1983

Strategies for Managing MIS Projects: A Transaction Cost Approach

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ABSTRACT

There is a growing awareness among MIS scholars and practitioners that there is not "one best way" to manage MIS development projects. This paper addresses the questions, "What is the set of strategies from which we can choose?" and "On what basis should we choose among the strategies?" The paper turns to the organization theory literature -- in particular the transaction cost approach -- for guidance in constructing a model for project strategy selection. Recent MIS literature on project management is shown to agree, for the most part, with the model's recommendations. As an example of how the model can be used to analyze organizational change, the paper uses the model to review the developments in project management strategies implied by Nolan's Stage hypothesis. The paper concludes with some thoughts on avenues for testing the model and on the model's implications for practice.

INTRODUCTION

This paper is about choosing strategies for managing Management Information Systems development projects. These projects are carried out by a project team to create computer software which serves some business function for a user.

When we speak of choosing a strategy to be used in managing an MIS project we are thinking of choosing answers to questions such as:

How will the project resources be allocated?
What will the planning process be?
How will the project be controlled?
How will the project be organized?
How will the project be directed? staffed?
How will the success of the project be evaluated?

Early MIS literature on project management advocated a single strategy, characterized by strong leadership by the MIS department, the use of project management tools such as PERT for planning and controlling, and frequent analogies to construction projects. Recent MIS literature, however, has advocated a contingency approach to project strategy selection; here a strategy is selected to match various project "contingencies." The particular strategies and contingencies vary from writer to writer.

The problem with the MIS project management literature is not that it is wrong, but rather that it has little theoretical foundation. Since MIS projects are organizations, this paper turns to the organization theory literature for some guidance in this area. Specifically, this paper proposes that the transaction cost perspective can provide a theoretical underpinning which can both unify the contingency literature and illuminate the changes in project management approaches implied by Nolan's Stage Hypothesis (Nolan, 1973).

The paper begins with a brief examination of the recent contingency recommendations for MIS projects.

THE MIS CONTINGENCY SCHEMES

Recent thought on MIS project management is that there are several viable MIS project management strategies, not just one, and each is appropriate under certain circumstances. In this view, project strategy should be matched to characteristics of the project or its context. Most theorists suggest several strategies and a basis for selecting among them. However, neither the strategies suggested nor the basis for selection is the same in any case.

The Suggested Strategies. The strategy most frequently mentioned is probably the one also most frequently used. Here the project is planned, controlled, directed, and staffed by the MIS organization, with periodic review and approval of specifications by the user. McLean (1979) calls this strategy the "Adversary" strategy, emphasizing the estrangement which may arise between the user and MIS. Alter (1978) calls it "Built For," accenting the distinction between the roles of the two parties -- MIS doing the building, the user doing the using. Finally, Gibson (1982) calls this strategy "Traditional," calling to mind its venerable position in many procedure manuals.

The second most frequently cited strategy calls for a shift of more project responsibilities to the user, so that MIS and the user become jointly responsible for project outcomes. McLean (1979) and Gibson (1982) both call this strategy "Cooperative," emphasizing the sharing of technical and management responsibilities. The Decision Support system literature (e.g., Keen and Scott Morton, 1978) recommends prototyping (to facilitate user participation in technical design) and decision process studies (to facilitate MIS participation in functional design). McFarlan (1980) cites the need for "external integration," a binding process between MIS and the user, to support this strategy.

With the growth of distributed computing there has been discussion of an informally organized "user managed" strategy. Here the user performs the entire project effort, including the tasks usually carried out by MIS (McLean, 1979; Hammond, 1982). MIS may offer technical guidance, but it has no responsibility for the outcome of the "user's project." Functional control -- getting the business task done -- replaces control through specifications and budgets.

Strategies without users are described, too. Gibson (1982) outlines an "authoritative" strategy, and Alter (1978) a "Forced Upon" strategy, in which user review and approval is omitted. In Alter's "Sold To" strategy, MIS takes the initiative in building the system, much as a software manufacturer would.

The Contingency Dimensions. On what basis is it suggested that one choose among these strategies? The most common themes center around application and user characteristics. In the application camp, McLean (1979) says that one should choose among strategies depending on whether the application being developed is transaction-based or in support of management decision making. McFarlan (1980) similarly believes that application characteristics are central to strategy selection, citing size of the project, the degree of structure to the problem, and the technology to be employed. Problem complexity (Hammond, 1982) is another application characteristic that receives attention. Gibson (1982) and Alter (1978), on the other hand, put their emphasis on user characteristics, citing user participation, user commitment, the degree of change to the user organization required by the new system, and time pressure to complete.

So, while there is agreement among some theorists that the key to choosing among strategies is attention to application characteristics, others focus exclusively on user characteristics instead. Overall, this literature provides only a set of untested, one-factor-at-a-time, directional propositions. We do not have a comprehensive rationale for the selection of any particular strategy, and the list of potential strategies seems endless.

The Problem

The problem, it is argued here, is not so much that the literature is incorrect or contradictory, but rather that it lacks a unifying theoretical basis. Most of its suggestions were developed by induction, from keen and insightful observation of the MIS scene. Its arguments reflect realities faced by MIS managers. But, being grounded in observation rather than theory, this literature is not likely to suggest strategies which have not been used. Further, without a theoretical concept of how strategies and contingencies relate to each other, it cannot tell us precisely on what the choice of strategy depends.

What is needed is a theory which (1) explains the relationship between strategies and contingencies, (2) identifies the contingencies on which the choice of strategy is based, and (3) distinguishes clearly among the strategies. The theory should explain why we have observed what we have observed about MIS project management strategy in the past, it should make useful predictions for future MIS projects, and it should lead to the development of testable hypotheses.

This paper proposes that the Transaction Cost perspective (e.g., Williamson, 1975; Ouchi, 1980; Williamson and Ouchi, 1981) provides a start toward such a theory.

THE TRANSACTION COST PERSPECTIVE

The transaction cost perspective focuses on organizations as they engage in economic exchanges or transactions. For example, an MIS project may be viewed as a transaction between MIS and a user, where resources, information, and software are exchanged. This perspective holds that the preferred strategy for managing a transaction is that which minimizes the sum of production costs and transaction costs. "Transaction costs" are costs over and above the costs of production necessary to make the exchange: in particular, the costs of negotiating contracts; and of hiring, training, and assigning employees. As MIS project managers are well aware, these costs can drastically increase the cost of developing a system.

Coase (1937) was the first to argue that transaction costs affected firm behavior. Williamson (1975) combined Coase's basic framework with literature from economics and organization theory to show that certain transaction characteristics would cause markets to fail and be replaced by hierarchies. Ouchi (1980) extended Williamson's work, arguing that some transactions are best governed by clans.

According to Williamson and Ouchi (1981), the choice of strategy for exchanging goods and services is determined by (1) the amount of uncertainty in the transaction, (2) the frequency of the transaction, and (3) the amount of transaction-specific investment which must be made to produce the good or service. Typically, MIS projects have varying amounts of uncertainty, frequency (duration or size of the project), and transaction-specific investment (mostly in the two-way exchange of skills between user and analyst).

Williamson (1975) argues that the reason uncertainty and frequency are problematic for organizations is that they increase the vulnerability of the organization to two human weaknesses -- bounded rationality and self-interest or opportunism. That is, the more uncertain the transaction, the more likely that bounded rationality will preclude the achievement of fairness; and the more frequently (or, for MIS projects, the longer the period of time over which) an uncertain transaction is carried out, the more opportunities there will be for one party to establish an unfair advantage over the other. Williamson says that the combination of task uncertainty and the potential for opportunism leads to "information impactedness." Information may be "impacted" either because information is not willingly shared or because information is lacking. Moreover, either difficulty is theorized to increase the other. When uncertainty is great, opportunism is more easily disguised; when dependence is great, strategic behavior is more likely, which, if unpredictable, increases uncertainty.

The transaction cost perspective holds that as information impactedness increases, more elaborate strategies are required to establish, monitor, and control the transaction. The market strategy is considered the least elaborate, and the clan strategy, the most elaborate.

<u>In a market</u> transactions are mediated by prices (frequently attached to external contracts). The presence of a competitive market reduces opportunities for establishing an advantageous position and thereby reassures both parties that the terms of exchange are fair. A market transaction is controlled by monitoring compliance with the contract and by competitive pressures. <u>In a bureaucracy</u> transactions are mediated as much as possible by rules and procedures, and then by referral through the legitimate authority of a hierarchy. An employment contract controls, to some extent, the exercise of self-interest. The employment contract further permits transactions to be controlled through explicit auditing. <u>In a clan</u> transactions are mediated primarily by traditions, and also by referral to traditional authority. Common values and beliefs minimize opportunistic behavior. Transactions are controlled by achieving a union of objectives (Ouchi, 1980).

More elaborate strategies, while more powerful, are more costly to establish and maintain. Furthermore, the increased interdependence of the more elaborate strategies may create congestion, and the absence of explicit controls may make subgoal pursuits difficult to detect and control. To minimize transaction costs, strategy must be matched to the amount of information impactedness in the transaction.

The following section presents the basic concepts of the Transaction Cost perspective -- information impactedness; the market, bureaucracy, and clan strategies; and the relationship between these two -- in MIS terms, as a model for selecting strategies.

A TRANSACTION COST MODEL FOR MIS PROJECT MANAGEMENT

The model for choosing MIS project management strategies proposed here arranges three project strategies (a market-type, a bureaucracy-type, and a clan-type) along a dimension called "Uncertainty," which captures the essence of information impactedness. The market-type and bureaucracy-type strategies have been renamed. In the case of the market-type strategy, the name "Arms-length" is chosen to embrace both internal and external market strategies, where prices are used to guide decision making, but real competition may or may not exist to help govern transactions. For the bureaucracy-type strategy the name "Matrix" serves to remind that straight hierarchical control is not typical for MIS projects.

The model is summarized in Figure 1.

Uncertainty

The dimension along which the strategies are arranged is labeled "Uncertainty" because that is its most common name in the MIS literature. Like information impactedness, this dimension embraces both uncertainty due to an absence of information and uncertainty due to an inability to eliminate strategic behavior (called "dependence" above).

Typical sources of the first type of uncertainty are the project objectives (e.g., their complexity, lack of structure, or instability) and the technology to be applied (e.g., its newness to the organization or the industry). From the transaction cost perspective, the key issue is project idiosyncracies, or the degree to which learning is required which will be useful only in the context of the current project. That is, requiring users to master an esoteric systems analysis technique increases uncertainty more than requiring them to learn a skill which they can see will have long term relevance to their careers.

The most common sources of uncertainty due to strategic behavior are the parties to the transaction: users, MIS management, upper management, and so forth. For MIS projects, strategic behavior seems most likely when there is lack of commitment to project goals or resistance to changes in policy, workflow, organization culture, etc.

Larger, longer projects are potentially more uncertain due to both types of uncertainty, as they provide more opportunities for complexities and strategic behavior to interact.

If the uncertainty a project faces is:	Low	Medium	High
The preferred project management strategy is:	Arms-length (Market-type)	Matrix (Bureaucracy-type)	Clan (Clan-type)

Figure 1. A Transaction Cost Model for MIS Project Management Strategy Selection

In summary, a project would have low uncertainty if, for example, the project requirements were clear, the technology to be applied was familiar, and the user was supportive of the project. A moderately uncertain project might be one which required project-specific learning or substantial organizational changes. And, a large project requiring extensive project-specific learning and with weak user support would likely have high uncertainty.

The Strategies

Table 1 summarizes the strategies.

<u>The Arms-length Strategy</u>. The market-type strategy in the model is called the Arms-length strategy to emphasize the two-party, arm's length nature of the relationship which results from its use. A formal specification and its associated price-tag act as a buffer between MIS and the user. Cost estimates are used to guide decisions. Explicit, formal control methods predominate, with emphasis on fulfillment of the specification. Project budgets track MIS-controlled costs only; users may or may not track their related costs, but at any length, the two sets of cost figures are not combined. Projects are managed and controlled by MIS. Team members are from MIS; they have career paths that are controlled by and limited to MIS. When this strategy is used by an MIS group and a user within one organization (an internal market situation) decisions are seldom referred up the hierarchy, either because the referral path is unclear, or because the higher authority lacks relevant expertise.

<u>The Clan Strategy</u>. The clan-type strategy is called the Clan strategy to emphasize its most important aspect -- the traditions or common world-view

Table 1. The Three Strategies Summarized

CHARACTERISTIC	ARMS-LENGTH	MATRIX	CLAN
Project plans prepared by	MIS	MIS and User	User
Funds allocation	Based on cost estimates	Bureaucratically administered	User discretion
Projects directed by	MIS	MIS and User	User
Projects staffed by	MIS	MIS and User	User
Projects located in	MIS	MIS area (technical phases)/User area (other phases)	User area
Decisions based on	Prices	Rules	Shared values and beliefs
Projects controlled	Explicitly, formally	Formally/informally	Implicitly, informally
Projects evaluated on	Time and budget performance to specification	Use	User satisfaction
Evaluation time horizon	Short run	Medium run	Long run

which make implicit control possible. A key aspect of this strategy is its one-party rather than two-party nature. The relative lack of differentiation between technical and functional roles is seen in the common skills, world-views and language of the team members. Shared understanding of the environment and the job to be performed permits control to be implicit and informal. Decisions are made based on knowledge of the business requirements. In contrast to the Arms-length strategy, the Clan has a hierarchy to which decisions can be referred. Projects are managed and controlled by the user, although outside expertise may be used in a consulting mode.

The Matrix Strategy. The bureaucracy-type strategy is called the Matrix strategy to emphasize the dual control that is characteristic of this strategy. Like the Arms-length strategy, the Matrix strategy requires formal planning and control. Like the Clan strategy, the Matrix strategy has a hierarchy in which referral can work, but unlike the Clan strategy the Matrix strategy does not have a common world-view on which to build implicit control. Instead, control is both formal, through a specification review and approval process or prototyping process, and informal, through extensive training and socialization carried out in both MIS and user groups. Decisions are made with consideration given to both project cost estimates and an understanding of the functional requirements of the system. Projects are managed by both the user and MIS, using dual reporting relationships and accounting systems. The most crucial ingredients of the Matrix strategy are those which bridge the gap between MIS and the user.

The Relationship Between Uncertainty and Strategy

According to the model, using a project management strategy suited to the level of uncertainty a project faces permits the project to reach their goals with a minimum of transaction costs. That is, the project achieves a combination of effectiveness and efficiency, of goal accomplishment and transaction cost minimization. Together these result in user satisfaction, the most common criterion of good MIS project performance. Completion of projects on time and within budget is generally believed to enhance user satisfaction, as are low operating costs and ease of use. On the other hand, the impression that costs were excessive is considered to result from using an overly elaborate strategy, and project failure or uncontrolled pursuit of subgoals, from using an inadequate strategy.

THE CONTINGENCY RECOMMENDATIONS RECONSIDERED

In this section we compare the model and the contingency recommendations for MIS project management reviewed earlier (see Table 2). We ask: can the strategies suggested in this literature be classified as Arms-length, Matrix, or Clan? Are the strategies so classified recommended for circumstances likely to be of low, moderate, and high uncertainty, respectively, as the model suggests?

The Adversary, Formal Planning and Control, Built For, Sold To, and Traditional Strategies are seen to be Arms-length strategies. MIS and user roles are distinctly defined, with the specification (or its equivalent) acting as a buffer between the two. Explicit, formal controls are a key characteristic of this strategy for every author.

This strategy type is universally recommended for situations our model would classify as low uncertainty: structured problems, known technology, high user commitment, few organ-

Table 2. Recent Contingency Recommendations for Project Management

STRATEGIES	RELEVANT CONTINGENCIES
<u>Arms-length Strategies</u>	
Adversary (McLean, 1979)	Transaction-based systems
Formal Planning and Control (McFarlan, 1980)	Highly structured systems, difficulties limited to the technology area
Built For, Sold To (Alter, 1978)	Users committed to the project few organizational changes anticipated
Traditional (Gibson, 1982)	
<u>Matrix Strategies</u>	
Cooperative (McLean, 1979)	Systems in support of management
Cooperative (Gibson, 1982)	Lack of user commitment, large organizational changes anticipated
External Integration (McFarlan, 1980)	Unstructured systems, large projects
Decision Support Systems (Keen and Scott Morton, 1978)	Unstructured systems
<u>Clan Strategies</u>	
End-user programming (McLean, 1980)	Straightforward applications
User-managed projects (Hammond, 1982)	Low complexity situations, small projects
<u>Other Strategies</u>	
Authoritative (Gibson, 1982)	Time pressure to complete
Forced Upon (Alter, 1978)	Uncooperative user

izational changes. In other words, both the model and the MIS literature view the Arms-length strategy as the most effective one for low uncertainty situations.

The "Cooperative" strategy and the other strategies which mix responsibilities are most like the Matrix strategy. Dual control is cited by all authors, although the particular distribution of roles varies somewhat. In particular, the project director role may be assigned to MIS or to the user. But, overall, the user's increased responsibility for project outcomes is clear. A requirements specification of some type is usually recommended, frequently in the form of a prototype system. Technical literacy, for the user, and an understanding of the decision or business function to be supported, for MIS, are considered prerequisites for this strategy.

This strategy is recommended in the MIS literature for situations which our model would classify as moderate or high uncertainty: lack of structure, lack of user commitment, large changes to the user organization. In contrast to our model, the MIS literature does not always limit the purported effectiveness of this strategy to situations of moderate uncertainty. However, the MIS literature does recognize that some projects are too uncertain to be doable under any (known) strategy, and this could be taken to be an implicit limitation to the potential effectiveness of this strategy. In summary, the MIS literature and the model agree in recommending the Matrix strategy for situations of moderate uncertainty. They tend to disagree as uncertainty becomes high, with the MIS literature seeming to recommend the Matrix strategy where the model would recommend the Clan strategy.

The most striking difference between the model and the literature is with respect to the user-managed strategies. These strategies are most like a Clan strategy; with MIS out of the picture, there exists sufficient "shared values and objectives" to support implicit control. But rather than being a strategy which is considered to be effective for high uncertainty projects, the MIS literature regards this strategy as a way of off-loading simple, relatively certain projects (report generation and inquiries, for example). The model would suggest that a Clan strategy would have a much more valuable potential in unstructured, complex, politically charged situations. While this discrepancy is potentially researchable, we note here that the absence of a link between the Clan strategy and high uncertainty in the MIS literature may stem from a narrow view of the MIS department as the legitimate interpreter of technology for the user.

There are a few strategies recommended which we have not categorized as either Arms-length, Matrix, or Clan strategies. For example, there are two strategies in which the user does not participate in the project ("Authoritative," in Gibson, 1982; "Forced Upon," in Alter, 1978). Gibson recommends this strategy when time pressure to complete is great, and Alter notes that it is used when the user is uncooperative. In both cases it seems that there is no transaction between MIS and the non-participating user. lacking an underlying transaction, we cannot categorize these strategies in terms of the model.

In summary, the MIS literature and the model seem to be in agreement on the use of an Arms-length strategy in situations of low uncertainty and the use of a Matrix strategy in situations of moderate uncertainty. Only the high uncertainty case seems to be subject to different expectations in the MIS literature and the model proposed here.

The transaction cost model proposed here seems to provide a useful organizing principle for current thinking on MIS project management. It explains the link between strategies and project characteristics. It says that successful completion of a project requires the use of a strategy which is elaborate enough to insure that the project goals will be reached, but not so excessively elaborate as to incur unnecessary transaction costs.

But this has been static view of the proposed model. In the next section we will investigate its potential for dynamic analysis.

THE TRANSACTION COST MODEL AND THE STAGE HYPOTHESIS

In this section we look at how the model can inform our understanding of how project management strategies changed during the late 1960s and early 1970s, as described in Nolan's Stage Hypothesis papers (Nolan, 1973; Gibson and Nolan, 1974; Nolan, 1979). Analysis of organizational change has been a central issue in the transaction cost literature, notably in Williamson's analysis of markets "failing" (that is, changing) into hierarchies (Williamson, 1975). In general the notion is that changes in the level of information impactedness will be accompanied by changes in strategy, if the level of success is to remain the same.

In this tradition we will use the model to take a somewhat speculative, but, we hope, interesting look at the changes in MIS project management strategies implied by the first four stages in Nolan's Stage Hypothesis. The fundamental working assumption is that Nolan's description of what transpired in the typical MIS organization is correct. Support for this assumption may be found in the warm reception Nolan's articles received from many practitioners.

We will review Nolan's original four stages, asking at each stage: What level of uncertainty prevailed? What strategy was used? What level of success was experienced? (Table 3 summarizes the results.) Descriptive material from the Nolan (1973, 1979) and Gibson and Nolan (1974) articles on the Stage Hypothesis will be used to develop evaluations of uncertainty, strategy, and performance typical for each stage. Uncertainty estimates will be based on the portfolio objectives, the technological environment, and the user's attitudes. Key characteristics of the strategies are: for Arms-length, the presence of formal controls based on written specifications; for Matrix, dual control by MIS and the user, supported by written documentation and cross-socialization; and for Clan, the use of informal, implicit controls, based on common values and world views. Performance will be inferred primarily from evidence of user satisfaction. Project failure, uncontrolled pursuit of subgoals, and excessive project costs will be considered indications of poor performance.

Stage I: The Early Clan Years. In the early 1960s many companies began to

Table 3. Project Management and Nolan's First Four Stages

STAGE	WHAT LEVEL OF UNCERTAINTY?	WHAT STRATEGY?	WHAT LEVEL OF SUCCESS?
Stage I	High	Clan	Good
Stage II	Moderate/Low	Clan	Poor
Stage III (early)	Low	Market	Good
Stage III (late)	Moderate	Market	Poor
Stage IV	Moderate	Matrix	Good

use computers to increase the efficiency of those business functions which processed large amounts of data. As there was no computer department yet, these projects were carried out by members of the user department. The uncertainty of these early projects was typically very high: project goals were undocumented, the technical environment was totally new, and the organizational changes that accompanied the first systems were monumental.

The Initiation stage project management strategy was most like a clan strategy. Gibson and Nolan say that during this period project controls were "notably lacking" (1974, p.79), but, in a detailed case study, Mann and Williams (1960) demonstrate that control was simply implicit and informal, relying mostly on the goodwill of the employees and their commitment to and understanding of organization goals.

What level of success was experienced? Overall, these early projects were remarkably successful. The evidence for this is primarily in the flurry of demand for additional automation that followed. Despite the disruptive impact of computing, "the managerial tendency is commitment to computing" (Nolan, 1973, p. 402).

In summary, the experience of Stage I, Initiation, conforms to the predictions of the model: a situation of high uncertainty is successfully managed using a clan strategy.

<u>Stage II: Uncontrolled Growth</u>. The demand for computing soared. A computer department was formed, kicking off what Nolan calls Stage II, Contagion. During this stage the uncertainty of the projects declined. On the second or third accounting application, for example, data control and user interface features could be duplicated from system to system. The introduction of COBOL made programs easier to write and debug. User committment was insured by the prospects of "impressive cost savings in clerical areas" (Nolan, 1973, p. 403).

Despite the shift of locus to the computer department, projects continued to use a Clan strategy. Nolan says "the need for emphasis on planning tasks is still not recognized" (1973, p. 403). Project management is characterized as implicit, informal, unplanned, even "more lax" than Stage I (Nolan, 1979, p.117).

With a mismatch of clan strategy and moderate or low uncertainty the model predicts poor performance due to excessive costs and undetected pursuit of subgoals. Ultimately, those were the complaints levied against Stage II. Around 1970 (coinciding with a downturn in the economy) many organizations abruptly and restrospectively "discovered" that MIS budgets had been increasing exponentially for several years. Their new systems were suddenly too expensive. The problem of subgoal pursuit arose as more and more project decisions were made in the new computer department. According to Gibson and Nolan, project selection during this stage exhibited "a preference for those projects which offer the greatest professional challenge" (1974, p. 81).

In summary, during Stage II the uncertainty of the projects declined, but the strategy being used did not adapt, resulting in the perception that costs had been excessive and that the MIS staff could not be relied on to pursue organization goals without guidance.

<u>Early Stage III: Using the Arms-length Strategy</u>. The organization reacted in Stage III by changing to an Arms-length strategy. Key to the new approach was the use of specifications, which the user would review and approve. Specifications and change con-

trol procedures made it theoretically possible to fix responsibility for project outcomes. The project team, staffed and directed by MIS, was expected to fulfill the specification, on time and within budget. User participation in the project was restricted to activities that were separately budgeted and controlled.

While the project slate of Stage II may have had a mix of moderate and low uncertainty projects, the projects undertaken in the early parts of Stage III were of low uncertainty. The specification process itself tended to eliminate projects which could not be reduced to documentation. Moratoriums on MIS budget increases slowed the introduction of new technology and reduced the user community to only the most highly commited.

As the model predicts, using the Arms-length strategy in this low uncertainty situation ended the crisis atmosphere under which Stage III started. Confidence was restored.

Late Stage III: The Perils of Success. With increasing confidence, users began tackling "revenue-producing and decision-making projects" (Gibson and Nolan, 1974, p. 84). These projects are generally considered much less amenable to specification (Gorry and Scott Morton, 1971), and the swelling network of systems drew in uncommitted, even hostile, users. At the same time, the technological environment expanded to include online processing and database systems. In sum, the uncertainty of the typical project increased markedly.

The Arms-length strategy, however, continued in force. As the model would predict, problems arose. Desirable projects did not get off the ground; they were smothered in specification re-writes or over-simplified to the point of impotence. The result is "underutilization of the potential of the resource" (Gibson and Nolan, 1974, p. 84).

Stage IV: Matrix for Maturity. Attention turned to the project management strategy. Suddenly, what had seemed to be the ideal strategy was seen as "inappropriately strong controls" (Gibson and Nolan, 1974, p.84), an "overreaction" (Nolan, 1973, p. 403). The solution was to change the project management strategy to accommodate additional uncertainty. The Stage IV project control strategy described by Nolan is a Matrix strategy. Control is loosened, but not eliminated. Systems analysts are decentralized to the user, increasing the analysts' identification with user goals. Chargeback and other project coordination tools are modified to permit the technically competent user to participate as an equal partner in control of projects.

According to the model, changing to a Matrix strategy should solve the underutilization problem. In fact, Nolan says that users "perceive real value" in Stage IV applications. Their enthusiasm, in fact, "creates DP expenditure growth rates that may be reminiscent of those in stage 2," a sure sign of success (Nolan, 1979, p. 120).

Conclusions About the Stage Hypothesis. It appears that the model proposed here offers a different logic for the changes in MIS project management strategies observed by Nolan. Whereas the Nolan explanation for these events implies an inevitable, fixed sequence of successes and failures before full success ("Maturity") is possible, the model proposed here says simply that success and failure are related to the matching of project strategy and uncertainty. It is possible that only failure could motivate the adaptations that Nolan observed. But perhaps the sequence of adaptations could have been different, or could be different for today's MIS organizations.

CONCLUSION

In this brief review we have seen that a transaction cost-based model offers a new explanation for the observations typically associated with the Stage Hypothesis and is in general agreement with the most recent recommendations made for MIS project management. The model appears to provide a theoretical basis for understanding the MIS project management experience, whether viewed through history or through the observations of current MIS practice.

Implications for Research. That the model can offer some explanations for observations made by MIS theorists does not, however, constitute strong evidence of the validity of the model. Empirical validation is needed. Unfortunately, reliable, validated measures of MIS project performance and uncertainty do not exist, much less reliable, validated methods of distinguishing among strategies.

While measurement of the performance of MIS projects receives considerable attention in the MIS literature (see, for example, King and Rodriguez, 1978), considerations of the issue of measuring uncertainty are few. McFarlan (1980) suggests a scale for measuring project risk which co-mingles elements of the uncertainty a project faces with attributes of the strategies selected to deal with that uncertainty. Such a scale may be useful for practitioners who wish to assess their residual risk, but it is unsuitable here.

A more intriguing task might be to determine whether or not the three project management strategies hypothesized here are used in today's MIS organizations. Presumably, organizations can be expected to behave optimally over the long term. Hence, we would expect to find, if the hypothesis of this paper is correct, that as MIS organizations attempted projects of varying uncertainty they would eventually discover and retain the three project management forms described here. That this occurs is repeatedly inferred in the contingency literature reviewed in this paper. Attempts to confirm that the three forms occur naturally in MIS organizations may be clouded by the as yet relatively short life span of the typical MIS organization (that is, behaviors may not have elaborated and stabilized around the optimal) and by the myth surrounding the Arms-length strategy. The idea that an Arms-length strategy is required for MIS projects is very strong among MIS practitioners and may mask the presence of other strategies. Despite these difficulties, an attempt to establish that the three strategies exist and can be identified seems the most worthwhile first step toward the validation of the model proposed here.

Implications for Policy. In the future, as MIS expertise becomes more pervasive, and as the technology becomes more accessible, we can expect to see more situations in which a Clan strategy can be viably applied. For example, with increased computer awareness, users may be able to complete the initial phase of a project on their own, choosing among a multiplicity of incompatible features and arriving at completion criteria, things which almost no one can really do for them. An important caveat is in order, however: whenever a project team needs outside expertise to be responsible for results, or when it needs formal controls for any reason, the Clan strategy is not appropriate.

The model also suggests that MIS should take every opportunity to reduce uncertainty enough so that the Arms-length strategy can be used, either by purchasing software, by turning programming phases over to a (frequently less expensive) software services company, or simply reducing the scope of a project. But the caveat here is that when we do this we must be absolutely sure that we have considered all the sources of uncertainty, particularly those related to organizational change and the subtle effects of self-interest.

Because of the caveats on the use of the Clan and the Arms-length strategies -- the need to be sure one has a Clan on the one hand, and the need to be sure one has low uncertainty on the other -- it appears that, given imperfect knowledge, the Matrix strategy might be our most cost effective choice. There are risks: if uncertainty is actually low, the project is likely to cost more than it would have with the Arms-length strategy; if uncertainty is actually high, the project may falter. In any case, we need to improve our abilities to use the Matrix strategy. We need to clarify the distinction between the Arms-length strategy and the Matrix strategy. And, we need to treat the elements of the Matrix strategy as acceptable organization behaviors and structures, not just part of some successful project manager's personal style. With computer awareness expanding at an exponential rate, users are increasingly capable of sharing technical responsibilities. Our job is to learn how to share that responsibility with them.

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