The Strategic Role of Business Intelligence in the Extended Enterprise: BI Configurations for Control Affordances in Outsourcing

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Abstract

This study examines the impact of business intelligence in the extended enterprise. Specifically, we develop propositions about how BI contributes to the way firms can leverage outsourcing relationships for operational performance improvement and two strategic ends: mastery of uncertainty and development of strategic resources and capabilities. Drawing on a set of control theories from the organization theory, economics, and accounting domains, we explain that BI changes the possibilities for the extended enterprise by introducing new control affordances. We operationalize business intelligence as a set of "BI elements" rather than as a unitary construct, in order to propose configurational theory in which the strategic, tactical, and operational benefits of outsourcing can be realized through different BI configurations. This is research-in-progress and we are currently seeking data for a pilot test.

1. IT, strategy, and the extended enterprise

A major theme in information systems research over the past two decades has been to show that IT supports not only operational efficiency and decision-making, but is an important enabler of strategies [1] and strategic transformations [2]. Business intelligence (BI) technologies and applications, such as data integration and analytics, are in the spotlight, and there is now a substantial body of research into the effects of BI on strategic outcomes such as strategic decision making [3], innovation [4], and business transformation [5].

This trend coincides with a growing interest in the strategic management discipline in alliances, networks, and the ways these interorganizational relationships convey strategic advantage [6,7]. Information systems scholars have shown that business networks enhance the strategic value of IT [2] and that IT capabilities enhance the strategic value of business networks [8]. We contribute to this growing area of overlap between IS and strategy by inquiring into the strategic role of business intelligence in the extended enterprise.

The *extended enterprise* refers to a firm and the network of partners with which it is connected by way of alliances, boundary-spanning processes, and inter-organizational information systems (IOS), viewed from the perspective of the focal firm. The strategic importance of inter-organizational networks has long been recognized in the strategy [9] and information systems [10,2] literatures, and recent work in both areas has taken an explicit focal-firm perspective, asking how firms can use their alliances and IOS for strategic advantage [6,8].

Because the range of possible extended enterprise configurations is very diverse, some narrowing down of the problem is necessary for a practical research projects. One particularly well-studied extended enterprise model is business process *outsourcing*, in which organizations turn to outside vendors to perform important business activities that could alternatively be, or previously were, performed within the organization. Because we can draw on a rich and eclectic outsourcing literature for theory-building material [11], we choose to use outsourcing to examine the strategic impact of BI on the extended enterprise. Specifically, we ask: how does BI change the way(s) firms can leverage outsourcing relationships for strategic ends?

In subsequent studies, we can expand our focus to other slices of the extended enterprise, such as joint ventures or the supply chain.

1.1. Focus on outsourcing

In a thorough review and analysis of outsourcing literature, Dibbern et al [11] organize the findings of prior research according to five questions: *why* firms outsource, *what* outsourcing options are available, how firms decide *which* options to take, *how* outsourcing relationships are implemented, and what *outcomes* result from outsourcing. Although their review specifically targeted papers on information systems outsourcing, as opposed to outsourcing of other business processes, they noted that the IS outsourcing literature *is* the primary literature on outsourcing, and

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there is little reason to believe that most of the findings were not generalizable.

These five overarching questions are interrelated. If we wish to propose that BI creates new options for outsourcing, for example, we must then consider how those options affect implementation, relationship development, and outcomes. All of these questions depend on the first: why do firms outsource? By definition, outsourcing is in competition with the "insourcing" alternative, so we must identify the intended or perceived benefits of outsourcing over insourcing before we can further investigate how BI contributes to the pursuit of these benefits.

Although dozens of antecedents and drivers of outsourcing can be identified in the literature [11], a few key ideas are dominant drivers of outsourcing in practice. We distinguish between operational, tactical, and strategic (intended) benefits, a framework that is well-established in IS scholarship [12]. At the level of operational benefits, outsourcing is perceived as offering greater quality/effectiveness, lower cost, or both. The rise of interest in outsourcing in the 1990s is certainly related to the emergence of "core competency" thinking in strategy. Together, the two ideas suggest that firms ought to keep their core activities in-house and outsource every other activity to vendors who can do them better. These operational benefits are expected to accrue due to economies of scale, specialization of expertise, better capacity utilization, a low-cost labor pool, or competition and market forces generally.

Table 1. Motivators of Outsourcing (3 Levels of Intended or Perceived Benefits)

Operational
Performance and efficiency, because:
Vendors have economies of scale. Vendors have superior capacity utilization. Vendors have specialized employees and skills. Offshore vendors have lower labor costs. Competition between vendors improves quality/cost.
Tactical
Tactical flexibility, because:
Fixed cost is traded for variable ("as a service") cost. Activity can be scaled up or scaled down easily. Vendors offer a wider range of service options than the firm could hope to provide for itself.
Strategic
Mastery of uncertainty, because:
Vendor network is intelligence-gathering network. Flexible outsourcing supports adaptation to change. Partnering can also be used to shape environment.
Resource/capability development, because:
Vendors offer access to specialized capabilities. Cooperation with partners can help firms build *internal* capabilities, too. (Outsourcing is a dynamic capability.)

The tactical level is the domain of managerial decision making, planning, and resource allocation. The main tactical benefits that drive outsourcing are various types of flexibility. Outsourcing trades in the fixed cost of building an internal capability for the variable cost of purchasing an activity as a service, thus enabling the outsourcer to scale up or scale down utilization of the activity as needs change. In addition, some types of outsourcing may enable the firm to reconfigure the activity itself on short notice, drawing on the "menu" of service components offered by a vendor. For example, an internet service provider may also have capabilities for website development or internet marketing, which the outsourcer could draw upon if a need arose.

These operational and tactical reasons for outsourcing are well known to academics and practitioners. We had to dig further into the academic literature to identify the potential *strategic* reasons for outsourcing.

1.2. Strategic reasons for outsourcing

We view strategy as the domain of external uncertainty, in which organizations seek to understand the evolving economic, technological, and competitive landscape, and shape or adapt to changes in this environment [13]. There are, of course, a great diversity of theories of strategic management [14] and of strategy and information systems [15]. In an important paper, Hoffman [6] explains that key strategic reasons for engaging in cooperative interorganizational relationships are to master strategic uncertainty and to improve the firm's strategic resource endowment. In other words, outsourcing offers a firm a way to match its strategy (in the resource-based view, a set of resources and capabilities) to its changing business environment.

There are a number of ways that outsourcing may facilitate such matching. On one hand, a network of outsourcing "partners" can serve as an intelligence-gathering network, enhancing the focal firm's visibility into its changing environment and mitigating strategic uncertainty [16,17]. On the other, a healthy market of vendors enables the focal firm to quickly access new capabilities when they become strategically important, without the money and time cost of building the skills internally. In addition to these "adapting" tactics, cooperative outsourcing relationships may also be used to develop a firm's own internal resources. For example, partnerships with multiple advertising and media outlets may be useful in developing the firm's

marketing capability. In this way, outsourcing may be seen as a *dynamic capability* [18,19]. Finally, outsourcing may be used to actively *shape* the environment to align with the firm's strengths.

Table 1 summarizes the operational, tactical, and strategic purposes that firms may have in mind when they choose to outsource, and the reasoning behind why those benefits might accrue.

2. Role of BI: new *control* options

Konsynski's [10] seminal article on "strategic control in the extended enterprise" provided the starting point for our thinking about how BI affects the way firms leverage interorganizational relationships for strategic ends. Konsynski characterizes strategic control as the IT-enabled capabilities of *understanding* and *influence* in the extended enterprise. The role of IT (here, referring to IOS in general) is to help the firm collect and interpret data from its partners, and to direct or manage its partners through IOS, "changing the rules" of the business. Around the same time, Venkatraman [2] highlighted the role of IT in enabling strategic business network *transformation* such as business process redesign, network redesign, or business scope redefinition. These themes – IS as interorganizational control system [e.g., 20], and IS as options for business transformation [e.g., 19] – continue to be echoed in literature on business intelligence, and more broadly on enterprise systems and IOS. Following the lead of the literature, we theorize that BI impacts the extended enterprise by introducing new options for strategic leveraging of outsourcing relationships. For guiding theory, we draw on a synthesis of theories of *control*, including agency theory and organizational control theory [21,22,23].

2.1. Synthesis of control theories

Ouchi [21,22] was one of the first organization theorists to study the problem of control as a distinct one. He noted that scholars from as far back as Weber, through the 1960s-70s, had understood control as synonymous with organizational structure. The literature prescribed different organizational forms as solutions to control needs that stemmed from various technologies (task characteristics). In much-cited papers, Ouchi distinguished control from structure [21] and laid out the basic principles of a theory of *organizational control* explaining "the mechanisms through which an organization can be managed so that it moves toward its objectives" [22].

Organizational control in Ouchi's formulation usually models the problem of an organization managing its workers (although there is no reason why the same concepts cannot be applied to the management of a machine, a process, or another organization such as a vendor). Two basic strategies for organizational control are (1) to develop a cybernetic system that monitors work, evaluates performance according to a standard, and gives feedback to managers who can take corrective action; or alternatively (2) to employ people whose values and objectives align perfectly with those of management. The two strategies are not mutually exclusive, indeed, they are complements. "Cybernetic control" requires costly investments in information systems and layers of management, whereas "social control" implies either high search and selection costs for human resources, or a lengthy training and socialization process. Either approach to social control makes the organization very vulnerable to turnover. Depending on these relative costs and vulnerabilities for a particular organization, management will likely choose a mix of monitoring and socialization approaches to control.

Only two phenomena can be observed by a cybernetic control system: behavior of the subjects being controlled, and outputs that result from that behavior. In order to implement an effective behavior-based control system, management must have correct knowledge about means-ends relationships. In order to build an output-based control system, management must have a valid and reliable measurement of the desired output. The choice between behavior control and output control thus hinges on the availability of information to satisfy these requirements. Ouchi found that organizational structure [21] and task characteristics [22] are important determinants of the choice of control strategy because they impact the knowledge of means-ends relationships and the availability of output measures.

Consider a baseball team achieving a double play. Given the cooperative nature of the task, the coach has a hard time assigning a quantitative outcome measure to each infielder's contribution. However, if the coach knows the "right" way his players should be doing their jobs, he can manage each player with individual feedback on *behavior*. By contrast, consider the example of a life insurance agent. Due to the complex and tacit nature of selling (task characteristic) and perhaps the management layers separating insurance company insiders from the job of customer-facing agents (structure), it is difficult both to prescribe the "right" way to sell policies, or to monitor agents. Instead an output measure, sales, is easily quantified and used to evaluate performance. In some cases, both behavior control and output control are possible, as in a manufacturing assembly line with well-defined tasks.

When organizations don't understand means-ends relationships and can't measure outputs, no strategies

are possible except social control that aligns workers' objectives with those of the organization. National culture, the norms of a profession, or a shared set of values within a firm ("clan control") are forms of social control systems.

		Knowledge of means-ends relationships	
		Perfect	*Imperfect*
Availability of output measures	*High*	Behavior Control or Output Control (e.g., assembly line)	Output Control (e.g., insurance company)
	Low	Behavior Control (e.g., baseball team)	Social Control (e.g., foreign service)

Figure 1. Conditions determining control strategy, adapted from Ouchi [21,22]

In summary, Ouchi's major contributions were to identify three control strategies – cybernetic behavior control, cybernetic output control, and social control – and to show that the choice of control strategy is guided by the availability of output measurement and means-end knowledge, which are in turn impacted by task characteristics and organizational structure. These elements characterize the organization theory perspective on control.

Eisenhardt [23] showed that an important complementary literature on control could be found in *agency theory*, a perspective that had been mainly the domain of economics and accounting. Agency theory focuses on the problem of determining an optimal contract between a principal and agent, assuming divergent preferences (i.e. the agent would like to work less, and is more risk averse, than the principal would prefer) and uncertain outcomes. Where organizational control theory places central focus on performance evaluation, agency theory focuses on rewards, but like organizational control theory holds that rewards can be based on behavior evaluation, output measurement, or a combination of both.

Agency theory highlights the role of outcome uncertainty in the problem of control. Because results are uncertain, good performance can sometimes yield poor returns, and poor performance can sometimes yield good returns. When output-based reward systems are employed, agents therefore assume some of the business's risk – as is often the case for top-tier executives who receive much of their pay in the form of bonuses and stock options. These output-based rewards can be very motivating, but also have the potential to encourage maladaptive behavior, as agents neglect those duties that are not measured, or make risk-averse choices that aren't optimal for the organization. In agency theory, therefore, the choice between behavior control and output control is made by weighing the cost of monitoring behavior against the three costs involved in output control: the cost of monitoring outputs, the premium that must be paid to the agent for bearing risk, and the potential "cost" of maladaptive behavior.

Synthesizing the organizational control and agency theory perspectives yields a richer understanding of the problem of designing control systems [23]. An additional theory that helps us link the usage of control systems to the operational, tactical, and strategic *intended* benefits is the control systems usage theory of Simons [24,25]. Simons proposed that regardless of the design of an information system, managers could use such a system in two different control modes: diagnostic, and interactive. Where consistent high performance is critical, such as in afirm's core operational process, managers use a *diagnostic* control mode that can be succinctly explained as management-by-exception. When and where performance falls below acceptable levels, the manager intervenes to take corrective action.

By contrast, in areas where strategic uncertainty about the future of the firm is more salient, managers may opt for an *interactive* control mode. In this mode, performance measurements are the subject of an ongoing conversation between organizational levels. Deviations from expected performance trigger not remedial action, but debate and investigation into the drivers of performance and the appropriateness of the standards against which it is measured. The interactive control mode is more geared toward strategic knowledge creation and uncertainty reduction than toward performance optimization. The critical point of Simons's thesis is that any control system can be used in either mode, and indeed the same information system may be used different ways in different organizations based on their needs.

The key ideas that result from integrating the various theories of control are:

- Control is a system of performance monitoring and evaluation, reward sharing, *and* risk allocation.
- Control can be based on behavior or outputs, or both.

- Task characteristics and organization structure are important determinants of the possibility and cost of monitoring behavior and outputs.

- Knowledge of means-ends relationships is a precondition for behavior control. A behavior control system built on a flawed theory can lead to suboptimal output.

- Output controls can lead to maladaptive behavior in which agents neglect responsibilities that are not measured.

- Where there is uncertainty in output, output control shifts risk onto agents. Principals must pay a premium for this risk-shifting, and there is a chance of maladaptive behavior by risk-averse agents.

- Social control represents an alternative to cybernetic control.

- Control systems, regardless of design, may be used in a diagnostic manner when performance is critical, or an interactive manner where strategic uncertainty is particularly salient.

The reference theories of organizational control, agency theory, and diagnostic and interactive control, are often used to explain how managers oversee their employees, but considerable literature carries them into other contexts, such as shareholder control of executives, and parent firm control of subsidiaries. We argue that the insights from control theorizing are particularly relevant in the outsourcing context, because outsourcing relationships are characterized by roles (principal and agent) and goals (operational, tactical, strategic) that firms work to achieve through partners. This makes the outsourcing problem akin to the management control problem but unlike other "interorganizational" phenomena such as communities of practice. Furthermore the constraints on monitoring vendor activity, the principal's expectations of high performance, and the need to master strategic uncertainty, are all extremely salient in outsourcing. Therefore, we use control theory as a guide to investigating how business intelligence changes the extended enterprise (outsourcing) picture.

2.2. BI introduces new control options

In organizational control theory, the possibility of monitoring and measuring behavior or outcomes is a given, determined by task characteristics [21,22]. In agency theory, on the other hand, one of the assumptions is that such monitoring can be accomplished at some cost (information systems investment) and the difference in costs of the two types of monitoring is a normative driver of control design.

Of course, the truth is somewhere between these two assumptions. Investments in information systems may create new options for business monitoring, reduce the cost of monitoring, or improve the validity and reliability of measurement. It is the job of IS scholarship to discover and understand what the different types of information systems can (and cannot) contribute to the challenges of control.

In this paper, we are interested in how business intelligence (distinct from other information systems concepts) changes the available options for control. A number of BI affordances for control, drawn from literature and contact with practice, are presented in Table 2 and explained below.

Table 2. BI Affordances for Control

1. Makes behavior control possible where vendor process was previously opaque.
2. Makes outcome control possible where certain outcomes were previously hard to measure.
3. Makes diagnostic control mode available where information overload was previously an obstacle.
4. Makes effective interactive control mode possible where data quality and visibility was previously a hindrance.
5. Makes rich data monitoring and exchange compatible with flexibility and reconfigurability of outsourcing arrangements.

Makes behavior control possible: Behavior control refers to a control system in which agents are evaluated and rewarded according to what they do, instead of according to outcomes. Control theories indicate that behavior control is a better way of ensuring performance when outcomes have significant random variation, because outcome-based controls in those cases might reward bad performers who have good luck over solid performers who have bad luck. However, behavior control requires a great deal more data than outcome-based control. Depending on the task, principals may want to monitor process steps, or a variety of performance measures, for which data may not have been previously collected. In outsourcing, perhaps a greater challenge is that vendors could not give principals access to the data either due to

incompatible IT systems or the need to protect trade secrets. Business intelligence helps create the option of behavior control in such situations, by facilitating the collection and integration of large amounts of data from various systems, and also by creating a culture of transparency between partners.

In a case study of call center outsourcing, the principal knew a lot about how sales calls should be answered, but was unable to access detailed data from its call center vendors before implementing BI [26]. It had to settle for outcome control, rewarding the call center based only on the number of orders placed. Since implementing BI and integrating data with its (multiple) call center vendors, the principal is now able to monitor individual operators within each call center on a number of variables such as closing rate, success rate for cross-selling, etc, and reward them individually with priority for answering future incoming calls (for which they earn commissions).

Makes outcome control possible: In the same case study [26], the firm wished to control the performance of its various marketing campaigns (not outsourced in that case, but the principle generalizes), but the real outcome seemed impossible to measure: the actual profit or loss resulting from each advertisement they ran on TV. As part of BI implementation, they were able to develop a KPI (key performance indicator) that enabled this outcome measurement. Doing so involved integrating data from outsourced call centers (the number of new customers acquired from each advertisement), and outsourced fulfillment and customer service centers (customer lifetime value as a sum of initial and repeat orders, returns, and customer service costs for each customer), to calculate the lifetime profit or loss total for each customer-acquisition campaign. With data integration, a single version of the truth, and dashboards/reports to slice and dice the data, outcome-based control was made possible for a previously intractable problem.

Makes diagnostic mode available for complex problems: The diagnostic mode of control is management by exception. Its strengths are the maintenance of strict standards of expected performance and the ability to react speedily to problems. Two primary obstacles to employing diagnostic control in outsourcing are the lag time in receiving reports of performance, and the potential for information overload in complex processes. Firms that outsource manufacturing, for example, gain little benefit from reacting weeks late to quality problems in a single process step or single part. In the past, these kinds of outsourcing had to be managed by a mix of interactive control (active, continuous, and expensive co-management with the vendor, perhaps on-site) and "social" controls (expecting that reputation concerns or professionalism would make the vendor take responsibility for performance).

BI changes the picture here by enabling real-time process monitoring even of vendors dispersed around the world. Furthermore, the concepts of dashboards and drill-down reduce the risk of information overload, enabling managers to use "traffic lights" as guides to focus their attention on problems even in the details.

Makes interactive mode available: On the other hand, in some cases outsourcing is an obstacle to the interactive control mode that's essential to managing strategic uncertainty. Interactive control demands that principals and agents be able to have a continuous and evolving "conversation" about salient strategic issues. Obstacles to doing so include the dispersion of fragmented knowledge throughout the extended enterprise, and the inconsistent identification and definition of entities in the data.

A primary example is data about customers. If customer contacts involve a number of vendors, such as marketing firms, logistics firms, and customer service vendors, each may track customers differently, making it hard for connections to lead to customer insight. If data is opaque and limited to outcomes, outsourcing makes it impossible to detect trends in changing customer preferences. The firm would either have to insource those functions (giving up the operational and tactical benefits of outsourcing) or give up hope of insight into strategic uncertainty.

BI creates an opportunity to achieve both benefits. By enabling rich data sharing between principal and vendors, creating a unified version of truth, and enabling sophisticated analytics, BI facilitates the ongoing discovery and discussion of issues salient to strategy [27].

Makes rich data exchange compatible with flexibility: Control theory says little about flexibility, assuming that the problem is management of agents rather than the ability to drop and add new agents, but flexibility and reconfigurability of the extended enterprise ("partnering flexibility") is increasingly seen as an important strategic capability in the strategic information systems discipline [8,28]. In one of Ouchi's papers [22], he introduces "market control" as yet another alternative control form. A strict form of outcome control, market control uses a single performance variable, price, and by way of competitive market forces ensures that agents (vendors) perform as the principals expect. But this forces a trade-off: firms may choose either the operational efficiency benefits that result from market forces, or the strategic benefits

of rich data exchange in inflexible principal-agent relationships.

By introducing data and process standards, BI enables the modular disconnection and (re)connection of principal and vendor systems, enabling the same kind of rich data integration discussed above but without sacrificing the partnering flexibility that is essential to create market forces to drive performance. In this way, firms could enjoy the operational benefits of a competitive outsourcing market, the tactical benefits of flexible partnering, and the strategic benefit of adaptive knowledge creation at the same time [29].

3. Research approach based on BI elements

At this point in the paper, an explanation of how we define and treat "business intelligence" is perhaps becoming overdue. There are probably as many definitions of that term as there are academics, practitioners, and consultants using it, and we have sidestepped the potential controversy of defining BI for the following reason: Experience with successful and unsuccessful business intelligence projects teaches that from the point of view of practice, one of the least important parts of implementing BI is... BI [26].

Instead, the difference between success and failure depends largely on the organizational, process, and IT infrastructural changes undertaken on the "back-end" [30] of the project, that make "front-end" applications like dashboards and analytics worth the effort. A variety of project implementation factors [31], data management issues [32], and process integration issues [33,20] are believed to be important to successful use of analytics. The literature on enterprise systems success is very informative here, as enterprise systems like ERP and CRM often overlap with business intelligence and analytics, and have many of the same "back-end" challenges.

It is these elements of implementing and supporting a BI effort that consume the majority of practitioners' time. Thus, we intend to operationalize business intelligence as a (not necessarily exhaustive) set of "BI elements" that may or may not be present in any given BI implementation. These elements may include aspects of "information, integration, and optimization" to borrow a popular framework from enterprise systems research [34], or data, technology, organizational, and human factors. Based on the discussion in the previous section, some salient BI elements include: data collection; interorganizational data integration; real-time capabilities; a transparency norm; drill-down to detailed/granular data; dashboards; analytics; data and process standards; and facilities for communication and data sharing.

In the world of practice, questions about BI are often of the form: What do I need to do to get benefit X from my extended enterprise? What are my options? These are questions not easily answered by a variance approach to research, which assumes simultaneous, symmetrical, necessary and sufficient causality are represented by correlation coefficients. In practice, asymmetric causality is the norm. A claim that diagnostic control with dashboards will result in high operational performance, for example, is a claim of sufficiency: it does not imply that the absence of dashboards makes high performance impossible. There may well be other causes that are also sufficient for the same outcome, such as market forces. We also care about necessary causation. Some fundamentals, like good clean data, are certainly necessary for successful use of BI. Data quality alone does not guarantee success, but its absence may well guarantee failure. Relationships of necessity and sufficiency, though, may seem "not significant" in variance-oriented analytical techniques that are based on statistical correlation [35].

3.1. A set-theoretic inquiry

The theoretical challenge at the heart of our work is to understand the complex relationships between the intended benefits that drive the (outsourcing) extended enterprise, and the elements of BI that can or must be implemented in order to realize these benefits. In the real world, practitioners draw upon theories of a verbal nature, and these are fundamentally claims about *set relations* [35]. For example, a theory that asserts that data warehousing success depends on data quality and system quality [31] argues in essence that the set of successful data warehousing implementations is a *subset* of the DW implementations with high data quality and high system quality (which is itself the *intersection* of the set with high data quality and the set with high system quality). These set relations can be understood in practice as necessary conditions for various desired outcomes.

A set-theoretic research paradigm offers us a way to articulate propositions that include complex or asymmetrical causality, and that are understandable and applicable to practitioners. Not only can we express necessary and sufficient causality as set relations, but we can also describe equifinal configurations or "causal recipes" that lead to our desired outcomes. For example, we may find that cases of high operational performance are found in two supersets: the set of firms with effective diagnostic control, and the set of firms with strong market forces. Theories of this nature answer the call for more

research that focuses on "problems" instead of "solutions" [38].

In this paper, we propose a set-theoretic study to relate "BI elements" to concepts from control theory and ultimately to the operational, tactical, and strategic ends that firms pursue through outsourcing.

Although most information systems theories can be expressed in terms of set relations, in the past we have not had good tools for analyzing them other than with qualitative case study research, much of which is inherently set-theoretic. Quantitative analysis of set relations would seem to be limited to primitive tools: categorical variables and frequency tabulations. Now, however, we are fortunate to have access to a new set-theoretic methodology developed in sociology [35] that has made inroads into organization theory [36] and is just beginning to appear in information systems journals [37]. Incorporating the concept of fuzzy set membership, this approach allows us to use more informative measures than simple categorical variables, and with well-developed measures of validity ("consistency") and significance ("coverage"), fuzzy set qualitative comparative analysis (fsQCA) enables us to achieve explanatory power comparable to qualitative research, but with empirical strength and external validity (generalizability) on par with large-N quantitative (variance) methods.

For more on the set-theoretic methodology and configurational paradigm, please see [35], [36], and [37] as space in this paper is too limited to do it service.

3.2. Propositions from control theory

This part of the paper is a work-in-progress, and we would appreciate feedback at the conference on how best to articulate and diagram our set-theoretic propositions. The following propositions are derived from our synthesis of the literature on control, and they relate the (intended) benefits of outsourcing to control concepts:

P1: Cases of high **operational performance** will conform to control configurations with **partnering flexibility**, **diagnostic** control, and/or **outcome** control.

P2: Cases of successful uncertainty mastery will conform to control configurations with **partnering flexibility** and/or **interactive** control.

P3: Cases of successful **resource/capability development** will conform to control configurations with **interactive** control and/or **behavior** control.

The literature indicates that high levels of operational efficiency can be supported either by a diagnostic control mode (vigilant management by exception) or by harnessing market forces (partnering flexibility) and in both cases, require that effective performance measurement and comparison be possible (outcome control). On the other hand, strategic knowledge is created by interactive engagement with data. Hoffmann [6] envisions a progression, based on the exploration/exploitation concept [39], from the flexible use of "probing" alliances for mastering uncertainty to the more committed use of partnerships for building capabilities, so we envision slightly different configurations depending on which strategic benefit is foremost in a firm's intentions.

Note that we do not express propositions about configurations leading to the tactical benefits of outsourcing: the various types of tactical flexibility described in section 1. Flexibility is not caused by control, but it is *itself* a control affordance, enabled by IT, that can be leveraged for operational or strategic benefits, or both, as explained in section 2.2.

Figure 2 depicts the propositions just described. Each arrow could be interpreted as meaning "necessitates", and multiple arrows emanating from the same construct should be interpreted as "and/or". For example, cases of high operational performance necessitate one or more of partnering flexibility, diagnostic control, or outcome control. These may represent alternative (sufficiency) pathways to high

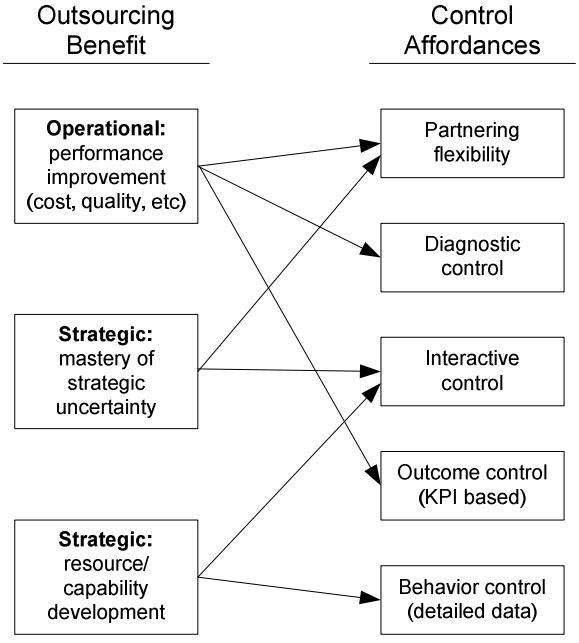

Figure 2. (intended) outsourcing benefits related to control affordances

operational performance.

3.3. Propositions about BI elements

It is the primary claim of this paper that the control mechanisms themselves are afforded by various elements of BI, and by extension that different outsourcing strategies are served by different configurations of BI elements. Some extended enterprises require real-time capabilities, some require advanced analytics, and some require process visibility – but BI implementations should not be one-size-fits-all. The following propositions follow from the discussion in section 2.2:

P4: **Partnering flexibility** necessitates the adoption of data and process **standards**.

P5: **Diagnostic** control necessitates **real-time** capabilities, **dashboards**, and **transparency** (drill-down).

P6: **Interactive** control necessitates **communication/sharing** capabilities, sophisticated **analytics** capability (human skills as well as IT), and **data integration** (single version of truth).

P7: **Outcome** control based on KPIs necessitates **dashboards** and **data integration** (single version of truth).

P8: **Behavior** control necessitates **transparency** and rich **data collection**.

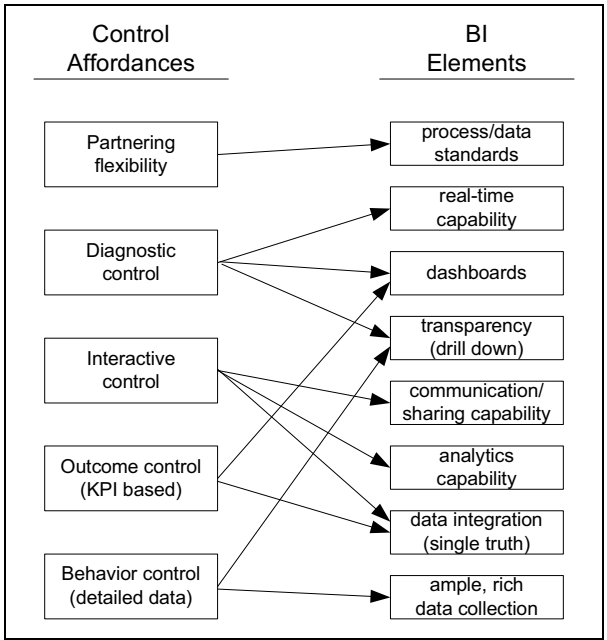

Figure 3. control affordances and configurational necessity of BI elements

Figure 3 illustrates the relationships of necessary causality in a diagram. By combining Figures 2 and 3, we show that different configurations of BI elements should support different types of operational and strategic goals in the extended enterprise.

5. Research progress

We are still developing the theoretical arguments of the paper and working on identifying a source of data. We intend to collect data through a survey instrument and are seeking cases of BI-supported outsourcing that provide a wide enough range of variation in aims and in BI implementations to test our propositions. We are considering a "shotgun" approach of conducting a large survey of the BI user community generally, or possibly a targeted study within a single corporation that has numerous outsourcing strategies (for numerous operational and strategic issues – the "issue", not the firm, being the unit of analysis because we can imagine a firm has some issues that it considers strategic, some operational, and so on). We hope to present progress on the data front at the conference.

6. References

[1] Piccoli, G., & Ives, B. (2005). IT-dependent strategic initiatives and sustained competitive advantage: A review and synthesis of the literature. *MIS Quarterly, 29*(4), 747-776.

[2] Venkatraman, N. (1994). IT-Enabled Business Transformation: From Automation to Business Scope Redefinition. *MIT Sloan Management Review, 35*(2), 73-73.

[3] Davenport, T. H., Harris, J. G., & Morison, R. F. (2010). *Analytics at work: smarter decisions, better results*. Boston, MA: Harvard Business School Press.

[4] May, T. A. (2009). *The new know: innovation powered by analytics*. Hoboken, NJ: John Wiley & Sons.

[5] Bhattacharya, P. J., Seddon, P. B., & Scheepers, R. (2010). *Enabling strategic transformations with enterprise systems: beyond operational efficiency*. Paper presented at the International Conference on Information Systems (ICIS 2010).

[6] Hoffmann, W. H. (2007). Strategies for managing a portfolio of alliances. *Strategic Management Journal, 28*(8), 827-856.

[7] Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *The Academy of Management Review, 23*(4), 660-679.

[8] Rai, A., & Tang, X. (2010). Leveraging IT Capabilities and Competitive Process Capabilities for the Management of Interorganizational Relationship Portfolios. *Information Systems Research, 21*(3), 516-542.

[9] Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational

Competitive Advantage. *The Academy of Management Review, 23*(4), 660-679.
[10] Konsynski, B. R. (1993). Strategic control in the extended enterprise. *IBM Systems Journal, 32*(1), 111-142.
[11] Dibbern, J., Goles, T., Hirschheim, R., & Jayatilaka, B. (2004). Information systems outsourcing: a survey and analysis of the literature. *SIGMIS Database, 35*(4), 6-102.
[12] Shang, S., & Seddon, P. B. (2002). Assessing and managing the benefits of enterprise systems: the business manager's perspective. *Information Systems Journal, 12*(4), 271-299.
[13] Courtney, H. (2001). Making the most of uncertainty. *McKinsey Quarterly, 2001*(4), 38-47.
[14] Mintzberg, H., & Lampel, J. (1999). Reflecting on the strategy process. *Sloan Management Review, 40*(3), 21.
[15] Gable, G. (2010). Strategic information systems research: An archival analysis. *The Journal of Strategic Information Systems, 19*(1), 3-16.
[16] Day, G. S., Schoemaker, P. J. H., & Snyder, S. A. (2009). Extended intelligence networks: minding and mining the periphery. In P. R. Kleindorfer, Y. J. Wind & R. E. Gunther (Eds.), *The Network Challenge: Strategy, Profit, and Risk in an Interlinked World* (pp. 277-295). Upper Saddle River, NJ: Wharton School Publishing.
[17] Brown, S. L., & Eisenhardt, K. M. (1997). The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly, 42*(1), 1-34.
[18] Eisenhardt, K., & Martin, J. (2000). Dynamic capabilities: what are they? *Strategic Management Journal, 21*, 1105-1121.
[19] Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. *MIS Quarterly, 27*(2), 237-263.
[20] Volkoff, O., Strong, D., & Elmes, M. (2005). Understanding enterprise systems-enabled integration. *European Journal of Information Systems, 14*(2), 110-120.
[21] Ouchi, W. G. (1977). The Relationship Between Organizational Structure and Organizational Control. *Administrative Science Quarterly, 22*(1), 95-113.
[22] Ouchi, W. G. (1979). A Conceptual Framework for the Design of Organizational Control Mechanisms. *Management Science, 25*(9), 833-848.
[23] Eisenhardt, K. M. (1985). Control: Organizational and Economic Approaches. *Management Science, 31*(2), 134-149.
[24] Simons, R. (1990). The role of management control systems in creating competitive advantage: new perspectives. *Accounting, Organizations and Society, 15*(1/2), 127-143.
[25] Simons, R. (1991). Strategic Orientation and Top Management Attention to Control Systems. *Strategic Management Journal, 12*(1), 49-62.
[26] Clark, J. W., & El Sawy, O. A. (2010). *Business Intelligence at Guthy-Renker: The Promise and Challenges of Sensing the Pulse*. Paper presented at the SIGDSS/TUN BI Congress II.
[27] Malhotra, A., Gosain, S., & El Sawy, O. A. (2005). Absorptive Capacity Configurations in Supply Chains: Gearing for Partner-Enabled Market Knowledge Creation. *MIS Quarterly, 29*(1), 145-187.
[28] Gosain, S., Malhotra, A., El Sawy, O. A., & Chehade, F. (2003). The impact of common e-business interfaces. *Communications of the ACM, 46*(12), 186-195.
[29] Malhotra, A., Gosain, S., & El Sawy, O. (2007). Leveraging standard electronic business interfaces to enable adaptive supply chain partnerships. *Information Systems Research, 18*(3), 260.
[30] Seddon, P. B., Calvert, C., & Yang, S. (2010). A Multi-Project Model of Key Factors Affecting Organizational Benefits from Enterprise Systems. *MIS Quarterly, 34*(2), 305-328.
[31] Wixom, B. H., & Watson, H. J. (2001). An Empirical Investigation of the Factors Affecting Data Warehousing Success. *MIS Quarterly, 25*(1), 17-41.
[32] Russom, P. (2011). *Next Generation Data Integration*: TDWI Best Practices Report. http://tdwi.org/
[33] Berente, N., Vandenbosch, B., & Aubert, B. (2009). Information flows and business process integration. *Business Process Management Journal, 15*(1), 119-141.
[34] Davenport, T. H., Harris, J. G., & Cantrell, S. (2004). Enterprise systems and ongoing process change. *Business Process Management Journal, 10*(1), 16-26.
[35] Ragin, C. C. (2008). *Redesigning social inquiry: fuzzy sets and beyond*. Chicago: University of Chicago Press.
[36] Fiss, P. C. (2011). Building Better Causal Theories: A Fuzzy Set Approach to Typologies in Organization Research. *Academy of Management Journal, 54*(2), 393-420.
[37] El Sawy, O. A., Malhotra, A., Park, Y., & Pavlou, P. A. (2010). Research Commentary -- Seeking the Configurations of Digital Ecodynamics: It Takes Three to Tango. *Information Systems Research, 21*(4), 835-848.
[38] Caglio, A., & Ditillo, A. (2008). A review and discussion of management control in inter-firm relationships: achievements and future directions. *Accounting, Organizations and Society, 33*(7-8), 865-898.
[39] March, J. G. (1991). Exploration and Exploitation in Organizational Learning. *Organization science, 2*(1), 71-87.