Internal-Influence Model as an Alternative Hypothesis

We need to specify the functional form for the internal-influence model for estimation. Solving equation (1) from our earlier discussion, we get

$$N(t) = \frac{m}{1+\frac{m-m_0}{m_0}\exp(-qmt)} \tag{5}$$

where m represents the number of adopters in the initial period. Using a discrete formulation, we have the following functional form:

$$x(t) = m\left[\frac{1}{1+\frac{(m-m_0)}{m_0}\exp(-qmt)} - \frac{1}{1+\frac{(m-m_0)}{m_0}\exp(-qm(t-1))}\right] \tag{6}$$

### The External-Influence Model as an Alternative Hypothesis

From equation (2) earlier, we have

$$N(t) = m\,[1-\exp(-pt)] \tag{7}$$

This results in the following functional form for estimation:

$$x(t) = m\,[\exp(-p(t-1)) - \exp(-pt)] \tag{8}$$

### The Mixed-Influence Model as an Alternative Hypothesis

An NLS estimation method for the mixed-influence model has been used by Srinivasan and Mason (1986) who show that this nonlinear estimation procedure

actually performed better than its ordinary least squares (OLS) and maximum likelihood estimation (MLE) counterparts. Accordingly, we use the following functional form:

$$x(t) = m\left[\frac{1-\exp(-(p+q)t)}{1+\frac{q}{p}\exp(-(p+q)t)} - \frac{1-\exp(-(p+q)(t-1))}{1+\frac{q}{p}\exp(-(p+q)(t-1))}\right] \quad (9)$$

**Test of Alternative Model Against the White-Noise Null Model**

In the null hypothesis, we have specified a white-noise model for the formation of joint ventures. As for the alternative hypothesis, we employ the several estimation models as given by the type of influence assumed. When a nonlinear model is used as the alternative hypothesis which is non-nested, we can apply a class of model specification tests developed by Davidson and MacKinnon (1981) for our statistical inference. Specifically, since our null model is linear, we employ their J-test. Accordingly, we estimate the regression

$$x(t) = (1-a)\, f(t) + a\hat{g}(t) + u(t) \quad (10)$$

where $f(t)=x(t-1)+e(t)$ is the null white-noise model, $\hat{g}(t)$ is the predicted value under an appropriate alternative model based on a maximum likelihood estimation, a is some constant, and u(t) is a random error which is normally and independently distributed with zero mean and constant variance. The econometric properties of the estimation and inference using equation (10) enable us to test the alternative hypothesis by applying the conventional asymptotic one-tailed t-test for the null hypothesis that $\alpha=0$ (Davidson and MacKinnon, 1981).

**Testing the Influence Models Against One Another**

Unlike our previous case where the null hypothesis (white-noise model) is linear, testing the three influence models against one another renders both the null and the alternative hypotheses nonlinear. Davidson and MacKinnon (1981) suggest another procedure called the P-test which can be used for our comparison here. This is quite similar to the J-test, except that we now estimate the following function:

$$x(t) = (1-\alpha)\, f(t) + \alpha\, \hat{g}(t) + \hat{F}\hat{B} + u(t) \qquad (11)$$

where $\hat{F}$ is a row vector containing the derivatives of f with respect to B (the parameters of f), evaluated at $\hat{B}$.

## Results

### Research Question One

***Results Based on Quarterly Data.*** Table 1 shows the parameter estimation and model fit of the three influence types based on the quarterly data. Table 2 presents the results of model comparisons with (a) the white-noise model; and (b) across the different influence types. The J-test is not able to reject the null white-noise model using the alternative external-influence model, even at the 0.10 level. The internal- and mixed- influence models, nevertheless, are more statistically significant when tested against the white-noise model (p-values are 0.0135 and 0.0075 respectively).

**Table 1: Results of Model Estimation Using Quarterly Data**

**1(a): Parameter Estimation**

| Diffusion Model | p | q | m |
|---|---|---|---|
| Internal Influence | NA | 0.1073 | 566.8060 |
| External Influence | 0.0846 | NA | 90.0001 |
| Mixed Influence | 0.0084 | 0.1563 | 356.7531 |

**1(b): Model Fit**

| Diffusion Model | MSE | F-value | adj $R^2$ |
|---|---|---|---|
| White Noise | 21.222 | NA | 0.6277 |
| Internal Influence | 10.031 | 20.128*** | 0.8271 |
| External Influence | 28.219 | 5.590** | 0.5049 |
| Mixed Influence | 13.316 | 10.842*** | 0.7664 |

* – significant at 0.10 level; ** – significant at 0.05 level; and *** – significant at 0.01 level.

To compare the various influence models against one another, the P-test is used. The results are somewhat consistent with those of the J-test. The external-influence model, when used as a null hypothesis, can be significantly rejected by the alternative internal- and mixed- influence models (p-values are 0.0620 and 0.0151 respectively).

Table 2: Results of Model Comparisons Using Quarterly Data

2(a) Comparison With the White-Noise Model Using the J-Test

| Influence | t-statistic | p-value |
|---|---|---|
| Internal | 2.912** | 0.0135 |
| External | 1.344 | 0.1104 |
| Mixed | 3.203*** | 0.0075 |

2(b) Comparison between Models Using the P-Tests

| Alternative Hypothesis | Null Hypothesis (entries are t-statistic and p-values in parantheses) | | |
|---|---|---|---|
| | Internal | External | Mixed |
| Internal | NA | 1.847* (0.0620) | 0.261 (0.4034) |
| External | 0.921 (0.2047) | NA | 0.949 (0.1931) |
| Mixed | 0.889 (0.2121) | 2.824** (0.0151) | NA |

* -- significant at 0.10 level; ** -- significant at 0.05 level; and *** -- significant at 0.01 level.

*Results Based on Monthly Data.* The estimation and fit results of the three influence models are depicted in Table 3. Table 4 shows the inference results for J-test and the P-test. Under the J-test, and using the white-noise null model, all the alternative influence models are statistically significant at the 0.01 level. However, when an external-influence null model is tested against an internal-influence alternative model with the P-test, it is rejected at the 0.05 level (p-value is 0.0187).

**Table 3: Results of Model Estimation Using Monthly Data**

**3(a): Parameter Estimation**

| Diffusion Model | p | q | m |
|---|---|---|---|
| Internal Influence | NA | 0.0824 | 60.0001 |
| External Influence | 0.0111 | NA | 200.0001 |
| Mixed Influence | 0.0097 | 0.0427 | 148.9987 |

**3(b): Model Fit**

| Diffusion Model | MSE | F-value | adj $R^2$ |
|---|---|---|---|
| White Noise | 4.929 | NA | 0.3921 |
| Internal Influence | 4.611 | 12.113*** | 0.4515 |
| External Influence | 4.386 | 12.879*** | 0.4590 |
| Mixed Influence | 3.671 | 12.278*** | 0.5472 |

* -- significant at 0.10 level; ** -- significant at 0.05 level; and *** -- significant at 0.01 level.

**Table 4: Results of Model Comparisons Using Monthly Data**

**4(a) Comparison With the White-Noise Model Using the J-Test**

| Influence | t-statistic | p-value |
|---|---|---|
| Internal | 4.021*** | 0.0003 |
| External | 2.497*** | 0.0096 |
| Mixed | 3.318*** | 0.0014 |

**4(b) Comparison between Models Using the P-Tests**

| Alternative Hypothesis | Null Hypothesis (entries are t-statistic and p-values in parantheses) | | |
|---|---|---|---|
| | Internal | External | Mixed |
| Internal | NA | 2.205** (0.0187) | -0.256 (0.6000) |
| External | 0.961 (0.1733) | NA | -1.164 (0.8720) |
| Mixed | 0.955 (0.1748) | -2.901 (0.9962) | NA |

* -- significant at 0.10 level; ** -- significant at 0.05 level; and *** -- significant at 0.01 level.

**Research Question Two**

The inference results for the 'pre-Kodak' regime -- April 1988 to July 1989 -- are summarized in Table 5. When tested against the white-noise model, the internal-influence model is statistically significant at the 0.05 level, while the external- and mixed- influence models are statistically significant at the 0.01 level:

Tested against each other, none of the model can be rejected at the 0.10 level.

**Table 5 Results of Model Comparisons Using Monthly Data (April 1988-July 1989)**

**5(a) Comparison With the White-Noise Model Using the J-Test**

| Influence | t-statistic | p-value |
|---|---|---|
| Internal | 2.013** | 0.0336 |
| External | 3.263*** | 0.0031 |
| Mixed | 3.283*** | 0.0030 |

**5(b) Comparison between Models Using the P-Tests**

| Alternative Hypothesis | Null Hypothesis (entries are t-statistic and p-values in parantheses) | | |
|---|---|---|---|
| | Internal | External | Mixed |
| Internal | NA | -0.047 (0.5183) | -0.981 (0.8251) |
| External | -0.237 (0.5914) | NA | -1.223 (0.8766) |
| Mixed | -0.240 (0.5923) | 0.974 (0.1748) | NA |

* – significant at 0.10 level; ** – significant at 0.05 level; and *** – significant at 0.01 level.

The inference results using the 'post-Kodak' regime – August 1989 to August 1990 – are revealed in Table 6. The J-test results indicate that both the internal- and external- influence models are significant at the 0.05 level, while the mixed-influence model is significant at the 0.01 level, with respect to the white-noise model. Using the P-test, however, the internal-influence model is able to reject the external-influence model at the 0.05 level.

Table 6 Results of Model Comparisons Using Monthly Data (August 1989-August 1990)

6(a) Comparison With the White-Noise Model Using the J-Test

| Influence | t-statistic | p-value |
|---|---|---|
| Internal | 2.585** | 0.0148 |
| External | 2.364** | 0.0199 |
| Mixed | 3.215*** | 0.0047 |

6(b) Comparison between Models Using the P-Tests

| Alternative Hypothesis | Null Hypothesis (entries are t-statistic and p-values in parantheses) | | |
|---|---|---|---|
| | Internal | External | Mixed |
| Internal | NA | 2.143** (0.0323) | 0.290 (0.7806) |
| External | 1.229 (0.1294) | NA | -1.453 (0.9078) |
| Mixed | 1.200 (0.1347) | -1.690 (0.9374) | NA |

* – significant at 0.10 level; ** – significant at 0.05 level; and *** – significant at 0.01 level.

## Discussion

### Diffusion of Outsourcing as an IT Governance Mechanism: Is There Imitation?

The results of this study – both the quarterly data and the monthly data – suggest that the internal-influence model is a better explanatory mechanism underlying the diffusion pattern of outsourcing than the external-influence model. This suggests that the key driving force of outsourcing is imitative behavior. Indeed, prior to the Kodak-IBM case, both internal and external influences are important in the diffusion of this mechanisms of IT governance. However, after Kodak's initiative, it appears that internal influence becomes more predominant in the subsequent observed outsourcing decisions. This supports our premise that the legitimization of this IT governance mechanism by a Fortune 20 firm, Kodak (ranked 18 in 1989), paved the way for imitative behavior by other organizations.

The significance of internal influence in the diffusion of outsourcing as an IT governance mechanism is consistent with the findings of Koh, Loh, and Venkatraman (1990), which established that joint ventures (both within the IT

sector as well as in a larger multi-industry sample) are also driven by imitation. This is in contrast to the importance of external influence observed in the diffusion of M-form (divisional) organizational structures reported in Koh et al. (1990), which is consistent with Chandler's (1962) historical treatise.

Thus, we posit that -- in terms of new mechanisms to manage the uncertainties underlying administrative processes within modern organizations -- organizations do mutually observe, interact, and/or learn from one another within a social system in formulating their strategies. There seems to be a closely-bonded (perhaps invisible) community of top IS executives, wherein managers use one another as sources of information about administrative practices. However, this paper did not explicitly model the impact of such collective behavior (see Markus, 1990 for a discussion of linking diffusion and collective actions) on the diffusion of outsourcing, which is noted as an interesting avenue for further research. In such a case, the specification of the equation for internal influence (1) could be modified to more directly specify the degree of information exchange among the members of the social system (example: chief information officers and/or chief executive officers).

**Diffusion of Outsourcing: User-Pull or Vendor-Push?**

The internal-influence supports a user-pull, implying that the organization solicits the participation of an IT vendor after the benefits of this governance mechanism are communicated from other prior adopters. The IS executives are generally viewed to be closely interconnected through various industry and university networks, with a considerable opportunity to learn about each other's practices. This may be why the imitation explanation is supported in our empirical study. Furthermore, the emulation of other successful organizations -- especially under conditions of high uncertainty as in the case of effective management of IT -- increases the likelihood of top management's acceptance of IT outsourcing. As *Computerworld* observes, "Whether or not a company decides to hop on the bandwagon, many senior executives are becoming curious about the option.... We

see a lot more direction from top management saying, 'Let's look at it. Let's see if it makes sense for us[12].'"

On the other hand, a major force emanating from outside the social system that encourages outsourcing is the vendor-push. Here, the vendor uses its promotional efforts to communicate the benefits of this governance mechanism to potential adopters. With expected intensifying competition in the outsourcing market, the vendors will be forced to market their services more aggressively. IBM, a key player, has already launched a new division, IBM Systems Services, to provide customized services ranging from building data centers to optimizing and managing data networks. The vendor-push phenomenon is perhaps most appropriately illustrated by the assertive approach of a key vendor, Electronic Data Systems (EDS), which was described as follows: "[EDS is] a rather pushy company ... They were always trying to expand what they were doing, making contact with upper management and get more business[13]." In fact the push-strategy of EDS has been buttressed by its $500 million cash reserves to finance acquisitions of users' IS divisions, and of course, a $127-billion-in-sales 'sugar daddy' in the gigantic parent company, General Motors (No. 1 on the Fortune 500 in 1989).

Our results imply that the user-pull dominates the vendor-push, especially after the Kodak saga. The benefits of outsourcing seem to be communicated from within the social system of prior and potential adopters, rather than from outside sources. However, as the level of vendor-push in this market increases, it may be necessary to respecify the equation for external influence (2) to recognize the role of their marketing efforts. This is akin to the inclusion of marketing-mix variables like advertising in the studies of diffusion of products like the computer terminals (Randes, 1983) or services like the telephone-based banking (Hosky and Simon, 1983). Thus, an extension of this study for a later time period could test the relative

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[12]Wilder. 1989-90, *op cit.*

[13] Gillin. P. 1990. EDS rides outsourcing to riches. *Computerworld*, October 15: 113.

importance of user-pull versus vendor-push in the diffusion of this governance mechanism.

**Towards a Research Agenda on IT Governance**

*Motivation to Outsource.* Our focus in this paper has been at a macro-level to develop a model of diffusion of the outsourcing phenomenon within a social system that builds from a micro-level impetus on the benefits underlying this specific governance mechanism. A useful line of inquiry is to develop a cross-sectional, structural model of the likelihood of outsourcing (as well as the specific mode of outsourcing developed in Figure 1) using a set of predictors derived from transaction cost economics and agency theory. Specifically, these predictors could include: asset specificity of the IT infrastructure, criticality and pervasiveness of IT in business operations, level of technological uncertainty, degree of competition in the vendor market, goal congruence as well as risk preferences of the concerned parties. A study along these lines is underway by the authors.

*Process of Managing the Governance Structure.* The second line of extension focuses on the organizational processes underlying the management of the governance structure. Since this is a relatively new mode of governance, it is both necessary and important to develop a *process* model of outsourcing to complement the *variance* model (see Mohr, 1982 for the distinction) implicit in the first area of extension discussed above. Such a process model may seek to identify new structures (example: shared authority-responsibility), management processes (example: allocation and coordination of resources; performance assessment; and degree of joint planning) and management roles (example: liaison personnel as well as management involvement) that may be required to effectively derive the benefits of this governance mechanism.

*Effects of Outsourcing as an IT Governance Mechanism.* A third line of inquiry is to develop a framework of effectiveness of IT governance mechanism that recognizes the motivational factors (strategy formulation) as well as the process

factors (strategy implementation). In other words, while the transaction cost perspective implicitly assumes that the most efficient governance mechanism will be chosen by the organization (with minimal attention to the process factors), it may be more appropriate to develop a comprehensive framework that delineates the various factors that lead to the effectiveness of the overall IT infrastructure.

## Conclusions

In this paper, we began by building an interpretation for outsourcing based on transaction cost economics. A definitional framework for outsourcing is proposed. The sources of costs and benefits affecting the outsourcing decision are also highlighted. We then present arguments on the consideration of outsourcing as an administrative innovation. The main thrust of the paper is the examination of the relative impacts of the various influence types on the diffusion of outsourcing. To this end, we have tested the various influence models against the white-noise model as well as against one another. Using nonlinear estimation techniques and a special class of specification tests, we established that imitation is a stronger driving force underlying the diffusion of outsourcing. The results have important implications on the debate concerning user-pull versus vendor-push effects of outsourcing.

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## Appendix: A Stylized Model of Outsourcing

In this stylized model, we specify the decision rule to outsource. Following the transaction cost framework of outsourcing (see Figure 1), let the degree of internalization of technological resources be represented by $a$, and the degree of internalization of human resources be represented by $b$. Naturally, we have the constraint: $0 \leq a, b \leq 1$. Consistent with our definition, we designate outsourcing to be the region $a + b \leq 1$, and inhouse operations to the region $a + b > 1$. Let the average total cost be denoted $c(c,b,k)$, where $k$ is some exogenous variable that are assumed constant.

Using the transaction cost logic, the organization solves:

$$\min_{a,\,b} c(a,b,k)$$

$$\text{s.t. } 0 \leq a, b \leq 1$$

For simplicity, we assume that the variables $a$ and $b$ affect the average total cost function with only first- and second- order terms:

$$c(a,b,k) = \alpha a^2 + \beta b^2 + \gamma ab + \delta a + \varepsilon b + \zeta(k)$$

The parameters $\alpha$, $\beta$, $\gamma$, $\delta$, $\varepsilon$, and $\zeta$ represents the 'unique' characteristics of the organization in the specification of transaction and production costs. The factors that increase or decrease these costs have been highlighted in the text. $\alpha$ and $\beta$ are the quadratic effects, $\gamma$ is the interactive effect, and $\delta$ and $\varepsilon$ are the linear effects of internalization on average total cost respectively. The first-order conditions for the minimization problem are:

$$2\alpha a^* + \gamma b^* + \delta = 0; \text{ and}$$

$$2\beta b^* + \gamma a^* + \varepsilon = 0.$$

The solutions are then:

$$a^* = (\gamma\varepsilon - 2\beta\delta)/(4\alpha\beta - \gamma^2); \text{ and}$$

$$b^* = (\gamma\delta - 2\alpha\varepsilon)/(4\alpha\beta - \gamma^2).$$

Now, outsourcing is represented by $a^* + b^* \leq 1$. Thus the decision rule for an organization is:

$$\text{Outsource iff } \gamma\varepsilon - 2\beta\delta + \gamma\delta - 2\alpha\varepsilon \leq 4\alpha\beta - \gamma^2$$