Transaction attributes and software outsourcing success: an empirical investigation of transaction cost theory

Eric T. G. Wang

Department of Information Management, School of Management, National Central University, Chung-Li, Taiwan 320, Republic of China, email: ewang@im.mgt.ncu.edu.tw

Abstract. *In recent years, an increasing amount of attention has been paid to information systems (IS) outsourcing by practitioners as well as academics. However, our understanding of the factors that affect outsourcing success is hardly complete. By adopting transaction cost theory (TCT) as the theoretical foundation, this study analyses the implications of transaction attributes on the consequences of customized software outsourcing practice. The research model includes three exogenous variables (contractor reputation, asset specificity and uncertainty) and two endogenous variables (post-contractual opportunism and outsourcing success). The moderating effects of asset specificity on the relationships between uncertainty and the endogenous variables are also examined. Based on data collected in Taiwan, a research model is constructed to test the hypotheses derived from the theory. The empirical evidence is generally supportive of the theory but with some important exceptions. In particular, contractor reputation and uncertainty have the predicted effects on the contractor's post-contractual opportunism perceived by the client and outsourcing success, but asset specificity shows a negative effect on post-contractual opportunism and a positive effect on outsourcing success, which are opposite to the typical predictions of TCT. Thus, in addition to the supportive findings of the theory, this study also raises an important research question regarding the effects of asset specificity on outsourcing for future research to explore.*

Keywords: Outsourcing, software, transaction cost theory, reputation, moderator

INTRODUCTION

As the expanding range of IS applications has led to mounting levels of IS expenditure, there have also been parallel pressures towards a realignment in the roles of in-house IS functions and outside vendors (Scarbrough, 1995). This gives rise to many important management issues that need to be addressed by IS managers and researchers. Although IS outsourcing

is not new, it has become a major IS phenomenon and has been recognized as an important means of managing IS, as evidenced by increasing large-scale outsourcing deals covered by the trade press. The importance of IS outsourcing management is also suggested by a recent survey showing that the management of outside services is one of the six strategic management issues confronting organizations in their management of corporate systems (Clark, 1992). Regardless of whether the trend towards outsourcing is significantly affected by the so-called 'Kodak effect' (Loh & Venkatraman, 1992) or by other influence sources (Hu *et al.*, 1997), IS outsourcing is here to stay and continues to grow rapidly (Rao *et al.*, 1996). Consequently, an increasing amount of attention has been paid to IS outsourcing by practitioners as well as academics.

Conventionally, it was suggested that non-strategic IS functions could be outsourced while strategic IS functions should be kept in-house. However, outsourcing practices have been constantly evolving – not only have the scale and scope of outsourcing become greater, but the nature of the relationship between the client and the vendor is also changing (Grover *et al.*, 1996). As clients gain confidence that vendors can manage strategic applications effectively, the strategies and options that managers can pursue are becoming more diverse and varied, resulting in increasing strategic IS functions being handled by external vendors (Gurbaxani, 1996). Among the wide range of IS functions being outsourced, applications development is the function that is most likely to require firm-specific knowledge for ensuring adequate performance. While much technical knowledge has been progressively transformed into discretely marketable commodities, such as software packages, customized software systems still remain in great demand for accommodating firms' varied, idiosyncratic requirements. Even though applications development usually requires firm-specific knowledge and software systems are expected to show growing impact on a firm's ability to gain competitive edge, software development is nonetheless one of the most outsourced IS functions (Patane & Jurison, 1994; Collins & Millen, 1995).

To better understand the factors affecting the outcomes of customized software outsourcing, transaction cost theory (TCT) (Williamson, 1985a) is adopted in this study. TCT is probably the most widely applied theory for analysing IS outsourcing, ranging from conceptual to analytical and empirical studies (Gurbaxani & Whang, 1991; Lacity & Hirschheim, 1993; Loh, 1994; Alpar & Saharia, 1995; Cheon *et al.*, 1995; Jurison, 1995; Grover *et al.*, 1996; Nam *et al.,* 1996; Currie & Willcocks, 1998; Ngwenyama & Bryson, 1999). Based on TCT, this study empirically investigates the effects of transaction attributes on the contractor's post-contractual opportunism perceived by the client and the success of customized software outsourcing. Unlike most of the previous studies, which use the theory primarily to analyse the paradigmatic 'make-or-buy' decision or some other measures of governance structures, such as contract forms, this research focuses only on outsourcing cases and not on comparing institutional efficiency. The bases for taking such an unconventional approach will be explained in detail in the next section. Generally speaking, this approach can be considered as both a response to the limitations of TCT raised by many researchers and an extended application of the theory. Overall, the empirical evidence is generally supportive of the research model proposed in this study. Thus, one of the contributions of the research is to theoretically extend

the use of TCT beyond its paradigmatic research questions and to provide empirical evidence for use in analysing outsourcing phenomena. Even though the data were collected in Taiwan, the model and the findings of this study should offer researchers additional theoretical bases for analysing outsourcing phenomena, as well as providing contractual parties with new insights into the factors that are likely to affect their contractual relationship and the success of outsourcing projects.

The plan of the article is as follows. The next section provides the general background of the study, including the theoretical basis, a justification of the application of TCT and a brief literature review. The third section discusses the research variables, the fourth sections derives the research hypotheses and the fifth section describes the research method. Data analysis and a discussion of the findings are provided in the sixth section. Finally, the last section contains some concluding remarks.

GENERAL BACKGROUND

Transaction cost analysis and software outsourcing

The transaction cost theory, pioneered by Coase (1937) and developed principally by Williamson (1975,1985a,1996a), posits that there are costs in using a market. These costs include operational costs (e.g. search costs) and contractual costs (e.g. costs of writing, monitoring and enforcing a contract) (Gurbaxani & Whang, 1991). Although the organization of economic activities depends on balancing production economics against the costs of transacting, the paradigmatic question of the theory is the 'make-or-buy' decision, in which economizing of transaction cost is central (Williamson, 1985b).

The theory is set forth by two behavioural assumptions: *bounded rationality* and *opportunism*. Following Simon's (1961) notion of bounded rationality, the economic actors are '*intendedly* rational, but only *limited* so.' [As argued by Chiles & McMackin (1996), risk neutrality should be the third assumption of TCT, but it has been largely ignored in studies based on TCT]. When rationality is bounded, the economic actors will experience uncertainty from various sources in transacting, and complex contracts are therefore necessarily incomplete to one degree or another, thus encouraging the study of institutions (Williamson, 1989). Opportunism is concerned with the economic actors' self-interest-seeking tendency, which makes allowances for guile. Because complex contracts are costly to refine, and thus necessarily incomplete, opportunism sets the stage for ex-post performance problems by adding behavioural uncertainty to contractual relationships. Thus, when paired with bounded rationality, opportunism further complicates problems of organization by compounding the sources of uncertainty. With these two behavioural assumptions, the problem of economic organization then is to '[o]rganize transactions so as to economize on bounded rationality while simultaneously safeguarding them against the hazards of opportunism' (Williamson, 1985b: 177). Thus, using a transaction as the unit of analysis, TCT regards firms, markets and mixed modes as alternative means of organization and views the allocation of economic activity among

them as a decision variable (Williamson, 1985b). Because transactions with different attributes can have different transaction cost consequences, TCT maintains that transactions with certain attributes can be administrated relatively more efficiently (i.e. incurring lower transaction costs) by the organization, thus helping to explain the existence of the firm.

In describing transactions, TCT relies on three key dimensions: the condition of asset specificity required to support the transaction; the degree and type of uncertainty surrounding the transaction; and the frequency of the transaction. Although all three dimensions are important, asset specificity is considered particularly critical for deriving refutable implications because of its potential heavy impact on the choice of governance structures (Riordan & Williamson, 1985; Williamson, 1989).

Asset specificity refers to 'the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value' (Williamson, 1989: 142). Thus, when a transaction requires important specific investment, it then requires a mechanism to protect the investor. In software outsourcing, specific investments may be the human capital required from both contractual parties. Such investments may have little or no value if the contract terminates prematurely, and are therefore considered to be the main potential sources of post-contractual hold-up.

Uncertainty is the second principal factor that can impact the choice of governance structures. Like asset specificity, uncertainty can come in various forms. One form highlighted by Williamson (1979) is parametric or environmental uncertainty, which complicates writing and enforcing contingency claims contracts. When unforeseen contingencies arise, market mode experiences strain in adapting to the changed environment because contract renegotiating leads to delay, and opportunistically behaving parties may also try to interpret unspecified clauses to their own advantage (Anderson & Schmittlein, 1984; John & Weitz, 1988). Given contracts that are at best incomplete, opportunistic inclinations of the transacting parties tend to compound the sources of uncertainty, thus causing the difficulties of ascertaining adherence to contractual agreements and of evaluating performance. This form of uncertainty is referred to as behavioural uncertainty and is reflected in post-contractual opportunism of the contracting parties.

In the context of software outsourcing, even though the contract typically specifies the contractor's responsibilities, the system's completion date, the cost and the client's responsibilities, these are likely to become disputable as unforeseen contingencies unfold. Typically, a customized software system cannot be acquired by simply announcing performance and design requirements to the contractor. Not only are the specifications often unknown ex ante, but design changes can also occur during the system development process (Richmond *et al.*, 1992). Opportunistic parties may then take such uncertainties to their own advantage during contract negotiation and execution, thus again giving rise to behavioural uncertainty or ex-post opportunism.

The last dimension for describing transactions in transaction cost theory is *frequency*. In the case of rarely occurring transactions it would not pay for the firm to establish a specialized governance mechanism as such a mechanism involves significant set-up and maintenance costs, and these costs are likely to be higher than the potential losses from opportunism and

inflexibility (Anderson & Schmittlein, 1984). As customized software projects vary in complexity and area of application, each one may well be considered as a distinct, one-time event. Although software development processes can also be conceptualized as involving on-going, interrelated transactions (Richmond *et al.*, 1992), they are nonetheless governed by a single contract at the project level. Because this study focuses on customized software outsourcing projects, the frequency dimension is excluded from the study without losing much theoretical completeness.

In addition to the three basic dimensions of transactions, transactor reputation has often been related to the transaction cost reasoning because of its ability to limit opportunism and to assure contractual performance (Klein & Leffler, 1981; Joskow, 1985; Klein, 1988). As Coase (1991: 71) has pointed out, 'the propensity for opportunism behavior is usually effectively checked by the need to take account of the effect of the firm's actions on future business.' It has been argued, however, that transactor reputations are limited, especially when the transactors lack a long-term business relationship (Dasgupta, 1988; Williamson, 1993a). Even though customized software projects can be treated as one-time events, as argued above, the contractor still needs to consider the effects of its actions on losing future business from either this client or other clients. That is, reputation can be considered as a form of irreversible investment, which is built over time, often at great cost. When damage is done to a contractor's reputation, the salvage of such investment will be very limited. So, the potential cost of opportunistic behaviour may limit the economic feasibility of hold-up threats and encourage specific investments. Consequently, transactor reputation is also included in this study.

Justification of research approach

According to the transaction cost reasoning, the constructs reviewed above should to some extent affect transaction costs. However, because of the difficulties of observing and measuring transaction costs, empirical validation of the theory typically has to rely on estimations of reduced-form relationships between observed transaction attributes and governance structures, i.e. a comparative institutional analysis (Masten *et al.*, 1991). In other words, organization variety is explained by the fact that transactions differ in their attributes, which means that their governance needs vary (Williamson, 1985b). As this study focuses on software outsourcing – the market governance – the governance structure is not explained here. Even though contract terms may to some extent be used to assure contractual performance, their effects are nonetheless limited for complex contracts. Thus, by focusing only on outsourcing cases, this study examines the effects of transaction attributes on the contractor's postcontractual opportunism perceived by the client and on outsourcing success. This approach deviates from the traditional transaction cost analysis, which typically seeks to explain governance choices (i.e. first-order economizing), and thus needs some justification.

This approach was taken because there are several problems associated with transaction cost theory when applied to institutional comparative analysis. First, to be understood as an explanation for the existence of the firm, transaction cost theory must face the problem of dis-

equilibrium (Langlois, 1985). As argued by Masten (1993), observed decisions and behaviour reflect the subjective perceptions and cognitive abilities of the decision makers. Thus, if managers are mistaken or ill-informed concerning transaction costs, estimations of the effect of transaction cost variables on governance choice would reveal little or no association even if transaction attributes, and thus transaction costs, actually affected performance. Presumably, managers are able to learn over time, and market force does correct mistakes, but these processes may be slow and inaccurate (Masten, 1993). Consequently, without reaching an equilibrium state, diverse governance structures may survive for extended periods even within the same industry. Because of a possibly lengthy evolutionary process, the anomalous coexistence of firms that adopt differing governance structures is consistent with the transaction cost reasoning (Chiles & McMackin, 1996). Although the disequilibrium problem can reduce the predicative power of transaction cost theory, the theory may still have strong capacity in explaining the performance of a chosen governance structure, because, after all, the survivability of an organizational form depends on its performance.

Further, Dow (1987: 18–19) has pointed out that 'in comparing costs across governance structures, it is essential that the relevant transaction be specified independently of the governance structure which is superimposed upon it'. Thus, to avoid tautological reasoning, the attributes of a transaction must remain invariant across governance structures; otherwise, transactions subjected to different governance structures will reduce to different transactions (cf. Dietrich, 1994). This problem is particularly pronounced for software development, as there is not yet, and may never be, a definition of 'efficiency' for software production. For example, the developer's skill and business domain knowledge, and the functions and quality of the software, and thereby the costs and benefits of the software, are likely to vary across different sources (Wang *et al.*, 1997). Therefore, unlike the commodity-type of information services such as data processing and data centre operation, a direct comparison between make and buy is not very appropriate for customized software systems. Also, because governance costs cannot be directly observed for structures not chosen, direct comparisons of alternative structures are impossible (Masten *et al.*, 1991).

Consequently, rather than investigating the first-order economizing question, this study focuses on cases of software outsourcing and analyses the effects of transaction attributes on the outcomes of such decisions as a further validity check on the transaction cost reasoning.

A brief review of empirical studies

Although TCT has been applied extensively in various fields to analyse vertical or dyadic relationships and the empirical research has been broadly supportive of the central transaction cost propositions (Williamson, 1985a; Joskow, 1988; Shelanski & Klein, 1995; Rindfleisch & Heide, 1997), empirical research based on the theory in the IS literature, though containing several novel studies, has been limited and the findings are at best mixed. Because the outsourcing-related literature is voluminous, the following review is limited to the empirical studies that incorporate TCT.

Loh (1994) takes a broader perspective of organizational economics to examine the effects of the firm costs and dyadic costs on IT outsourcing. His results indicate that the hypothesized positive relationships between asset specificity and uncertainty and dyadic costs are not supported empirically. However, because the dyadic costs are represented as a second-order factor, and thus not directly measured, these statistically non-significant results can only be interpreted, in terms of measurement, as lack of convergent validity of the first-order constructs on the second-order one (the dyadic costs). As a result, the implications of transaction attributes on governance costs and outsourcing remain largely unchecked.

Nam *et al*. (1996) also incorporate two transaction attributes – asset specificity and uncertainty – in their two-level investigation of IS outsourcing. They find that only the negative association between uncertainty and the extent of substitution by vendors is supported empirically. They argue that the non-significant effect of asset specificity may be caused either by an artefact of their data or by measurement. Further, because their sample contains a number of IS functions, the statistical relationships only manifest averaging effects of the variables over various functions.

Grover *et al*. (1996) investigated the relationship between the extent of outsourcing and outsourcing success. Their results showed that the relationship between the two is likely to vary with different IS functions, thus providing support to the theoretical premise of TCT. They also recognize, however, that some IS functions, e.g. application development, could comprise a range of projects varying in degree of asset specificity, and thus that their findings might require further refinements. The approach taken here is consistent with this suggestion.

In addition to the above survey research, there are also some related case studies. Lacity & Hirschheim (1993) use TCT and a political model as alternative theoretical bases to examine decisions to outsource IS activities in 13 firms. Aubert *et al*. (1996a) use TCT to explain the choice of outsourced activities and the terms and management of the outsourcing contracts. Their findings suggest the usefulness of transaction cost reasoning in explaining outsourcing behaviour. Also, Lacity & Willcocks (1996) analysed 61 sourcing decisions and outcomes made in 40 US and UK organizations according to the transaction cost framework. However, they found that only 13 of the 61 sourcing decisions mapped as predicted by TCT. Although such a phenomenon can be reinterpreted from the perspectives of both proponents and opponents of TCT, it might not be so surprising given the disequilibrium problem addressed above.

From these empirical results we can observe that, although TCT seems to be generally supported by the case studies, its support from the survey research is rather limited. The inconsistency of these findings may be due to a number of differential factors, such as methodology, operationalization of the theoretical constructs, focal relationships and activities examined, and specification of the model. Such inconsistent findings, of course, may also be caused by the disequilibrium problem addressed above. To avoid the disequilibrium problem, and to examine outsourcing activity with a finer granularity, this study focuses on analysing the effects of transaction attributes on the consequences of outsourcing a single IS function: customized software development. The reason for focusing on software outsourcing is that software development projects typically not only vary in their degrees of idiosyncrasy but also require specific investments from both the developer and the user. Thus, even with such a narrow

focus, it is believed that software outsourcing projects should exhibit sufficient variations in their transaction attributes for analysis. Besides, this can also avoid the confounding effects caused by different types of transactions. While differing from most previous studies in the focal dependent variable, the reasons for taking such an approach have been explained in detail earlier. Further, in order to obtain a solid theoretical foundation and avoid overextending the transaction cost reasoning, the research model includes mainly the constructs and the relationships that have been most analysed in the literature on both theoretical and empirical grounds. The following section explains the research constructs in detail.

CONCEPTS AND VARIABLES

This section contains a discussion of the five research constructs derived primarily from TCT. The conceptual model based on TCT and the related constructs is depicted in Figure 1. The model contains three exogenous variables and two endogenous variables and is explained in detail below.

Outsourcing success

By focusing on customized software outsourcing, the main concern of the study is how transaction attributes and post-contractual opportunism may affect the success of outsourcing decisions. This focal dependent variable, though atypical in outsourcing research based on TCT, provides justifications for and a linkage from transaction attributes to outsourcing decisions from a broader perspective. Certainly, different governance structures can have different cost as well as benefit properties, as argued by Dietrich (1994). This is particularly pronounced for software systems, as the costs and benefits of an IS service are likely to depend on its sources. Moreover, according to a recent report from Dataquest, topping the list of reasons for outsourcing IT and business processes are improved service levels, focus on core competencies, enhanced IT effectiveness and supplementing of existing IT staff (Vijayan & Hoffman, 1997). Such benefits, strictly speaking, are not the main focus of transaction cost analysis. This study nonetheless maintains that the attainment of outsourcing benefits of a particular application can be significantly affected by its transaction attributes via their effects on contractual relationships. Although argued mainly from the resource dependence perspective, Grover *et al*. (1996) also suggest that asset specificity can form the basis for eval-
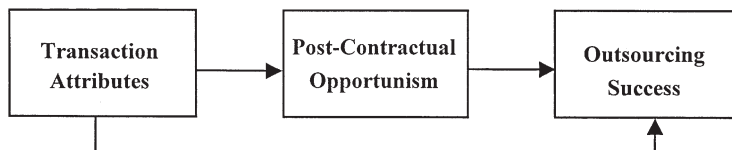

Figure 1. Conceptual model.

uating outsourcing benefits. Thus, outsourcing success in this study incorporates both costs and benefits attained by the software outsourced.

Asset specificity

Software applications vary in complexity, skills required and area of application. No matter how unique a firm's business operations are, it still needs certain standard information systems, e.g. financial accounting or inventory control, which may be outsourced. Outsourced software applications thus might not necessarily reflect a firm's overall firm-specific information requirements. As the unit of analysis here is customized software projects, it is appropriate to assess asset specificity at the project level rather than at the firm level. Asset specificity then is defined by the uniqueness of skills, functions and business knowledge required for completing the particular outsourcing projects.

Uncertainty

Like asset specificity, a firm's overall level of uncertainty experienced in business, technology and information requirements does not necessarily translate into a particular project being outsourced. Consequently, uncertainty is defined as the inherent characteristics of specific software outsourced in terms of the difficulties of prescribing specifications, scheduling delivery dates and estimating costs at the contracting stage. This construct then reflects the extent of bounded rationality, and thereby contract incompleteness, experienced by the contractual parties.

Reputation

Because transactor reputation is mainly a market-oriented concept, it is not typically included in the investigation of comparative make-or-buy decisions. However, as this study focuses on outsourced projects, i.e. the market governance, it is argued that a transactor's reputation can have a significant effect on its behaviour and contract performance (Joskow, 1985; Klein, 1988; Coase, 1991). Reputation is a multidimensional construct (Chiles & McMackin, 1996), including dimensions such as reliability (Weight & Camerer, 1988), predation (Kreps & Wilson, 1982; Milgrom & Roberts, 1992), quality (Weight & Camerer, 1988), tit-for-tat behaviour (Buckley & Casson, 1988), honesty (Milgrom & Roberts, 1982) and trustworthiness (Milgrom & Roberts, 1992; Ring & Van de Ven, 1992). In this study, reputation is construed as a contractor's reputation for trustworthiness in the customized software development market. Such a reputation can be an asset that provides a signal to other firms regarding a contractor's trustworthiness based on its prior history of trustworthy behaviour.

Post-contractual opportunism

Opportunism describes a condition of 'self-interest seeking with guile' that includes propensities to disseminate, distort, fail to disclose, and otherwise act in an untrustworthy and even

fraudulent manner for purposes of the transactor's own gain. This is 'a troublesome source of "behavioural" uncertainty in economic transactions – which uncertainty would vanish either if individuals were fully open and honest in their efforts to realize individual advantage or, alternatively, if full subordination, self-denial, and obedience could be presumed' (Williamson, 1985a: 49). However, to assume opportunism does not imply that most economic agents are engaged in opportunistic practices most of the time. Rather, the assumption is that *some* individuals are opportunistic *some* of the time, not that all individuals are necessarily given to opportunism in identical degree. Thus, it is costly to ascertain differential trustworthiness ex ante (Williamson, 1985b, 1996a), and 'problems of economic organization are compounded if the propensity to behave opportunistically is known to vary among members of the contracting population – as gains can be realized by expending resources to discriminate among types' (Williamson, 1985b: 175). Surely, putting opportunism under empirical investigation raises some problems regarding theory testing, as opportunism is a behavioural *assumption* from which the central propositions of TCT are derived. Therefore, strictly speaking, opportunism should not be subject to direct empirical testing. But, because opportunism is such a controversial concept (Williamson, 1993b; 1996b;Ghoshal & Moran, 1996) and also central for deriving empirical implications, the behavioural manifestations of contractor opportunism are included in the study to serve as a process-oriented variable that mediates the effects of transaction attributes on outsourcing success. To this end, the study focuses on the client's perception of post-contractual opportunistic behaviour of the contractor during contract execution, referring to 'the incomplete or distorted disclosure of information, especially to calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse' (Williamson, 1985a: 47). (To avoid clutter, it is understood that in what follows opportunism refers to the behavioural manifestations of opportunism.) Thus, this construct attempts to capture the behavioural uncertainty that arises within the context of the exchange itself owing to the opportunistic inclinations of contractual parties.

RESEARCH HYPOTHESES

This section derives the hypotheses that relate transaction attributes and their possible interactions to the contractor's post-contractual opportunism perceived by the client and then to outsourcing success. Among the 10 hypotheses derived, two pairs of hypotheses are rival hypotheses indicating opposite effects of asset specificity on opportunism and on outsourcing success.

Effect of reputation

Although the extent to which transactor reputation can control opportunistic behaviour and assure contractual performance remains controversial (Klein, 1988; Coase, 1991), researchers tend to argue in favour of its positive effect on transaction costs. Reputation is an asset earned from a transactor's past, irreversible investments in engaging in trustworthy behaviour. A trans-

actor possessing such an asset would be willing to forgo short-term gains obtainable through opportunistic behaviour in order to protect its valued asset and the long-term benefits the asset provides, such as lowered costs of finding and contracting with future exchange partners (Chiles & McMackin, 1996). Consequently, even if there are short-term gains obtainable through opportunistic behaviour, reputation effects may prevent hold-ups and encourage specific investments by tying the hands of the transactors (Klein, 1988). Further, software development processes usually last for long periods of time. Under these circumstances, software outsourcing can hardly be characterized as faceless and spontaneous, and the effectiveness of such transactions will depend on a relatively long-term, cooperative relationship between the contractual parties. Thus, as argued by Hill (1990: 501), 'in the long-run, the invisible hand selects actors whose behaviours are biased toward cooperation', a reputable software contractor should have stronger incentives to constrain its opportunistic behaviour and to cooperate with its clients, and thereby generate higher contractual performance. Because of this reputation effect, even when the contractor actually incurs a loss from the project, the project may still be seen by the client as a success. Hence, the following two hypotheses suggest the effects of contractor reputation:

H1: Contractor's reputation has a negative effect on the contractor's post-contractual opportunism perceived by the client.
H2: Contractor's reputation has a positive effect on software outsourcing success.

Effect of asset specificity

High asset specificity arises when the products, services or investments are customized to the transaction. Such assets are therefore not readily transferable to alternative uses without losing substantial productive value. A highly firm-specific software system usually involves unique design characteristics and requires idiosyncratic human capital and skills. To develop such a system, the contractor must incur sunk, specific investments in learning the idiosyncrasies of the client in order to perform the task adequately. This typically will not only lead to higher co-ordination costs between the contractor and the client, but also make less likely the realization of scale economies and risk-pooling benefits. The existence of specific know-how and skills and the difficulties of knowledge transfer mean that it will be costly for the parties to switch to a new relationship, thus leaving opportunism and maladaptation largely unchecked by market forces (Anderson & Schmittlein, 1984). Thus, transaction-specific investments may create incentives for one party to hold up the other ex post and lead to costly haggling. To avoid such hold-up potentials, underinvestment in transaction-specific assets by the contractual parties is likely to be pervasive during contract execution, a condition similar to the prisoner's dilemma problem. Outsourcing highly firm-specific software projects thus not only creates greater difficulties in coordinating a team of inputs, which Coase (1991) attributes as the essence of a firm, but also provides lower incentives for the contractor to invest in transaction-specific assets. Consequently, the extent of outsourcing success will also be less. Hence, we have the following first pair of hypotheses regarding the effects of asset specificity:

H3a: Asset specificity of the outsourced software has a positive effect on post-contractual opportunism perceived by the client.
H4a: Asset specificity of the outsourced software has a negative effect on software outsourcing success.

Although one of the central propositions of TCT maintains that the presence of transaction-specific assets is more likely to lead to hierarchical governance, a question remains as to whether the hypothesized adverse effects of asset specificity on contractual performance will in fact be realized *after* a firm has decided to adopt market governance for a particular transaction. Further, is it possible for a firm that outsources a highly firm-specific software development project to take actions to vest such a transaction in effective control, or even to turn asset specificity into a positive transaction attribute because of its potential as a source of productive value? This is quite likely if high asset specificity creates a mutually dependent relationship or 'hostage arrangements' between the contractor and the client to mitigate expropriation incentives possessed by one or both parties (Williamson, 1983; Scarbrough, 1995). In fact, outsourcing customized software systems usually requires that the contractor spends resources on learning the client's idiosyncratic business operations and information requirements as well as that the client exerts enough efforts to communicate and coordinate with the contractor. Such investments will be of little value to either party if the contract terminates prematurely. For instance, if the contract terminates prematurely, the client can either abandon the project completely, revert to internal development or contract with a new partner. In any case, the resources spent on the terminated contractor might be totally wasted. Moreover, higher asset specificity also means that it is more difficult for the client to identify other qualified contractors in the marketplace. Even if the client can successfully identify a potential contractor, it must also induce the contractor to make the same specialized investments. Thus, the client has clear incentives to work things out rather than terminate the contract.

Similar situations hold for the contractor. Because of high specificity of the software, the contractor's learned know-how and skills will have much lower value in alternative uses, if not be completely wasted. Even if the gained knowledge is not wasted, thus realizing scale or scope economies to some extent, the client still can enjoy certain reputational leverage over the because of the potential embarrassment if the project fails. The contractor's high performance on the project may motivate the client to outsource other development projects to that contractor. The small-numbers-bargaining condition created by high specificity also means less competition for the contractor as far as the future business is concerned. This will encourage the contractor to invest in client-specific assets, constrain opportunistic behaviour and assure adequate performance. Consequently, this study proposes the following second pair of alternative hypotheses which is opposite to the previous pair of hypotheses derived from the typical transaction cost reasoning:

H3b: Asset specificity of the outsourced software has a negative effect on post-contractual opportunism perceived by the client.
H4b: Asset specificity of the outsourced software has a positive effect on software outsourcing success.

Effect of uncertainty

For customized software outsourcing, not only are the functionalities, development costs and delivery dates difficult to determine at the contracting stage, but there are also many quality dimensions that cannot be measured concretely and objectively (Richmond *et al.*, 1992). When these problems are more severe, the contract will be less complete and require more frequent adaptations to changed environments. As a result of uncertainty, and the resulting contractual incompleteness, not all elements of performance can be specified in a contractually enforceable way, thus complicating writing and enforcing contracts. Further, because of bounded rationality, managers' subjective judgement may be used when performance is difficult to evaluate. Such judgement is, of course, subject to interpretation and disputable, and so conflicts between the parties may result even in the absence of opportunism. Under these circumstances, it is difficult for the client to distinguish bad outcomes that arise because of opportunistic behaviour from bad outcomes that arise because of bad luck (Joskow, 1985), thus providing a breeding ground for opportunism as well as creating ex-post performance problems. Although, in the absence of asset specificity, uncertainty is a matter of little consequence (Williamson, 1985a), we can nonetheless expect transactions to be completed less smoothly in more uncertain environments (Anderson & Schmittlein, 1984). Besides, as the transactions examined here are customized software projects, asset specificity, though to a varying extent, should be a general characteristic of the projects. Hence, we have the following two hypotheses:

H5: Uncertainty inherent in the outsourced software has a positive effect on post-contractual opportunism perceived by the client.
H6: Uncertainty inherent in the outsourced software has a negative effect on software outsourcing success.

Interaction effect and opportunism

One complication of transaction cost analysis is the possible interaction effects of transaction attributes on organization economies. Specifically, according to Williamson (1985a: 59), 'an increase in parametric uncertainty is a matter of little consequence for transactions that are nonspecific'. In other words, the influence of uncertainty on economic organization is conditional on the degree of asset specificity inherent in the transaction. 'Whenever assets are specific in nontrivial degree, increasing the degree of uncertainty makes it more imperative that the parties devise a machinery to "work things out" – since contractual gaps will be larger and the occasions for sequential adaptations will increase in number and importance as the degree of uncertainty increases' (Williamson, 1985a: 60). Except perhaps for Anderson & Schmittlein (1984), empirical studies based on TCT have not paid much attention to such interaction effects.

In order to test the interaction effects of uncertainty and asset specificity, one question needs to be addressed: will such interactions have a direct effect on both post-contractual opportunism and outsourcing success? Again, according to Williamson (1985b: 176), 'Were it not
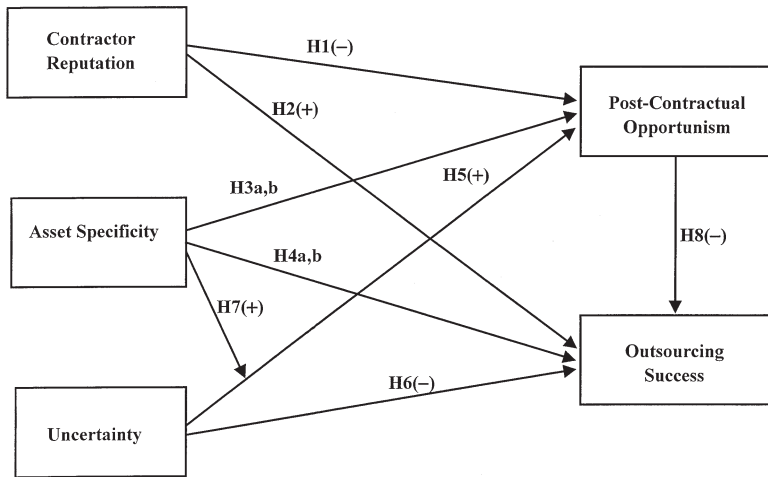
Figure 2. Research model.

for opportunism, all behaviour could be rule-governed. Moreover, this need not imply comprehensive preplanning: Unanticipated events could be dealt with by general rules, whereby the parties agree to be bound by actions of a joint-profit-maximizing kind.' Consequently, this study maintains that the interaction of uncertainty and asset specificity has a direct positive effect on post-contractual opportunism, but its effect on outsourcing success is mediated by opportunism, and thereby indirect. As the implications of opportunism on outsourcing success are obvious, we have the following two hypotheses:

H7: The higher the degree of asset specificity of the software outsourced, the stronger is the positive effect of uncertainty on post-contractual opportunism perceived by the client.
H8: The contractor's post-contractual opportunism perceived by the client has a negative effect on software outsourcing success.

Given the above research hypotheses, the research model for empirical testing is depicted in Figure 2. The methods for collecting and analysing data are described in the following sections.

METHOD

This section presents an overview of the survey procedure and a brief description of the sample used in this study. It then describes how the research variables were operationalized and measured.

Survey procedure

A cross-sectional postal questionnaire was developed for collecting customized software out-sourcing data from a group of medium to large-sized firms in Taiwan. The questionnaire asked the CIO of the firms to answer the survey questions, based on a major customized software outsourcing project of which she/he had the best understanding of the nature and the consequences of the project. Because CIOs are typically the most knowledgeable individual concerning a firm's major outsourcing projects, and should also have sufficient ability and information to assess various aspects of outsourcing deals, they were selected as the key informants of the study (Huber & Power, 1985).

A draft survey with most of the measures identified in the literature was translated into Chinese by a bilingual research associate and then refined and verified by two MIS PhDs. The Chinese version of the draft survey was then examined by four IS senior managers for face and content validity in a pretest. The reviewers were asked to describe their interpretation of the questions in order to compare them with the original intent. This process resulted in modifications of the wording of some survey items. The final instrument was distributed to the CIOs of 950 firms randomly selected from among the 1000 largest manufacturing firms, 500 largest service firms, and 100 largest finance firms in Taiwan listed in the 1996 edition of *Common Wealth.* The sample included 550 firms in the manufacturing sector, 300 firms in the service sector and 100 firms in the financial (consisting of banking and insurance) industry. The sample was thought to be representative of the medium to large-sized firms in Taiwan. A follow-up survey was posted to the firms with no response after 2 weeks. After an additional 2 weeks, a number of non-responding firms were contacted to enquire about their reasons for not responding to the survey. The two primary reasons were lack of time and no software outsourcing experience.

Sample

Through the procedure described above, 163 surveys were returned from 94 firms (58%) in the manufacturing sector, 47 firms (29%) in the service sector and 22 firms (13%) in the financial sector. The distribution of respondents is fairly close to that of our original sample. Also, approximately 11% (18 firms) of the respondents had total assets less than NT\$1bn, 41% (67 firms) had more than \$1bn but less than \$5bn, 26% had more \$5bn but less than \$10bn and 21% had total assets over \$10bn.

To ensure the representativeness of the sample, chi-square tests were conducted on industry sectors and total asset values with a sample of 100 randomly selected non-respondents to check for possible non-response bias. The results of chi-square tests showed no significant differences ($P > 0.05$) in either of the variables. Also, the surveys were further divided into two halves based on the dates of return, and then a comparison of the early respondents with those returned late was conducted based on the same variables (Armstrong & Overton, 1977). The results of chi-square tests again showed no significant differences in either of the

Table 1. Demographic characteristics of respondents

	No. of respondents	No. of outsourcing respondents
Industrial sector		
Manufacturing	94	66
Service	47	17
Financial	22	13
Private or public		
Private	159	99
Public	4	1
Total asset (NT$)		
Less than $bn	18	17
$1bn–$5bn	67	38
$5bn–$10bn	43	12
Over $10bn	35	33

variables. Thus, non-response bias was unlikely in this study. Among the 163 respondents, 63 firms did not have any experience in customized software outsourcing and therefore were discarded from further analysis. The characteristics of all the responding firms and those having experience in customized software outsourcing are presented in Table 1. From the table, it appears that the service sector has the lowest percentage of firms with outsourcing experience, while the financial sector has the highest. Further, among the 100 firms with outsourcing experience, five firms did not provide complete data, and therefore were also discarded, leaving us with 95 firms usable for subsequent analysis.

Although the response rate is relative low, demonstrating a lack of response bias is more important than a high response rate (Babbie, 1973). Thus, in addition to the above tests for response bias based on all respondents, industry sectors and total asset values of the final sample (95 firms) were further compared with those of a sample of non-respondents. The resulting chi-square tests again indicated no significant differences between the two groups at the significance level of 0.05.

Measures

Although most constructs included in this study are abstract and possibly multidimensional, succinct measures were adapted to the current study whenever available in the literature. In so doing, the length of the instrument was thought to be less likely to discourage the firms from responding to the survey. While running the risk of oversimplification, based on the results of the pretest with four senior IS managers, these measures should nonetheless capture enough essence of the research constructs.

Reputation was measured with three items as the extent to which the client felt that the contractor had developed a reputation for honesty, fairness and trustworthiness in dealing with its client firms (Ganesan, 1994; Dyer, 1996). *Asset specificity* has many types. This study focused

on dedicated and human assets, which were thought to be most relevant for software out-sourcing. Five items were developed to measure this construct from reviewing the literature (Loh, 1994; Lohtia *et al.*, 1994; Zaheer & Venkatraman, 1995). *Uncertainty* was measured with three items as the extent to which the parties had difficulties in predicting system require-ments, delivery dates and costs at the contracting stage. As few survey studies have focused on software outsourcing at the project level, the items were developed from reviewing theoretical as well as case studies (Richmond *et al.*, 1992; Aubert *et al.*, 1996a). *Post-contractual opportunism* was measured as the extent to which the client perceived the contractor's propensities to distort information and to fail to keep its promises at the post-contractual stages. Three items were adapted from John's (1984) six-item scale to measure this construct. Nine items were used to measure *outsourcing success*, which basically were adopted from the outsourcing success scale of Grover *et al.* (1996) and which attempted to measure performance attainment in three aspects of software outsourcing: strategic, eco-nomic and technological. English versions of the measures are provided in Appendix A.

Statistical procedures

Because some of constructs, such as outsourcing success, are multidimensional and because the validity of the measures developed here is not well established, exploratory factor analy-sis (EFA) was used to examine the measurement properties of the survey items. After ensur-ing that all the measures had desirable measurement properties, multiple regression analysis was then applied for hypothesis testing based on the composite scales.

ANALYSIS

Measurement

To avoid interpretational confounding, all items were pooled together and examined by EFA. As the constructs are derived from TCT and therefore theoretically related, OBLIMIN rotation was used to allow the constructs to be correlated. Using the Kaiser criterion (i.e. eigenvalue > 1), five significant factors emerged from the factor analysis (see Table 2). The five factors that explained the greatest amount of variance were consistent with the five constructs hypoth-esized a priori. Kaiser's measure of sampling adequacy (MSA), which measures the extent to which variables are appropriate for factor analysis, was 0.83 overall, indicating a meritori-ous level of adequacy (Hair *et al.*, 1995).

According to Hair *et al.* (1995), when the sample size is 100, with a power level of 80% and a 0.05 significance level, the absolute value of a factor loading has to be greater than 0.55 to be considered significant. As our sample size is 95, 0.55 appeared to be a minimum cut-off for assessing the significance of factor loadings. Using 0.55 as the criterion, Table 2 showed that 20 out of the 23 items had significant factor loadings on at least one of the five factors. The three items that failed to be significant were OPP3, SUC1 and SUC9. Item OPP3 loaded more significantly on contractor reputation than on opportunism with a wrong sign, and

Table 2. Factor analysis of measures with OBLIMIN rotation (*n* = 95)

	REP	A-S	UNC	OPP	SUC	Corrected item-total correlation
REP1	−0.76377	−0.04257	−0.12991	0.04623	0.15175	0.7213
REP2	−0.75631	−0.13157	−0.00141	−0.04653	0.18886	0.8020
REP3	−0.77012	0.04037	0.00103	−0.33940	0.02640	0.6568
A-S1	−0.02056	−0.85845	−0.05751	0.02077	0.04420	0.8195
A-S2	−0.11464	−0.78747	0.09493	−0.13239	0.04295	0.7960
A-S3	−0.01195	−0.91083	0.04716	−0.02296	−0.10312	0.7498
A-S4	0.07311	−0.82156	0.15332	0.00299	0.05538	0.7024
A-S5	0.07585	−0.80673	−0.14034	−0.01729	0.04914	0.7024
UNC1	0.07828	0.07401	0.82050	−0.11899	−0.05297	0.5986
UNC2	0.06326	−0.00756	0.87586	−0.07179	0.01874	0.7198
UNC3	−0.02618	−0.20407	0.69514	0.29707	0.02770	0.4725
OPP1	0.05963	0.30638	0.03421	0.74952	0.00164	0.6227
OPP2	0.38333	0.10150	0.11038	0.61996	−0.09688	0.6227
OPP3	0.47866	0.11075	0.26302	−0.39977	0.11777	Dropped
SUC1	−0.33888	−0.07921	0.01149	0.15671	0.45524	Dropped
SUC2	−0.19700	0.04335	0.10089	0.10918	0.65578	0.5025
SUC3	−0.02560	0.02425	0.09608	−0.00985	0.74034	0.5989
SUC4	0.29990	−0.01156	−0.31484	−0.19711	0.71013	0.6682
SUC5	0.26986	−0.07613	−0.17403	−0.11552	0.70249	0.6296
SUC6	−0.09473	−0.00579	0.11247	−0.07639	0.74574	0.6691
SUC7	−0.01869	−0.11566	−0.10544	0.13219	0.71359	0.6664
SUC8	−0.08578	−0.16434	−0.01223	−0.07349	0.68606	0.7249
SUC9	−0.23617	−0.21840	−0.15487	−0.22688	0.45256	Dropped

therefore was excluded from the opportunism scale, leaving two items for measuring post-contractual opportunism. The loadings of SUC1 and SUC9, though considered important (±0.0.4 or greater), failed to reach the level of practical significance (Hair *et al.*, 1995), and thus were also excluded from the outsourcing success scale. [Although the loadings of SUC1 and SUC9 could be considered important and their correlations with all other items were significant ($P < 0.05$), they were nonetheless dropped because of the cut-off chosen. This, however, would not change the results in any significant way.] Consequently, only seven items were left for measuring outsourcing success. Although outsourcing success was conceptualized as a multidimensional construct, all the remaining seven items appeared to converge on a single factor, thus showing sufficient convergent validity of the items. The internal consistency of the measure was further supported by the high corrected item-total correlations of the items (see Table 2), which were calculated without the non-significant items. After excluding the three non-significant items, all the remaining items loaded on one intended factor with a high corrected item-total correlation, they were thereby considered sufficiently unidimensional and suitable for subsequent analysis.

Cronbach's coefficient α was then used to assess the reliability or internal consistency of the measures (Cronbach, 1947). As shown on the diagonal of Table 3, all the αs were

Table 3. Correlations and Cronbach's α of the scales

Constructs	1	2	3	4	5
1. Reputation (REP)	(0.853)				
2. Asset specificity (A-S)	0.396	(0.893)			
3. Uncertainty (UNC)	−0.232	−0.031	(0.760)		
4. Opportunism (OPP)	−0.357	−0.452	0.202	(0.767)	
5. Success (SUC)	0.453	0.507	−0.244	−0.474	(0.865)
Mean	3.284	2.992	2.888	2.884	3.141
Standard deviation	0.617	0.808	0.782	0.646	0.626

Correlations greater than 0.20 and 0.27 are significant at 5% and 1% respectively.

beyond the typical requirement of 0.7, thus showing acceptable scale reliability (Nunnally, 1978).

After ensuring that all the measures were sufficiently unidimensional and reliable, composite scales of the constructs were derived by averaging their corresponding item scores and then used for subsequent analysis. Table 3 gives the correlations among the composite scales of the five research variables. Except for the correlation between asset specificity and uncertainty, all other correlations are statistically significant ($P < 0.05$). The table also shows the means and standard deviations of the scales.

Moreover, in the organization literature, contingency studies have been criticized for lack of variation in the data, especially in the contingent variables (Pfeffer, 1982). This could be a potential problem for this study because it focuses solely on outsourcing cases instead of comparing institutional efficiency. To ensure that the data have adequate variations for hypothesis testing, following Drazin & Van de Ven (1985), median splits were performed on all variables, and the resultant mean differences were compared using *t*-tests. Means for all variables were different at the significance level of 0.001. Thus, lack of data variation should not be a problem in this study. Having explained and validated the data used in the study, the following subsection presents the multiple regression analysis used for testing the research model.

Multiple regression analysis

Following the traditional approach in regression analysis (Jaccard *et al*, 1990), the interaction between asset specificity and uncertainty was also represented as the multiplication of these two scales. Further, it is well known that mean centring (prior to forming the product term) can improve the likelihood of detecting interactions by reducing the correlations between the product term and the component parts of the term without affecting the substantive evaluation, thus relieving the problem of multicollinearity (Cronbach, 1987; Jaccard *et al*., 1990; Ping, 1996). In order to ensure the absence of an interaction effect of uncertainty and asset specificity on outsourcing success, moderated regression for outsourcing success was also performed.

Table 4. Results of moderated regression analysis($n = 95$)

	Dependent variables			
	OPP (M1)	OPP (M2)	SUC (M3)	SUC (M4)
REP	−0.244**	−0.218**	0.170**	0.173**
A-S	−0.299***	−0.264***	0.270***	0.274***
UNC	0.127**	0.133**	−0.116**	−0.113**
A-S × UNC		0.229***		0.057
OPP			−0.200**	−0.215**
R	0.514	0.566	0.586	0.588
R^2	0.274	0.321	0.343	0.346
R^2 adjusted	0.250	0.290	0.314	0.309
F-value	11.442***	10.616***	11.766***	9.425***
ΔR^2		0.047		0.003

*$P < 0.1$; **$P < 0.05$; ***$P < 0.01$; t-statistics are based on the one-tailed test.

Models M2 and M4 include the interaction effect of asset specificity and uncertainty.

Table 5. Research hypotheses and empirical support obtained

Hypothesis	Estimate	SE	t-value	Supported?
(H1) Reputation (−) → Opportunism	−0.218**	0.103	−2.123	Yes
(H2) Reputation (+) → Success	0.170**	0.101	1.692	Yes
(H3a) Asset specificity (+) → Opportunism	−0.264***	0.077	−3.409	No
(H3b) Asset specificity (−) →Opportunism	−0.264***	0.077	−3.409	Yes
(H4a) Asset specificity (−) → Success	0.270***	0.079	3.438	No
(H4b) Asset specificity (+) → Success	0.270***	0.079	3.438	Yes
(H5) Uncertainty (+) → Opportunism	0.133**	0.074	1.798	Yes
(H6) Uncertainty (−) → Success	−0.116*	0.072	−1.616	Marginal
(H7) Asset specificity → Uncertainty (+) → Opportunism	0.229***	0.092	2.486	Yes
(H8) Opportunism (−) → Success	−0.200**	0.098	−2.040	Yes

*$P < 0.1$; **$P < 0.05$; ***$P < 0.01$; based on the one-tailed test.

Table 4 contains four regression results; two used opportunism as the dependent variables (M1 & M2) while the other two used outsourcing success as the dependent variables (M3 and M4). Comparing M1 with M2, we see that adding the interaction term of asset specificity and uncertainty to M1 produces a significant improvement in explaining post-contractual opportunism ($\Delta R^2 = 4.7\%$; $P < 0.05$), thus showing the significant moderating effect of asset specificity on the relationship between uncertainty and opportunism. However, the results of M3 and M4 indicate that such an interaction effect fails to be significant in explaining out-sourcing success. Consequently, the regression estimates of M2 and M3 are used to test the research hypotheses. In general, the regression results are largely consistent with the hypoth-esized relationships and summarized in Table 5. A detailed discussion of the findings is given below.

Discussion

The hypothesized effects of contractor reputation on opportunism and outsourcing success are supported at the significant level of 0.05. Even though many researchers have argued that reputation can only have limited effects on constraining contractors' opportunistic behaviour and on assuring contractual performance (Dasgupta, 1988; Williamson, 1993a), our result shows that such effects are nonetheless significant. Because TCT assumes only that some economic agents are opportunistic some of the time, and because good reputation has to be built up by consistent, trustworthy business conducts, contractor reputation can then be used to distinguish potential contractors' propensity to opportunism. Thus, to assure a better contractual relationship and performance, reputation should be an important criterion for outsourcing firms in selecting appropriate contractors.

More interestingly, contrary to the typical transaction cost theorizing that asset specificity tends to increase post-contractual opportunism, and therefore has negative implications on contractual performance, this study demonstrates that asset specificity has significant positive effects on both reducing the contractor's post-contractual opportunism perceived by the client and increasing outsourcing success. This indicates, as hypothesized in H3b and H4b, that a customized software project usually requires both the client and the contractor to invest more heavily in sunk, specific investments in order to make the project a success. Other than as the potential sources of productive value, these specific investments, similar to the exchange of hostages, tend to create a mutual dependence, bilateral monopoly relationship. This can increase the opportunity costs of contract termination for both parties, and thereby has the effects of constraining opportunistic behaviour and increasing contractual performance, a result contradicting the typical transaction cost propositions as hypothesized in H3a and H4a. Of course, this result might be unique to customized software outsourcing, and therefore cannot be generalized to other types of IS outsourcing. Also, as the data were collected in Taiwan, the finding might simply reflect the different ways of conducting business in different cultures and market conditions. This phenomenon may be an area requiring further investigation.

The direct effects of uncertainty on opportunism and outsourcing success are as hypothesized, but their levels of statistical significance are weaker than those of asset specificity. In particular, the effect of uncertainty on outsourcing success is only marginal ($P < 0.1$). To some extent, these results appear consistent with the transaction cost reasoning that uncertainty by itself is a matter of little consequence. Another interesting and important result that provides additional support to the theory is the significantly positive moderating effect of asset specificity on the relationship between uncertainty and contractor opportunism, i.e. the higher the degree of asset specificity, the stronger is the positive effect of uncertainty on post-contractual opportunism perceived by the client. As the interaction effect is represented as the product term of asset specificity and uncertainty, the positively linear relationship between uncertainty and opportunism, statistically speaking, is also varied linearly with asset specificity.

In the presence of statistically significant interaction effects, the meaningfulness and interpretability of the main effects are controversial (Jaccard *et al.*, 1990). One perspective argues

that a significant interaction effect indicates no constant effect of an independent variable on a dependent variable, and thus the main effect is meaningless (e.g. Hays, 1983; cf. Jaccard *et al.*, 1990). We follow the other perspective that interprets main effects, in the presence of significant interaction effects, in terms of the average effect of an independent variable on a dependent variable across values of the moderator (Jaccard *et al.*, 1990). Accordingly, out-sourcing contracts with a higher degree of uncertainty, on average, results in a greater extent of opportunism perceived by the client, and such a relationship is stronger for software projects with a higher degree of asset specificity. This result provides a more complete picture regarding the complex interactions among asset specificity, uncertainty and opportunism, and is consistent with what has been predicated by TCT (Williamson, 1985a).

Moreover, regression analysis can only be used to test the moderating effect on the form, rather than the degree, of relationships. As argued by Arnold (1982), the form of the relationship between two variables is indicated by the coefficients of the regression equation, whereas the degree of that relationship is measured by the magnitude of the correlation coefficient. Therefore, in order to obtain a more complete picture of the moderating effects of asset specificity, correlational analysis was also conducted. The result of the analysis is presented in Appendix B, which again shows significant moderating effects of asset specificity on the relationship between uncertainty and opportunism, but not on the relationship between uncertainty and outsourcing success.

Further, as hypothesized, the effect of opportunism on outsourcing success is negative at the significance level of 0.05. It thus appears that asset specificity and uncertainty, though in opposite directions, have both direct and indirect effects on post-contractual opportunism as well as outsourcing success. As the interaction of uncertainty and asset specificity was hypothesized to have a direct effect on opportunism but not on outsourcing success, the interaction can affect outsourcing success indirectly via the presence of opportunism. Such a mediating effect of the interaction appears to be consistent with the argument that 'were it not for opportunism, all behaviour could be rule-governed' (Williamson, 1985b: 176). Accordingly, attempting to associate the interaction of asset specificity and uncertainty directly with outsourcing success, or even with the governance choice (e.g. Anderson & Schmittlein, 1984), would be likely to fail. Although the interaction effect has not been thoroughly examined in the literature, variables such as post-contractual opportunism included in this study may deserve more attention when such endeavour is attempted.

In terms of the overall model, as shown by the R^2 values in Table 4, 32% and 35% of the variances of post-contractual opportunism and outsourcing success, respectively, are explained by the antecedent variables. Although the portions of variance explained are not particularly high, these results nonetheless demonstrate, to a great extent, the power of the transaction attributes in explaining contractual relationship and outsourcing success, and thereby provide general support to the transaction cost argument.

The results of this study should have some significant implications for practitioners. First, the transaction attributes examined in the study all appear to impact on the contractor's post-contractual opportunism and outsourcing success in one way or another, and thus should be carefully considered in any software outsourcing projects. Contractor reputation, which is not

typically included in transaction cost analysis, has been shown to impact on outsourcing significantly and thus should also be carefully screened when selecting contractors. Further, contrary to the usual transaction cost argument that firm-specific activities are not good targets for outsourcing because of the hold-up potentials they can create, this study shows that asset specificity may be a source of productive value and thereby can yield significantly positive gains for outsourcing firms. Only when combined with a high degree of uncertainty are such positive gains of asset specificity significantly reduced. Thus, asset specificity alone might not be a decisive factor against outsourcing. Contractor reputation, uncertainty inherent in the software project and the extent of mutual dependence between parties should all be considered together with asset specificity.

Overall, the results of this study appear to be largely consistent with the predictions of TCT. Because this study focuses only on customized software outsourcing projects, it is inappropriate to claim that the performance of these projects would be lower if they were developed internally, as we cannot compare the results of outsourcing with those of an alternative not chosen. Rather, the results point out that the transaction attributes postulated in TCT may have significant effects on contractual relationships and performance, and thus need to be evaluated in outsourcing customized software projects.

CONCLUSION

Based on TCT, this study examines the effects of transaction attributes on post-contractual opportunism and outsourcing performance. Rather than analysing the first-order economizing or 'make-or-buy' decision, this paper focuses on the implications of TCT on the practice of customized software outsourcing. This approach can be treated as a second-order refinement of the theory. Even without the implicitly assumed equilibrium in the distribution of governance structures, this research has demonstrated the value of TCT in analysing contractual relationships and performance. Of course, because the application of the theory in this study is atypical, the results reported here are only preliminary and require additional investigation.

This study has a number of limitations and possible extensions. First, to avoid resource constraints being the predominant factor that motivates the firms to outsource, this study focused on medium- to large-sized firms, which presumably would have greater capacity to develop systems internally if they see fit. Consequently, the results of the study may not be generalizable to smaller firms.

As the study focuses on customized software projects, their degrees of asset specificity and uncertainty are likely to fall between those of in-house developed systems and those of application packages. A more complete analysis of the effects of the transaction attributes may thus include systems that are acquired from different sources. Also, compared with the projects developed in-house, it should be easier for firms to ensure the success of those customized outsourcing projects contractually because of their relatively low degrees of asset specificity and uncertainty. As it is possible for firms to enter market contracts containing various hierarchical elements (Ang & Beath, 1993), which may interact with transaction attrib-

utes in complex ways and thus significantly impact the contractual relationships and out-sourcing performance, a natural extension of the current study could be to analyse how a firm may economize on transaction costs through contractual means, i.e. a second-order economizing problem.

Even though the measures used in the study were validated statistically, better measurement scales are needed for such rich constructs analysed here (Aubert *et al.*, 1996b). Better measures may produce more complete implications of the transaction attributes and thus provide stronger validation of the theory. Also, because responses were solicited from a single informant of each client firm in a post-hoc manner, the results only reported one side of the story and might contain response bias. Thus, it would be valuable for future research to measure explicitly the extent of specific investment made by each contractual party. In this direction, further in-depth case analyses and survey studies with multiple informants from both contractual parties should provide useful insights into the practice of customized software outsourcing.

Finally, while empirical evidence has been generally supportive of TCT, there are several directions in which the theory can be extended for studying governance choice in general and IS outsourcing in particular. First, even though the value of incorporating concepts such as trust, social control and partnership into the transaction cost reasoning is debatable (Williamson, 1993a, 1993b), the empirical evidence thus far seems to suggest the importance of these concepts in better understanding transaction relationships and performance (Klepper, 1995; Scarbrough, 1995; Zaheer & Venkatraman, 1995; Grover *et al.*, 1996). Moschandreas (1997) also argues that not only is human behaviour too complicated to be adequately summarized by opportunism, but the concept of opportunism has not been utilized consistently between market and hierarchy in TCT. Second, as argued by Chiles & McMackin (1996), risk neutrality is also an assumption of TCT, which has not received much attention from researchers. Risk neutrality might be a good first approximation of the risk preference of firms, but it is hardly perfect. There may be circumstances in which a firm's risk preference can have significant implications on its governance choice and performance (Jurison, 1995; Chiles & McMackin, 1996). Third, as organizational capabilities can behave as a source of competitive advantage as well as a constraint, incorporating the logic of organizational capabilities may provide a more complete explanation of governance choices and the performance associated with them (Madhok, 1996). Finally, as suggested by Cheon *et al.* (1995), there are several additional theoretical foundations, such as agency theory, resource-based view and resource-dependence theory, which may be incorporated in IS outsourcing research alongside TCT.

APPENDIX A: SURVEY ITEMS

Please answer the following questions based on a major customized software out-sourcing project of which you understand best of the nature and the consequences of the project. All questionnaire items utilize a five-point scale: 1 = Not at all; 5 = To a very great extent.

Reputation. Please indicate the extent to which the contractor of this particular project had developed a reputation for:

(REP1) honesty when conducting business
(REP2) caring for its clients
(REP3) fair dealing with its clients

Asset specificity. Please indicate the uniqueness of the following aspects involved in this particular software project:

(A-S1) functional/information requirements
(A-S2) operating procedures
(A-S3) business domain knowledge required
(A-S4) training for the developers
(A-S5) technical skills required

Uncertainty. For this particular outsourcing project, please indicate the extent of difficulties in setting the following elements of contract at the contracting stage:

(UNC1) requirements specification
(UNC2) delivery dates
(UNC3) costs

Opportunism. For this particular outsourcing project, please indicate the extent to which the following behaviour of the contractor had been perceived by our company:

(OPP1) the contractor altered the facts slightly in order to get what it wanted
(OPP2) the contractor had promised to do things without actually doing them later
(OPP3) the contractor always provided accurate information relating to the project (reverse score) (dropped)

Outsourcing success. For this particular outsourcing project, please indicate the extent of satisfaction derived from the project in the following aspects:

(SUC1) focus on core business (dropped)
(SUC2) increase IS competence
(SUC3) access to skilled personnel
(SUC4) cost savings on human resources
(SUC5) cost savings on technological resources
(SUC6) control of IS expenses

Table 6. Analysis of correlational differences

Variable	High A-S	Low A-S	Difference	z-value	Significance
OPP	0.496	−0.102	0.598	2.889	$P < 0.01$
SUC	−0.341	−0.110	0.188	1.116	$P > 0.1$

(SUC7) avoidance of obsolescence risk
(SUC8) access to key IS
(SUC9) overall successfulness (dropped)

APPENDIX B: DEGREE OF RELATIONSHIP

To test the moderating effect on the degree of relationships, median split was performed on asset specificity, resulting in two groups with 47 and 48 members. For both groups, the correlations between uncertainty and opportunism and between uncertainty and outsourcing success were calculated. According to Arnold (1982), the following formula can be used for testing differences between correlations:

$$z = (r_1 - r_2)\Big/\left\{[1/(n_1 - 1) + 1/(n_2 - 1)]^{1/2}\right\}$$

where r_i and n_i are, respectively, the correlation and the sample size of group i. Table 6 shows the differences between correlations and their statistical significance.

From Table 6, it is clear that the correlation between uncertainty and opportunism is significantly different for the two groups, but not the correlation between uncertainty and outsourcing success. This shows that the degree of underlying relationship between uncertainty and opportunism varies across levels of asset specificity, but no such systematic variation is found for the degree of relationship between uncertainty and outsourcing success.

From the above analysis and the previous regression analysis, asset specificity has been shown to have statistically significant moderating effects on the relationship between uncertainty and opportunism in terms of the form as well as the degree of that relationship. Consistent with the predictions of TCT, this finding demonstrates that, when the level of asset specificity is higher, not only is uncertainty more likely to motivate contractors to engage in opportunistic behaviour, but such an association is also stronger.

REFERENCES

Alpar, P. & Saharia, A.N. (1995) Outsourcing information systems functions: an organization economics perspective. *Journal of Organizational Computing*, **5** (3), 197–217.

Anderson, E. & Schmittlein, D.C. (1984) Integration of the sales force: an empirical examination. *Rand Journal of Economics*, **15**, 385–395.

Ang, S. & Beath, C.M. (1993) Hierarchical elements in soft-

ware contracts. *Journal of Organizational Computing*, **3**, 329–361.

Armstrong, J.S. & Overton, T.S. (1977) Estimating non-response bias in mail surveys. *Journal of Marketing Research*, **14**, 396–402.

Arnold, H.J. (1982) Moderator variables: a clarification of conceptual, analytic, and psychometric issues. *Organizational Behaviour and Human Performance*, **29**, 143–174.

Aubert, B.A., Rivard, S. & Patry, M. (1996a) A transaction cost approach to outsourcing behaviour: some empirical evidence. *Information and Management*, **30**, 51–63.

Aubert, B.A., Rivard, S. & Patry, M. (1996b) Development of measures to assess dimensions of IS operation transactions. *Omega*, **24** (6), 661–680.

Babbie, E.R. (1973) *Survey Research Methods.* Wadsworth, Belmont, CA.

Buckley, P.J. & Casson (1988) A theory of cooperation in international business. In: *Cooperative Strategies in International Business,* Contractor, F. &.Lorange P. (eds). Lexington Books Lexington, MA:.

Cheon, M.J., Grover, V. & Teng, J.T.C. (1995) Theoretical perspective on the outsourcing of information systems. *Journal of Information Technology*, **10**, 209–219.

Chiles, T.H. & McMackin, J.F. (1996) Integrating variable risk preferences, trust, and transaction cost economics. *Academy of Management Review*, **21** (1), 73–99.

Clark, T.D. Jr (1992) Corporate systems management: an overview and research perspective. *Communications of the ACM*, **35** (2), 60–75.

Coase, R.H. (1937) The nature of the firm. *Economica*, **4**, 386–405.

Coase, R.H. (1991) The nature of the firm: influence. In: *The Nature of the Firm: Origins, Evolution, and Development*, Williamson, O.E. & Winter, S.G. (eds), pp. 61–74. Oxford University Press, New York.

Collins, J.S. & Millen, R.A. (1995) Information systems outsourcing by large american industrial firms: choices and impact. *Information Resources Management Journal*, **8** (1), 5–13.

Cronbach, L.J. (1947) Test "reliability": its meaning and determination', *Psychometrika*, **16** (March), 1–16.

Cronbach, L. (1987) Statistical tests for moderator variables: flaws in analysis recently proposed. *Psychological Bulletin*, **102**, 414–417.

Currie, W.L. & Willcocks, L.P. (1998) Analysing four types of IT sourcing decisions in the context of scale, client/supplier interdependency and risk mitigation. *Information Systems Journal*, **8**, 119–143.

Dasgupta, P. (1988) Trust as a commodity. In: *Trust: Making and Breaking Cooperative Relations*, Gambetta, D. (ed.), pp. 49–72. Basil Blackwell,.Oxford.

Dietrich, M. (1994) *Transaction Cost Economics and Beyond*. Routledge, London.

Dow, G.K. (1987) The function of authority in transaction cost economics. *Journal of Economic Behaviour and Organization*, **8**, 13–38.

Drazin, R. & Van de Ven, A.H. (1985) Alternative forms of fit in contingency theory. *Administrative Science Quarterly*, **30**, 514–539.

Dyer, J.H. (1996) Does governance matter? *Keiretsu* alliances and asset specificity as sources of japanese competitive advantage. *Organization Science*, **7**, 649–666.

Ganesan, S. (1994) Determinants of long-term orientation in buyer-seller relationships. *Journal of Marketing*, **58**, 1–19.

Ghoshal, S. & Moran, P. (1996) Bad for practice: a critique of the transaction cost theory. *Academy of Management Review*, **21** (1), 13–47.

Grover, V., Cheon, M.J. & Teng, J.T. (1996) The effect of service quality and partnership on the outsourcing of information systems functions. *Journal of Management Information Systems*, **12** (4), 89–116.

Gurbaxani, V. (1996) The new world of information technology outsourcing. *Communications of the ACM*, **39** (7), 45–46.

Gurbaxani, V. & Whang, S. (1991) The impact of information systems on organizations and markets. *Communications of ACM*, **34** (1), 59–73.

Hair, J.F., Anderson, R., Jr, Tatham, R.L. & Black, W.C. (1995) *Multivariate Data Analysis with Readings*, 4th edn. Prentice Hall, Englewood Cliffs, NJ.

Hays, W.L. (1983) *Statistics*. Holt, Rinehart & Winston, New York:

Hill, C.L. (1990) Cooperative, opportunism, and the invisible hand: implications from transaction cost theory. *Academy of Management Review*, **15**, 500–514.

Hu, Q., Saunders, C. & Gebelt, M. (1997) Research report: diffusion of information systems outsourcing: a reevaluation of influence sources. *Information Systems Research*, **8**, 288–301.

Huber, G.P. & Power, D.J. (1985) Retrospective reports of strategic-level managers: guidelines for increasing their accuracy. *Strategic Management Journal*, **6**, 171–180.

Jaccard, J., Turrisi, R. & Wan, C.K. (1990) *Interaction Effects in Multiple Regression*. Sage Publications, Newbury Park, CA.

John, G. (1984) An empirical investigation of some antecedents of opportunism in a marketing channel. *Journal of Marketing Research*, **21**, 278–289.

John, G. & Weitz, B.A. (1988) Forward integration into distribution: an empirical test of transaction cost analysis. *Journal of Law, Economics, and Organization*, **4**, 337–355.

Joskow, P.L. (1985) Vertical integration and long-term contracts: the case of coal-burning electric generating plants. *Journal of Law, Economics, and Organization*, **1**, 33–80.

Joskow, P.L. (1988) Asset specificity and the structure of vertical relationships: empirical evidence. *Journal of Law, Economics, and Organization*, **4**, 95–117.

Jurison, J. (1995) The role of risk and return in information technology outsourcing decisions. *Journal of Information Technology*, **10**, 239–247.

Klein, B. (1988) Vertical integration as organizational ownership: the Fisher Body–General Motors relationship revisited. *Journal of Law, Economics, and Organization*, **4**, 199–213.

Klein, B. & Leffler, K.B. (1981) The role of market forces in assuring contractual performance. *Journal of Political Economy*, **89**, 615–641.

Klepper, R. (1995) The management of partnership development in I/S outsourcing. *Journal of Information Technology*, **10**, 249–258.

Kreps, D.M. & Wilson, R. (1982) Reputation and Imperfect Information. *Journal of Economic Theory*, **27**, 253–279.

Lacity, M.C. & Hirschheim, R. (1993) *Information Systems Outsourcing: Myths, Metaphors and Realities*. Wiley, Chichester.

Lacity, M.C. & Willcocks, L.P. (1996) Interpreting information technology sourcing decision from a transaction cost perspective: findings and critique. *Accounting, Management, and Information Technology*, **5** (3/4), 203–244.

Langlois, R.N. (1985) The new institutional economics: an introductory essay. In: *Economics as a Process: Essays in the New Institutional Economics,* Langlois, R.N. (ed.), pp.1–25. Cambridge University Press, Cambridge.

Loh, L. (1994) An Organization-economic blueprint for information technology outsourcing: concepts and evidence. In: *Proceedings of the Fifteenth International Conference on Information Systems, Vancouver,* DeGross, J.I., Huff, S.L.& Munro, M.C.(eds), pp. 73–90.

Loh, L. & Venkatraman, N. (1992) Diffusion of information technology outsourcing: influence sources and the Kodak effect. *Information Systems Research*, **3**, 334–358.

Lohtia, R., Brooks, C.M. & Krapfel, R.E. (1994) What constitutes a transaction-specific asset? An examination of the dimensions and types. *Journal of Business Research*, **30**, 261–270.

Madhok, A. (1996) The organization of economic activity: transaction costs, firm capabilities, and the nature of governance. *Organization Science*, **7**, 577–648.

Masten, S.E. (1993) Transaction costs, mistakes, and performance: assessing the importance of governance. *Managerial and Decision Economics*, **14**, 119–129.

Masten, S.E., Meehan, J.W. & Snyder, E.A. (1991) The costs of organization. *Journal of Law, Economics, and Organization*, **7**, 1–25.

Milgrom, P. & Roberts, J. (1982) Predation, reputation, and entry deterrence. *Journal of Economic Theory*, **27**, 280–312.

Milgrom, P. & Roberts, J. (1992) *Economics, Organization and Management*. Prentice Hall, Englewood Cliffs, NJ.

Moschandreas, M. (1997) The role of opportunism in transaction cost economics. *Journal of Economic Issues*, **31** (1), 39–57.

Nam, K., Rajagopalan, S., Rao, H.R. & Chaudhury, A. (1996) A two-level investigation of information systems outsourcing. *Communications of ACM*, **39** (7), 36–44.

Ngwenyama, O.K. & Bryson, N. (1999) Making the information systems outsourcing decision: a transaction cost approach to analyzing outsourcing decision problem. *European Journal of Operational Research*, **115**, 351–367.

Nunnally, J. (1978) *Psychometric Theory*. McGraw-Hill, New York.

Patane, J. & Jurison, J. (1994) Is global outsourcing diminishing the prospects for American programmers?. *Journal of System Management*, **45**, 6–10.

Pfeffer, J. (1982) *Organizations and Organization Theory*. Pitman, Marshfield, MA.

Ping, R.A. (1996) Improving the detection of interactions in selling and sales management research. *Journal of Personal Selling and Sales Management*, **16** (1), 53–64.

Rao, H., Nam, K. & Chaudhury, A. (1996) Information systems outsourcing. *Communications of ACM*, **39** (7), 27–28.

Richmond, W.B., Seidmann, A. & Whinston, A.B. (1992) Incomplete contracting issues in information systems development outsourcing. *Decision Support Systems*, **8**, 459–477.

Rindfleisch, A. & Heide, J.B. (1997) Transaction cost analysis: past, present, and future applications. *Journal of Marketing*, **61** (October), 30–54.

Ring, P.S. & Van de Ven, A. (1992) Structuring cooperative relationships between organizations. *Strategic Management Journal*, **13**, 483–498.

Riordan, M.H. & Williamson, O.E. (1985) Asset specificity and economic organization. *International Journal of Industrial Organization*, **3**, 265–278.

Scarbrough, H. (1995) Blackboxes, hostages and prisoners. *Organization Studies*, **16** (6), 991–1019.

Shelanski, H.A. & Klein, P.G. (1995) Empirical research in transaction cost economics: a review and assessment. *Journal of Law, Economics, and Organization*, **11** (2), 335–361.

Simon, H.A. (1961) *Administrative Behaviour*, 2nd edn. Macmillan, New York.

Vijayan, J. & Hoffman, T. (1997) Improved service top-cited outsourcing goal. *Computerworld*, **31** (48), 10.

Wang, E., Barron, T. & Seidmann, A. (1997) Contracting structures for custom software development: the impacts of informational rents and uncertainty on internal development and outsourcing. *Management Science*, **43**, 1726–1744.

Weight, K. & Camerer, C. (1988) Reputation and corporate strategy: a review of recent theory and application. *Strategic Management Journal*, **9**, 443–454.

Williamson, O.E. (1975) *Markets and Hierarchies: Analysis and Antitrust Implications*. The Free Press, New York.

Williamson, O.E. (1979) Transaction-cost economics: the governance of contractual relations. *Journal of Law and Economics*, **22**, 233–262.

Williamson, O.E. (1983) Credible commitments: using hostages to support exchange. *American Economic Review*, **73**, 519–540.

Williamson, O.E. (1985a) *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. The Free Press, New York.

Williamson, O.E. (1985b) The economics of governance: framework and implications. In: *Economics as a Process: Essays in the New Institutional Economics,* Langlois, R.N.(ed.), pp. 171–202. Cambridge University Press, Cambridge.

Williamson, O.E. (1989) Transaction cost economics. In: *Handbook of Industrial Organization,* Schmalensee, R.& Willing, R. (eds), pp. 136–182. Elsevier Science, Amsterdam.

Williamson, O.E. (1993a) Calculativeness, trust, and economic organization. *Journal of Law and Economics*, **36**, 453–486.

Williamson, O.E. (1993b) Opportunism and its critics. *Managerial and Decision Economics*, **14**, 97–107.

Williamson, O.E. (1996a) *The Mechanisms of Governance*. Oxford University Press, New York.

Williamson, O.E. (1996b) Economic organization: the case for candor. *Academy of Management Review*, **21** (1), 48–57.

Zaheer, A. & Venkatraman, N. (1995) Relational governance as an interorganizational strategy: an empirical test of the role of trust in economic exchange. *Strategic Management Journal*, **16**, 373–392.

Biography

Eric T. G. Wang is a professor in the Department of Information Management at National Central University, Taiwan (ROC). He received his PhD in Business Administration, specializing in computer and information systems, from the William E. Simon School of Business Administration, University of Rochester. His research interests include electronic commerce, outsourcing, organizational economics and organizational impact of information technology. His research has appeared (and is due to appear) in *Information Systems Research, Management Science*, *Decision Support Systems*, *International Journal of Information Management*, *Omega, European Journal of Operational Research*, *Journal of Organizational Computing*, and others.