2010

# A Normative Theory of Organizational Control: Main and Interaction Effects of Control Modes on Performance

Li Liu
*University of Sydney*, Li.liu@Sydney.edu.au

Philip Yetton
*University of New South Wales*, p.yetton@unsw.edu.au

Christopher Sauer
*University of Oxford*, chris.sauer@sbs.ox.ac.uk


# A NORMATIVE THEORY OF ORGANIZATIONAL CONTROL: MAIN AND INTERACTION EFFECTS OF CONTROL MODES ON PERFORMANCE


| | |
|---|---|
| Journal: | *18th European Conference on Information Systems* |
| Manuscript ID: | ECIS2010-0088.R1 |
| Submission Type: | Research Paper |
| Keyword: | Organizational learning, Business process management, Information systems project management, IS control |
| | |


# A NORMATIVE THEORY OF ORGANIZATIONAL CONTROL: MAIN AND INTERACTION EFFECTS OF CONTROL MODES ON PERFORMANCE

*Liu, li, University of Sydney, Building J05, Sydney 2006, Australia. Li.liu@sydney.edu.au

Yetton, Philip, Australian School of Business, University of New South Wales, NSW 2032, Australia. P.yetton@unsw.edu.au

Sauer, Christopher, Saïd business school, University of Oxford, Oxford, UK. chris.sauer@sbs.ox.ac.uk

*Corresponding author

## Abstract

*The dominant model of organisation control was developed by Ouchi and his colleagues. It predicts the choice among control modes as a function of the task context. It has two limitations. One is that it predicts the choice of control modes but not the effect of those choices on performance. The other is that it restricts that choice to a single control mode for a specific context and does not consider the choice of a combination or portfolio of control modes, which the same literature frequently describes as practice. Here, contributing to control theory, these two limitations are addressed through the development of a more complete and complex normative model which includes interactions among modes and their effect on performance. This model has important implications for both the theory and practice of outsourcing, IT project methodology and IT-based organisational transformation.*

*Keywords: organisational control, control modes, output control, input control, behavioural control, project performance, exploitative learning, exploratory learning .*

# 1 INTRODUCTION

Organizational control theory (Ouchi 1977, 1979, Eisenhardt 1985, Snell 1992) has frequently been applied in the context of both in-house ISD projects (Kirsch 1996, 1997, Henderson and Lee 1992) and outsourced ISD projects (Kirsch et al. 2002, Choudhury & Sabherwal 2003, Rustagi et al. 2008). Extant control theory examines how managers make the choice of a specific control mode, including the choice of output control (e.g. setting and verifying project targets), behaviour control (e.g. specify detailed procedure of how conduct tasks) or input control (e.g. the selection and training of personnel). However, the dominant control framework suffers from a number of limitations (Cardinal et al. 2004; Kirsch et al. 2002) and, as a result, could have constrained our understanding of the effects of control modes on performance.

The purpose of this paper is to identify the limitations of the extant control theory; develop a new framework that predicts the effect of control modes on performance; and, finally, elaborate how the framework can increase our understanding of how to effectively control information systems development (ISD) projects.

In practice, various control modes are typically implemented through organisation-wide processes such as PRINCE II and the Capability Maturity Model (CMM) developed by the Software Engineering Institute (SEI). Drawing on the literature of the effects of CMM implementation on IS project performance, we show that the new normative framework explains the findings better than the dominant control theory framework with important implications for practice.

Below, the literature is reviewed and nine hypotheses are developed. Then, the extension to the dominant control model is summarized. Finally, implications for theory development and practice are discussed, and limitations of the study are outlined.

# 2 ORGANIZATIONAL CONTROL THEORY

The dominant model of organization control was developed by Ouchi and his colleagues in a series of papers beginning with Ouchi and McGuire (1975) and ending with Snell (1992). Ouchi and McGuire began by analyzing the conditions that govern the use of output and behavior control by managers. Ouchi (1977) develops the model and presents it in the familiar 2x2 matrix form, with dimensions of availability of output measures and knowledge of transformation processes. The model predicts the use of behavior or output control in the high/high cell and the use of ritual in the low/low cell. Ritual is replaced with clan control in Ouchi (1979, 1980) and with input control in Snell (1992). The resultant, frequently cited model is presented in Figure 1.

Inspecting Figure 1 highlights two issues. One is that the model proposes a contingent framework for managers' choices of control modes, rather than of the effects of those choices on performance. The other is that the model specifies either a single mode of control or, in the high/high cell, a choice between two modes. Combinations of modes are not included in the model. These two issues are the basis of the two questions framing this research.

First, the model presented in Figure 1 predicts the choices of control modes by managers. If a task is well understood, it is possible to specify the behaviors necessary to achieve the planned result. Thus, behavior control is appropriate. If it is easy to measure outputs, then outputs can be monitored and controlled to deliver the planned result. Thus, output control is appropriate. If neither of these conditions holds, input control is the default mode.

While Ouchi (1977) claims that the model is normative, it is only normative in the limited sense that rational managers would adopt an appropriate control mode given the context. Subsequent research on the model in Figure 1 and its derivatives typically assumes, rather than formally tests, the effects on

performance of the control modes chosen. The limited empirical research reports results that are sometimes inconsistent with Ouchi's implicit normative framework. For example, while Cardinal (2001) reports, consistent with Ouchi's framework, that input control enhances innovation, she also reports, inconsistent with Ouchi's framework, that output control enhances innovation in R&D project management, where task uncertainty is high. Other studies show that over-reliance on outcome control leads to gaming behavior, misrepresentation of performance (Bevan & Hood 2006, Heinrich 2002, 2007) and thus negative performance effects. These findings, combined with the importance of organization control, motivated the first of the two questions framing this research: *How do control modes affect organization performance?*

| | | **Knowledge of the transformation process** (Task Programmability) | |
|---|---|---|---|
| | | *Low* | *High* |
| **Ability to measure outputs** (Output Measurability) | *High* | Output | Behavior or Output |
| | *Low* | Input | Behavior |

*Adapted from Ouchi (1979), Eisenhardt (1985) and Govindarajan and Fisher (1990)

*Figure 1. Choice of Organizational Control Mode.*

Second, combinations of control modes are not included in Ouchi's framework. Ouchi (1980) argues that markets, bureaucracies and clans are three distinct mechanisms that operate independently of each other. However, the research stream based on the model in Figure 1 frequently comments that different control modes are applied in combination (See, for example, Henderson & Lee 1992, Kirsch 1996, Nidumolu and Subramani 2003).

For example, Kirsch (1996) writes: "While multiple types of control were measured in this research, this study was based on a *tradition in the control literature* of examining the relationship between a set of environmental characteristics and each mode of control. Consequently, the focus was *not on how controls are used in combination* in organizations" (Italics added for emphasis). She goes on to comment that the correlations among control modes are significant and concludes: "These correlations suggest that, when control mechanisms are put in place, it is likely that multiple types of mechanisms are implemented." This and similar speculations about combinations of control modes motivated the second question guiding this research: *How do combinations of control modes influence organization performance?*

It is worth noting that there are alternative control models proposed, including Jaworski (1988) and Anderson and Oliver (1987) in sales force management, and Flamholtz et al (1985) in accounting control. With limited empirical support (Jaworski et al. 1993; Anderson and Oliver 1994), there have been few adoptions of these models outside their respective domain.

# 3 EFFECTS OF CONTROL MODES ON PERFORMANCE

To develop a more complete and complex normative model of the effects on performance of control modes than is implicit in Figure 1, this study draws from three research streams. The first includes goal setting theory (Locke & Latham 1990), management by objective (MBO)(Tosi & Carroll 1968,

Greenwood 1981, Rodgers & Hunter 1992) and outcome-based performance management (Bevan & Hood 2006, Heinrich 2002, 2007) to explain the effects on performance of output control. The second includes organization learning theory (March 1991) and process management (Benner & Tushman 2003) to explain the effect on performance of exploitative and exploratory processes. The third is the literature on human resource management (HRM), which explains the effects on performance of input control (Snell 1992, Delaney & Huselid 1996, Evans & Davis 2005).

First, goal setting affects performance in two ways (Locke & Latham 1990). When task uncertainty is low, goal setting increases individuals' motivation to perform, affecting the direction, persistence and level of an individual's effort. This is called the goal motivation effect. In contrast, when task uncertainty is high, goal setting stimulates individuals to look for innovative solutions. This is called the goal strategy effect. Goal setting theory is one of the most rigorous and extensive research streams in management theory While its primary level of analysis is individual behavior, the MBO and outcome-based performance management literatures extend the goal setting approach to organization behavior and performance.

Second, organization learning theory also specifies different mechanisms by which processes affect performance when task uncertainty is high versus when it is low (March 1991, Benner & Tushman 2000). Exploitative behavior delivers high performance when task uncertainty is low and exploratory behavior delivers high performance when task uncertainty is high. The learning approach an organization adopts influences the choices and effects of control modes.

Third, the HRM literature examines various approaches to the development of human capital and their effects on organization performance (Evans & Davis 2005, Delaney & Huselid 1996). Essentially, its focus is on the link between input control and performance. This study draws from a subset from this stream to develop the hypotheses on the link between input control and performance.

Since the two underlying theories, partitions tasks into high/low task uncertainty contexts, the discussions below inherit this practice and the two theories can be integrated.

### 3.1 Low Task Uncertainty

In goal setting theory, when task uncertainty is low, performance is a positive function of the goal setting motivational effect on the level of effort, and its direction and persistence. Goals affect the intensity of effort an individual expends on a task. They also affect its direction and duration, motivating individuals to persist in their actions until the goal is reached. Goals motivate individuals to adopt goal-relevant actions, while ignoring non-goal-relevant activities (Locke & Latham 1990). At the organization level of analysis, the management by objective (MBO) literature (Tosi & Carroll 1968, Greenwood 1981, Rodgers & Hunter 1992) and the literature on outcome-based performance management (Bevan & Hood 2006, Heinrich 2002, 2007) support the general assumption that setting goals increases incremental, continuous improvements in organization performance. Formally:

*Hypothesis 1: When task uncertainty is low, performance is a positive function of output control.*

In organization learning theory when task uncertainty is low, performance is improved through the exploitation of knowledge about existing practices (March 1991). Adjustments to existing behavior improve mean performance and reduce performance variance (Benner & Tushman 2003). This occurs through single loop learning. This learning leads to improvement in business processes and reduction of costs through standardization and routinization, i.e. behavior control (March 1991, McGrath 2001).

This exploitation effect on performance of process improvements relies on comprehensive knowledge. Low task uncertainty is conducive to comprehensive knowledge which enables the specification of effective design processes (Fredrickson 1984, Pisano 1994). In such situations, organization learning theory predicts that exploitative learning through comprehensive process management generates positive organization outcomes (March 1991, McGrath 2001, Benner & Tushman 2002, 2003). Formally:

*Hypothesis 2: When task uncertainty is low, performance is a positive function of behavior control.*

Input control regulates the human resource-based antecedent conditions of performance, specifically, the knowledge, skills, abilities, values and motives of employees (Snell 1992). Approaches for enhancing employees' skills include selection, training and development activities (Delaney & Huselid 1996, Evans & Davis 2005). Various conceptual frameworks, including agency theory, resource-based view, institutional theory, to name a few, have been used to explain the link between HRM practices and organization performance (Delaney & Huselid 1996). Empirical results show that staff selectivity is related to organization level performance (Becker & Huselid 1992, Schmidt et al. 1979). Training and development activities improve organization performance (Bartel 1994, Knoke & Kalleberg 1994). When task uncertainty is low, input control supports exploitative learning, including training for established processes and learning from past projects. These impact directly on performance. In contrast, when task uncertainty is high, as discussed below, input control practices that support exploratory learning are likely to be effective. Formally:

*Hypothesis 3: When task uncertainty is low, performance is a positive function of input control.*

Now, consider the interactions between those control modes. First, examine the interaction between behavior and output controls. When behavior control is weak, processes are not monitored and reinforced by management, non-optimal behavior develops. In those circumstances, increases in output-based motivation, the goal setting motivation effect, have a limited positive effect on performance. Instead, the increased motivation reinforces the emergent non-optimal behavior. Thus, when behavior control is weak, the effect on performance of output control is limited.

In contrast, when behavior control is effective, increases in output-based motivation reinforce the effective behavior and, therefore, have strong positive effects on performance. This is because process improvement typically involves the use of process effectiveness measures and statistical methods based on goals or output control for variation reduction in processes and outputs (Garvin 1995; Harry & Schroeder 2000). This is consistent with Benner and Tushman (2003), who, implicitly but not explicitly, model the effect of exploitative behavior to include an interaction between, rather than simply an additive function of, output and behavior control.

Specifically, Benner and Tushman (2003) argue that business process management approaches typically involve three practices: process mapping, process improvement and adhering to the improved processes. During the mapping process, the functions of a business entity are defined, the responsible person is identified, and the expected standard and success criteria, or goals, for a business process are specified (Deming 1982, Juran 1988). The mapped and improved processes need to be adhered to reap potential business benefits from repeated processes, e.g. reliable measurement data for and continuous improvement in outputs (Mukherjee et al. 1998). The quality of the processes moderate the performance effects of output control. Formally:

*Hypothesis 4: When task uncertainty is low, behavior control moderates the effect of output control on performance.*

Second, consider the interaction between output and input control. From goal setting theory, output control increases performance through its effect on extrinsic motivation (Hypothesis 1). Input control, by selecting for and improving employees' ability to learn and work independently, increases performance through its effect on intrinsic motivation (Hypothesis 3). Drawing on cognitive evaluation theory (Anderson & Oliver 1987), total motivation is less than the sum of the expected independent intrinsic and extrinsic effects.

Deci and Ryan argue that high extrinsic motivation erodes high intrinsic motivation because certain forms of output control, including negative performance feedback and deadlines, decrease intrinsic motivation (Deci 1972, Ryan & Deci 2000). So, when the effect of input control on intrinsic motivation is combined with the effect of output control on extrinsic motivation, the interaction of the two modes of control has less effect on performance than the sum of their expected individual effects. Formally:

*Hypothesis 5: When task uncertainty is low, output control moderates the effect of input control on performance.*

In our review of the literature, we did not identify a theoretical model of or compelling speculation for an interaction between behavior and input control, and the effect of that interaction on organization performance. So, no hypothesis is developed and presented here.

### 3.2 High Task Uncertainty

Now, consider the context when task uncertainty is high. The basic argument for the use of input control is well stated by Snell and Youndt (1995): Drawing on the work of researchers such as Dimmick and Murray (1978), an HRM control system based on input control, including rigorous staffing, training and induction, has a positive effect on organization performance. Specifically, Cardinal (2001) found that input control enhances innovation for the typically uncertain R&D projects.

Snell and Youndt (1995) note that the positive effect of input control, when task uncertainty is high, is consistent with the arguments in the knowledge management literature on the transformation to flexible, knowledge-based organizations (See, for example, Nonaka 1991). This is particularly the case in high task uncertainty contexts, where, unable to rely on past successful behavior, high performance depends on an organization's knowledge base (Eisenhardt & Bourgeois 1988). Similarly, Nonaka and Takeuchi (1995) argues that it is the redundant and overlapping information sets in a knowledge base that support organization innovation and variety. Input control, through selection, training and induction, helps develop those knowledge sets and supports access to them by developing and reinforcing values that support increased communication and interaction (Barker 1993, Flamholtz et al. 1985, Turner & Makhija 2006).

Increased interaction gives managers access to diverse knowledge (Hoopes & Postrel 1999). This knowledge is typically tacit rather than explicit. The ability to exchange that knowledge facilitates its recombination, generating new insights (Galunic & Rodan 1998). Those insights, generating innovative actions, are the basis of exploratory learning (March 1991, Turner & Makhija 2006).

Under conditions of high uncertainty, experiential learning becomes a crucial part of the development process such as on the job training, job rotation and mentoring (Swap et al. 2001). In contrast to low uncertainty conditions, where the development is likely to be focused on learning past experience and the application of known, stable work processes, development in high task uncertainty situations, that supports exploratory learning and facilitate entrepreneurial intuition, e.g. experiencing and understanding work processes, problem solving and work languages, impact positively on organization performance.

Consistent with the extant control theory (Ouchi 1979, Snell 1992, Cardinal 2001) and the HRM literature (Becker & Huselid 1992, Schmidt et al. 1979, Bartel 1994, Knoke & Kalleberg 1994), the selection, development and training of employees has a positive effect on firm performance. Formally:

*Hypothesis 6: When task uncertainty is high, performance is a positive function of input control.*

It is implicit in the dominant model of organizational control theory in Figure 1 that, under high task uncertainty, both output and behavioral controls have weak or no effects on performance. Now, while Hypothesis 1 is based on the goal motivation effect when task uncertainty is low, when task uncertainty is high, performance is a positive function of the goal strategy effect--challenging goals stimulate the search for innovative ways to meet the targets (Locke & Latham 1990, p 96).

The discovery of new task strategies is also consistent with exploratory learning processes, which involve risk taking, experimentation and innovation (March 1991, Benner & Tushman 2003). Adaptation through exploratory learning processes fits high task uncertainty contexts, where changes are unpredictable (Eisenhardt & Martin 2000). In those contexts, successful performance depends upon generating a sufficient number of novel solutions or options so that some are successful (McGrath 2001). In this way, specific, challenging goals stimulate the process of exploratory learning

to identify options. In addition, when performance is below their aspiration levels, decision makers take on more risks (Tversky & Kahneman 1986, Abrahamson 1996, Abrahamson & Fairchild 1999), engaging in exploratory search processes (March 1991) and experimenting with new processes, technologies and strategies (Baum et al. 2005).

Empirical evidence from studies of software development (Nidumolu & Subramani 2003, Choudhury & Sabherwal 2003) and pharmaceutical R&D projects (Cardinal 2001) provides further support that output control has a positive effect on performance when task uncertainty is high. The literature on software project risk management also reports that output control has a positive effect on performance (Barki et al. 2001, Rustagi et al. 2008). Both studies report that the use of output controls, including, for example, monitoring project status, is associated with improved performance. Formally:

*Hypothesis 7: When task uncertainty is high, performance is a positive function of output control.*

Now, consider the effect of behavior control on performance. Essentially, behavior control is the basis of standard operating procedures (SOPs). The effective application of SOPs requires that organizations have complete understanding of the interdependences among the tasks to deliver high performance (Eisenhardt 1985, Snell 1992, Turner & Makhija 2006). While this condition is typically satisfied when task uncertainty is low, it is unlikely to be satisfied when task uncertainty is high.

Consistent with this, Ittner and Larcker (1997) report a positive effect of behavior control on performance in the low task uncertainty auto industry of the '90s (See Hypothesis 2 above) but no relationship in the dynamic, high task uncertainty, computer industry. This absence of a positive effect of behavior control on performance when task uncertainty is high is consistent with its implicit null effect in the dominant organizational presented control model in Figure 1. Formally:

*Hypothesis 8: When task uncertainty is high, performance is independent of behavior control.*

Finally, consider the interaction between input and output controls when task uncertainty is high. As argued above (Hypothesis 7), when task uncertainty is high, output control increases performance by improving the task strategy selected. This is the goal strategy effect (Locke & Latham 1990) rather than the goal motivation effect that underpins Hypothesis 1.

Therefore, when task uncertainty is high, unlike the case when task uncertainty is low (Hypothesis 5), there is no interaction between input and output controls on performance. This is because the intrinsic motivation effect of input control on performance is independent of the strategy selection effect of output control on performance. Therefore, the effects of input and output controls on performance are additive. Formally:

*Hypothesis 9: When task uncertainty is high, input and output controls have independent effects on performance.*

# 4 EXTENSIONS TO THE DOMINANT MODEL

Hypotheses 1-9 present a theory of organization control in which the effects on performance of control modes are contingent on task uncertainty. A comparison of this theory with the dominant model shows that the implicit normative model in Figure 1 can be treated as a restricted sub-model of the more general model developed above. Table 1 lists Hypotheses 1-9, indicating where they are similar to and where they extend the dominant model. To do this, we make the assumption that the high/high and low/low cells in Figure 1 are equivalent to low and high task uncertainty contexts, respectively. Then, inspecting Table 1 reveals that the implicit normative model presented in Figure 1 is a special case of the normative model developed above.

Hypotheses 1, 2, and 6 re-state the direct effects of output and behavior control on performance in the high/high cell and the effect of input control in the low/low cell in Figure 1. Hypothesis 8 makes explicit the implicit null effect of behavior control on performance in the low/low cell.

| Control Modes | High Task Uncertainty | Low Task Uncertainty |
|---|---|---|
| Output | H7 | H1 (dominant model) |
| Behavior | H8 (null effect: dominant model) | H2 (dominant model) |
| Input | H6 (dominant model) | H3 |
| Behavior x Output | H8 (null effect) | H4 |
| Output x Input | H9 | H5 |

*Table 1. A Comparison of two Theories.*

Hypotheses 3 and 7 extend the dominant model by predicting direct effects for input control on performance in the high/high cell and output control on performance in the low/low cell, respectively. Hypotheses 4 and 5 extend the model by predicting interaction effects on performance in the high/high cell between behavior control and output control, and input control and output control, respectively. In the former case, the dominant model includes the individual effects of each mode of control but does not include the relationship between them and the effect on performance of that relationship. In the latter case, the dominant model does not include the effect of input control on performance. Therefore, it neither considers the relationship between input and output control nor the effect on performance of that relationship. Finally, Hypothesis 9 shows that the effects of input and output control on performance in the low/low cell are independent of each other.

# 5 DISCUSSION

In this section, the implications of the new normative model for theory development are discussed first. In particular, our focus is on the explanatory power of the new model in comparison with the concept of "balance of control modes". Then, the implications for practice are illustrated and conclusions are drawn.

## 5.1 Implications for Theory

The effect on performance of interactions among control modes is the motivation for a critique of the concept of balance in the use of control modes. The extant research on the effect on performance of combinations of control modes is limited to simply aggregating their joint effects without specifying the functional form of those effects. For example, Jaworski et al. (1993) combine output and behavior control into formal control, and clan and self control into informal control, and then analyze the effect on performance of combinations of formal and informal control modes; and Long et al. (2002) compare the aggregate effect of behavior, output and input control on performance with the independent effect on performance of each control mode.

Exploring the dynamics of control modes, Cardinal et al. (2004) analyze the effect of reducing the emphasis on output and input control, interpreted as unbalancing the control modes, in phase two of a start up furniture removal business. The use of behavior control on its own resulted in a major drop in performance. Reintroducing output and input controls, interpreted as rebalancing the control modes, reversed this loss of performance.

Cardinal et al. (2004) define balance as "a state where an organization exhibits a harmonious use of multiple forms of control." They offer no definition of 'harmonious' independent of the effect on performance of the combination of output, behavior and input controls adopted in phase three. Nor do they consider in what context that combination of controls would not be harmonious or, at least, would not be successful.

The theory developed above offers insights into both of those issues. When task uncertainty is low, organization performance is a function of output, behavior and input controls, and of the interactions between output and behavior controls, and input and output controls. Balance requires the effective

combination of output and behavior control (Hypothesis 4). A comparison of performance against the goals provides feedback to incrementally refine the behavior controls and capture the benefits of exploitative behavior (Turner & Makhija 2006, Benner & Tushman 2003). At the same time, the focus on output control should not be too strong; otherwise it would risk a loss of intrinsic motivation from the interaction of output and input controls (Hypothesis 5).

The above definition of balance is specific to the low task uncertainty context. Balance in a high uncertainty context is simply the additive effects on performance of output and input controls (Hypothesis 9). These findings are consistent with Nidumolu and Subramani (2003), and Choudhury and Sabherwal (2003) findings. Nidumolu and Subramani (2003) report no effect on performance of standardization of methods, behavior control, but a strong effect on performance of standardization of performance criteria, output control. They also report a positive effect on performance of decentralization of methods, dependent on input control.

Similarly, Choudhury and Sabherwal (2003) report the importance of output and input (selection of vendor capability) control on outsourcing software development performance. When performance was unsatisfactory in three of the five projects they researched, both forms of control were increased. Behavior control was not considered to be an effective control mode in this high task uncertainty context because behaviour observability was low.

### 5.2 Implications for Practice

We draw four implications for practice from the extended theory of organizational control developed above. First, under conditions of high task uncertainty, behavior control may confer the illusion of control in a challenging and uncertain environment. However, it does not improve performance. Large IT projects represent the classic instance of this false assumption. Methodologies, specifying detailed sets of procedures, are rigorously followed with frequently disappointing results. Basing control theory on a foundation of goal-setting and learning theories helps explain this lesson.

Second, the performance achieved through reliance on a single mode of control can always be improved upon by the adoption of other control modes, with the exception of behavior control under high uncertainty. In particular, organizations that rely solely on aggressive output targets or bureaucracies that rely exclusively on behavior controls should be encouraged to adopt a portfolio of controls appropriate to the context. This has potentially important implications for IS project management and outsourcing.

Third, it is important to recognize that different mixes of controls support different strategies in different contexts. This requires fine tuning the mix of controls to the context, capturing the benefits of exploitation in low task uncertainty contexts and exploration in high uncertainty contexts. Therefore, when attempting to realize the benefits of exploitation in a low uncertainty context, for example, data centre outsourcing, it is appropriate to implement strong behavior controls, but the output targets should not be so challenging as to shift the strategy from one of exploitation to one of exploration. Conversely, in the case of an exploration strategy under high uncertainty, for example, an IS-based, organization transformational project, conservative targets may fail to adequately motivate the search for innovation. In goal setting terms, exploitation sets high but achievable goals, consistent with processes including TQM and six sigma. Exploration sets stretch goals.

Fourth, exploration and exploitation need to be managed under distinct control regimes. To attempt to achieve both using the same portfolio of controls is counterproductive. Abernathy (1978) presents an early critique of the idea that organizations should focus on both cost reductions and innovation. Porter (1980) treats these strategies as mutually exclusive. The control profiles developed above for the two contexts are mutually incompatible.

Now apply these insights to the popular CMM model. It classifies organisations' maturity for managing IS projects into five levels from ad hoc to continuous improvement (Humphrey 1989). To progress from level 1 to level 3, organisations need to put in place basic project and software

engineering management practices and define basic processes for measuring project outcomes and training personnel. In levels 4 and 5, process outcomes are measured and the processes are subjected to continuous improvement efforts.

Progressing from level 1 to level 3 represents the formal implementation of a mix of basic output, input and behavioural control modes that would improve performance independent of whether the context is one of low task uncertainty, for example, outsourcing a data centre, or high uncertainty, for example, outsourcing an organization-transforming software development. Progressing to levels 4 and 5 is consistent with maximising the benefits of exploitative learning in the case of the data centre outsourcing. In contrast, it would be counter productive in the case of the transformational software development.

Empirical studies on the effects of implementing CMM on IS project performance suggests that the benefits of progressing one level up from lower levels (e.g. from levels 1 to 2 or from 2 to 3) are associated with substantial improvements in project performance while the improvements for achieving levels 4 & 5 appear to be limited (Harter et al. 2000, Galin and Avrahami 2006). It may be that the benefits of moving from level 3 to levels 4 or 5 are contingent on project context.

Certainly, most organization theorists consider that exploration and exploitation are competing rather than compatible organizational processes (Adler et al. 1999, March 1991, Teece et al. 1997, Benner & Tushman 2003). As Benner and Tushman (2003) conclude: "To create dual organization structures, senior teams must develop techniques that permit them to be consistently inconsistent as they steer a balance between the need to be small and large, centralized and decentralized, and focused on both the short and the long term, simultaneously (Gavetti & Levinthal 2000, Hedberg et al. 1976, Weick 1995)". In revised theory, the different portfolios of control recommended for low and high task uncertainty contexts help explain why these strategies are incompatible rather than complementary.

### 5.3 Re-engineering the Context

The theory developed above shows that, in the short term, managers should adapt their portfolio of controls to fit the context. In the longer term, an alternative is to transform a high task uncertainty context into a low task uncertainty context. This is the transition typically followed as an industry matures. The benefit of such a shift is the higher performance achievable in a low task uncertainty context compared with a high task uncertainty context (Liu & Yetton 2007).

In addition, organization contexts are characterized by cycles of technological variation, alternating between periods of incremental change and periods of rapid innovation (Abernathy & Utterback 1978, Uzumeri & Sanderson 1995, Tushman & Anderson 1986). A period of discontinuous innovation ends when a new dominant design emerges (Abernathy 1978, Anderson & Tushman 1990, Benner & Tushman 2003, Tushman & Rosenkopf 1992).

This describes a cycle from low task uncertainty to high task uncertainty, and back to low task uncertainty, as the market moves from a dominant design through a period of innovation until a new dominant design emerges. This suggests the interesting question of whether it is more effective to retain the mix of control modes appropriate for a low task uncertainty context, while the market shifts to a high task uncertainty context. Then, when the new dominant design is identified, adopt a fast follower strategy. Alternatively, the organization could experiment with the development of new IT systems in house, while task uncertainty is high, and outsource the new systems, when task uncertainty becomes low with the emergence of the new dominant design.. This extension to the theory developed here should be the subject of future research.

## Key References

Abernathy, W. J. (1978). The productivity dilemma. Johns Hopkins University Press, Baltimore.

Abernathy, W. J. and Utterback, J. M. (1978). Patterns of industrial innovation. Tech. Review, 80 (7), 40-47.
Anderson, E. and Oliver, R. L. (1987). Perspectives on Behavior-Based versus Outcome-Based Salesforce Control Systems. Journal of Marketing, 51 (4), 76-88.
Bartel, A. P. (1994). Productivity gains from the implementation of employee training programs. Industrial Relations, 33, 411-425.
Becker, B. E. and Huselid, M. A. (1992). The Incentive Effects of Tournament Compensation Systems. Administrative Science Quarterly, 37, 336-350
Benner, M. J. and Tushman, M. L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. Academy of Management Review, 28 (2), 238-256.
Bevan, G., and Hood, C. (2006). What's measured is what matters: Targets and gaming in the English public health care system. Public Administration, 84 (3), 517–538.
Cardinal, L. B. (2001). Technological innovation in the pharmaceutical industry: The use of organizational control in managing research and development. Organization Science, 12 (1), 19-36.
Cardinal, L. B., Sitkin, S. B. and Long, C. P. (2004). Balancing and Rebalancing in the Creation and Evolution of Organizational Control. Organization Science, 15 (4), 411–431.
Choudhury, V. and Sabherwal, R. (2003). Portfolios of control in outsourced software development projects. Information Systems Research, 14 (3), 291-314.
Crossan, M. M., Lane, H. W. and White, R. E. (1999). An Organizational Learning Framework: From Intuition to Institution. The Academy of Management Review, 24 (3), 522-537.
Deci, E. L. (1972). The effects of contingent and noncontingent rewards and controls on intrinsic motivation. Organizational Behavior and Human Performance, 8 (2), 217-229.
Delaney, J. T. and Huselid, M. A. (1996). The Impact of Human Resource Management Practices on Perceptions of Organizational Performance. The Academy of Management Journal, 39 (4), 949-969.
Eisenhardt, K. M. (1985). Control: Organizational and economic approaches. Management Science, 31 (2), 134-149.
Eisenhardt, K. M. and Martin, J. A. (2000). Dynamic capabilities: What are they? Strategic Management Journal, 21 (10/11), 1105-1121.
Evans, W. R. and Davis, W. D. (2005). High-Performance Work Systems and Organizational Performance: The Mediating Role of Internal Social Structure. Journal of Management, 31 (5), 758-775.
Galin, D. and Avrahami, M. (2006). Are CMM Program Investments Beneficial? Analyzing Past Studies. IEEE Software, 23 (6), 81-87.
Galunic, D. C and Rodan, S. A.. (1998). Resource recombination in the firm: Knowledge structures and the potential for Schumpeterian innovation. Strategic Management Journal, 19 (12), 1193–1201.
Garvin, D. A. (1995). Leveraging processes for strategic advantage. Harvard Business Review, 73 (5), 77-90.
Harter, D. E., Krishnan, M. S. and Slaughter, S. A. (2000). Effects of Process Maturity on Quality, Cycle Time, and Effort in Software Product Development. Management Science, 46 (4), 451-466.
Heinrich , C . J . (2002). Outcomes-based Performance Management in the Public Sector: Implications for Government Accountability and Effectiveness. Public Administration Review, 62 (6), 712 – 25.
Heinrich, C. J. (2007). False or Fitting Recognition? The Use of High Performance Bonuses in Motivating Organizational Achievements. Journal of Policy Analysis and Management, 26 (2), 281–304.
Henderson, J. C. and Lee, S. (1992). Managing IS design teams: A control theories perspective. Management Science, 38 (6), 757-777.
Humphrey, W.S. (1989). Managing the Software Process, Addison-Wesley, Reading, MA.
Ittner, C. D. and Larcker, D. (1997). The performance effects of process management techniques. Management Science, 43 (4), 522-534.
Jaworski, B. J., Stathakopoulos, V. and Krishnan, H. S. (1993). Control Combinations in Marketing: Conceptual Framework and Empirical Evidence. Journal of Marketing, 57 (January), 57–69.

Kirsch, L. J. (1996). The management of complex tasks in organizations: Controlling the systems development process. Organization Science, 7 (1), 1-21.
Kirsch, L. J. (1997). Portfolios of control modes and IS project management. Inform. Systems Research, 8 (3), 215–239.
Knoke, D., and Kalleberg, A. L. (1994). Job training in U.S. organizations. American Sociological Review, 59, 537-546.
Liu, L. and Yetton, P. (2007). The contingent effects on project performance of conducting project reviews and deploying project management offices. IEEE Transactions on Engineering Management, 54 (4), 789-799.
Locke, E. A. and Latham, G. P. (1990). A theory of goal setting and task performance. Prentice-Hall, Englewood Cliffs, NJ.
Long, C. P., Burton, R. M. and Cardinal, L. B. (2002). Three controls are better than one: A simulation model of complex control systems. Computational Math. Organ. Theory, 8, 197–220.
March, J. (1991). Exploration and exploitation in organizational learning. Organization Science, 2 (1), 71-87.
McGrath, R. G. (2001). Exploratory learning, innovative capacity, and managerial oversight. Academy of Management Journal, 44 (1), 118–131.
Mukherjee, A., Lapre, M. and Van Wassenhove, L. (1998). Knowledge driven quality improvement. Management Science, 44 (Supplement), S35-S49.
Nidumolu, S. R. and Subramani, M. R. (2003). The matrix of control: Combining process and structure approaches to managing software development. J. of Management Inform. Systems, 20 (3), 159-197.
Ouchi, W.G. (1977). The relationship between organizational structure and organizational control. Administrative Science Quarterly, 22 (1), 95-113.
Ouchi, W. G. (1979). A conceptual framework for the design of organizational control mechanisms. Management Science, 5 (9), 833-848.
Ouchi, W.G. and M. A. Maguire. (1975). Organizational Control: Two Functions. Administrative Science Quarterly, 20 (December), 559-569.
Pisano, G. P. (1994). Knowledge, integration, and the locus of learning: An empirical analysis of process development. Strategic Management Journal, 15 (8), 85–100.
Porter, M.E. (1980). Competitive strategy. The Free Press, New York.
Rodgers, R. and Hunter, J. E. (1992). A Foundation of Good Management Practice in Government: Management by Objectives. Public Administration Review, 52 (1), 27-39.
Rustagi, S., King, W. R. and Kirsch, L. J. (2008). Predictors of Formal Control Usage in IT Outsourcing Partnerships. Information Systems Research, 19 (2), 126–143
Ryan, R. M. and Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. Contemporary Educational Psychology, 25 (1), 54-67.
Snell, A. S. (1992). Control theory in strategic human resource management: The mediating effect of administrative information. Academy of Management Journal, 35 (2), 292-327.
Snell, S. A. and Youndt, M. A. (1995). Human resource management and firm performance: Testing a contingency model of executive controls. Journal of Management, 21 (4), 711-737.
Swap, W., Leonard, D., Shields, M. and Abrams, L. (2001). Using Mentoring and Storytelling to Transfer Knowledge in the Workplace. Journal of Management Information Systems, 18 (1), 95-114.
Tosi, H. L. and Carroll, S. J. (1968). Managerial Reaction to Management by Objectives. Academy of Management Journal, 11 (4), 415-426.
Turner, K. L. and Makhija, M. V. (2006). The role of organizational controls in managing knowledge. Academy of Management Review, 31 (1), 197–217.
Tushman, M. L. and Anderson, P. (1986). Technological discontinuities and organizational environments. Administrative Science Quarterly, 31 (3), 439-465.
Tversky, A. and Kahneman, D. (1986). Rational choice and the framing of decisions. Journal of Business, 59 (4), 251-278.