



Effects of organizational process change on responsibility accounting and managers' revelations of private knowledge

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Abstract

We report the results of a nine-year field study that examines how responsibility accounting (RA) is used to manage horizontal relationships among several responsibility center (RC) managers including those who work on committees or cross-functional teams. We find theory-consistent evidence that the goal-congruent design or redesign of accounting and participation practices in general, and of RA in particular, depends on the magnitude, scope, and speed of organizational process change. When there is a change in the magnitude, scope, and speed of organizational process change, we find that the measurability of RC managers' financial performance can change, and we also find that using RA to manage RC boundaries is an important mechanism for achieving goal-congruent behavior and avoiding dysfunctional behavior. Moreover, we show that several accounting and participation practices (e.g., activity-based costing, open book accounting, project budgeting, cross-functional teams) support RC boundary management that involves framing or reframing RC boundaries so as to influence competitive or cooperative behavior among RC managers. Finally, this study contributes by introducing a new research method to the accounting literature that is effective in structuring and interpreting longitudinal field data in relation to theoretical expectations.

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Introduction

Organizations are increasingly changing their strategies and structures as they experiment with and implement organizational strategies such as

continuous improvement, stretch targets, restructuring, and reengineering as well as new organizational structures such as flat structures, autonomous work teams, committees, and cross-functional teams (Abernethy & Lillis, 1995; Chenhall, 2006; Denison, Hart, & Kahn, 1996; Kanter, 1989; Mohrman, Cohen, & Mohrman, 1995; Scott & Tiessen, 1999; Siegel & Sorensen, 1999). We focus on responsibility accounting (RA), which is a key mechanism for

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how management accounting interfaces with organizational strategies and structures (Anthony & Govindarajan, 2001; Simons, 2000). A central question is whether the design of accounting and participation practices in general, and RA in particular, are aligned (or realigned) to be consistent with these changes in organizational strategies and structures. If there is misalignment, then management accounting can be a source of friction or competitive disadvantage. However, there is little research on RA, such as factors that influence its design and effects in the context of contemporary changes in organizational strategies and structures towards more subunit interdependence and team-based management.

RA is traditionally based on the assumption that responsibility-center (RC) managers are individually accountable for an organizational subunit such as a department or division (Horngren, Datar, & Foster, 2006; Merchant, 1985; Simon, Guetzkow, Kozmetsky, & Tyndall, 1954). In contrast, recognizing contemporary strategic and structural changes in organizations, we define RA more broadly as including interdependent or joint activities in which groups of RC managers (e.g., committees, cross-functional teams) are jointly accountable for their aggregate performance (e.g., Bushman, Indjejikian, & Smith, 1995; McNair, 1990; Rowe, 2004; Scott & Tiessen, 1999). Thus, instead of focusing on RA principally as a mechanism for managing individual RC managers vertically up and down an organizational hierarchy (e.g., Demski & Sappington, 1989), we focus on RA as a mechanism for horizontally managing groups, teams, or committees of several functionally differentiated RC managers who work on a common organizational value chain or organizational process (Hopwood, 1996; Ditillo, 2004; Rowe, 2004).¹

We identify and examine relations between two elements of RA that have typically been studied separately: the financial measurability of RC performance and RC boundaries. We consider RC measurability to be an organization's ability either

to separably measure each individual RC manager's financial performance or to only inseparably measure the aggregate financial performance of a group of RC managers who work jointly on a common organizational process (Bushman et al., 1995; McNair, 1990; North, 1981; Rankin & Sayre, 2000; Rowe, 2004). Few studies investigate control problems that are associated with organizational contexts in which it is not possible or desirable to separately measure each RC's performance (e.g., distrust, social loafing, free riding, and inequity) (Kachelmeier & Shehata, 1997; Rowe, 2004), for example due to jointness or interdependence, which can be caused by changes in organizational strategy and/or structure (North, 1981; Teece, 1996).

Motivating RC managers to have competitive or cooperative behavior can be critical to achieving goal-congruent behavior (Demski, Fellingham, Ijiri, & Sunder, 2002). In particular, whether motivating competitive or cooperative behavior among RC managers increases or decreases organizational performance can depend on the magnitude, scope, and speed of organizational process change (Bowditch & Buono, 2005; Hirshleifer, 1980; North, 1981). Building on research by Rowe (2004), we use the social psychology theory of relational framing (Fiske, 1991; Haslam, 2004; Tetlock & McGraw, 2005) to explain how the design or redesign of several accounting and participation practices support boundary management that involves framing or reframing RC boundaries so as to influence whether RC managers' behavior is competitive or cooperative.

We address the following research question: How do RC financial performance measurability and RC boundaries affect RC managers' revelations of private knowledge when central managers alter their intended strategy of organizational process change from continuous to discontinuous or vice versa? In particular, we investigate how the magnitude, scope, and speed of organizational process change affects RC measurability and RC boundaries. We also examine how RC measurability and RC boundaries interactively influence managers' goal-congruent behavior, in particular their revelations of private knowledge about opportunities to increase organizational performance (Antonelli, 1995; Rowe, 2004; Teece, 1996).

¹ We use the terms group and team interchangeably. In contrast, following Galbraith (1993) we use the term committee to denote a special kind of group or team with relatively high authority in a hierarchy.

Central managers' strategies for organizational process change can be classified as being continuous or discontinuous (Meyer, Goes, & Brooks, 1995; Romanelli & Tushman, 1994; Tushman & Romanelli, 1985; Weick & Quinn, 1999). The usual strategy is continuous organizational process change in which the intent is to increase organizational performance slowly and gradually (e.g., total quality management, statistical process control). However, occasionally central managers' pursue a strategy of discontinuous organizational process change in order to increase organizational performance rapidly and dramatically (e.g., reengineering, restructuring). For example, discontinuous organizational process change is associated with economic crises, regulatory changes, and/or a product lifecycle changes (Romanelli & Tushman, 1994). Although discontinuous organizational process change is more difficult to achieve, it can generate integrative (synergistic) gains and thus larger potential increases in organizational performance than the sum of smaller gains in organizational performance arising from continuous organizational process changes (Romanelli & Tushman, 1994).

We provide evidence on the research question with data from a nine-year longitudinal field study of a large division of a US aerospace contractor. To analyze these data we use a variance research method to study changes in the causes and effects of RA over time (Langley, 1999; Van de Ven & Poole, 2005). We do this by dividing (later called temporal bracketing) the nine years of data into four time periods and then making two types of variance comparisons to provide evidence on how consistent these data are with the expected levels of the four variables in the theoretical model within each time period and between adjacent time periods.

We contribute to the accounting literature by developing a model and providing evidence on the validity of the model concerning how the design or redesign of several accounting and participation practices (e.g., activity-based costing, open book accounting, project budgeting, and cross-functional teams) supports boundary management that involves framing or reframing RC boundaries so as to influence competitive or cooperative behavior among RC managers. We also show that boundary management is an important mechanism for

achieving goal-congruent behavior and avoiding dysfunctional behavior when the measurability of RC managers changes. As predicted, we find evidence that RC measurability and RC boundaries interactively affect RC managers' revelations of private knowledge that facilitates central managers in realizing increased organizational performance from organizational process change. Finally, this paper contributes to the accounting literature by using a new way to structure and interpret longitudinal field data in relation to theoretical expectations.

The remainder of this paper is organized as follows: Section 2 provides a review of literature that is pertinent to the development of the theoretical model and Section 3 develops the model and its three expectations. Section 4 describes the research method and Section 5 presents evidence from the field study with respect to the validity of the three expectations. Section 6 concludes with a discussion that summarizes this paper, identifies evidence that is consistent and inconsistent with the theoretical model, revises the initial theoretical model in light of inconsistent evidence, and finally identifies limitations and implications of this research.

Literature review

This section first reviews the literature on organizational process change, managers' private knowledge, and RA. The following section then analyzes this literature as the basis for developing a model consisting of three expectations.

Organizational process change

Many organizations can be viewed as containing several organizational processes (or intra-organizational value-chains) such as new product development or materials management. Each process runs horizontally across (at least part of) an organization and groups together related activities from several functional RCs (e.g., accounting, design engineering, inventory control, manufacturing engineering, procurement, quality assurance, and transportation) (Horngren et al., 2006; McNair, 1995; Shank & Govindarajan, 1993).

We examine organizational process change using the punctuated equilibrium model, which treats strategies for change as being dichotomous (Adler, 2001; Bartunek, 1993; Meyer et al., 1995; Mintzberg & Westley, 1992; Romanelli & Tushman, 1994; Tushman & Romanelli, 1985; Weick & Quinn, 1999). This model assumes that central managers' face a strategic choice between managing organizational process change as either a loosely-coupled system (continuous change) or a tightly coupled system (discontinuous change). Continuous and discontinuous organizational process change differ in terms of (1) the number of RC managers who must interact simultaneously to increase organizational performance and (2) the need for trust and effective communication among RC managers who have different professional training and expertise (e.g., accounting, engineering, legal, marketing) (Manley, 1999). The usual strategy for most organizations is continuous organizational process change (e.g., total quality management, statistical process control). However, occasionally central managers choose an intended strategy of discontinuous organizational process change (e.g., reengineering, restructuring) in response to economic crises, regulatory changes, and/or product life cycle changes (Meyer et al., 1995; Romanelli & Tushman, 1994).

Continuous and discontinuous organizational process changes differ in terms of magnitude, scope, and speed. Continuous organizational process change is intended to increase organizational performance through small gradual improvements that are implemented within individual RCs. In contrast, discontinuous organizational process change is intended to increase organizational performance through large fast improvements that are implemented across several RCs (Galbraith, 1982, 1993; Mintzberg & Westley, 1992; Weick & Quinn, 1999). Due to economies of scope, discontinuous change can create greater potential for increasing organizational performance than continuous change. Both continuous and discontinuous organizational process change can result in increases in organizational performance that are the sum of within-RC increases in performance. However, only discontinuous organizational process change can result in increases in organizational perfor-

mance from integrative (synergistic) gains that arise from interactions among RC managers (e.g., an RC manager makes changes in his or her RC that may not increase his or her performance but they do increase the performance of other RC managers) (Romanelli & Tushman, 1994). The punctuated equilibrium model predicts that fully realizing integrative gains from discontinuous organizational process change is problematic due to managerial resistance (e.g., an RC manager withholds or distorts his or her revelations of private knowledge to avoid losing resources).

RC managers' revelations of private knowledge

An organization's ability to extract organizational benefits from an organizational process change can depend on motivating several functionally differentiated RC managers to accurately reveal private knowledge (Antonelli, 1995; Ditillo, 2004; North, 1981; Rowe, 2004; Teece, 1996).² Revealing private knowledge is costly to RC managers but beneficial to the organization, because it enables central managers to identify and eliminate resources that the RC managers could have otherwise consumed (Antle & Eppen, 1985). The cost to the RC managers not only includes costs of implementing change but also includes costs related to giving up budgetary resources, losing power, and laying off employees (Bariff & Galbraith, 1978). Thus RC managers can have an incentive to distort revelations of private knowledge, for example, through biasing, filtering, focusing, and withholding (Birnberg, Turopolec, & Young, 1983).

RC measurability

RC measurability describes an organization's ability to either separably measure each RC manager's financial performance or only inseparably measure the financial performance of several RC managers who work jointly on a common organizational process (McNair, 1990; Merchant, 1985; Ouchi, 1980; Rockness & Shields, 1984). For

² We operationalize managers' revelations of private knowledge by how revelations reduce expected division cost.

example, activity-based costing (ABC) is one means of measuring the performance of an organizational process, consistent with inseparable measurability (McNair, 1990). Separate measurement of each RC manager's performance is a fundamental objective of RA as a means of motivating self-interested RC managers to have goal-congruent behavior (Bushman et al., 1995; Rankin & Sayre, 2000; Williamson, 1975).³ Economic theory, however, recognizes that factors such as infrequent transactions, task interdependency, and intangible knowledge can cause the cost of separate measures of individual RC performance to increase such that they are no longer cost effective and thus are replaced by inseparable RC measures (Alchian & Demsetz, 1972; Milgrom & Roberts, 1992; North, 1981; Williamson, 1975).

Inseparable RC measurability also has motivational problems. These include free riding, social loafing, distrust, and conflict over an inequitable distribution of rewards (Kramer, 1999; Latane, Williams, & Harkins, 1979; North, 1981; Ouchi, 1980; Williamson, 1975).⁴

RC boundaries

We define RC boundaries broadly as including several accounting and participation practices (Table 1) that convey implicit (implied cognitive frames) and/or explicit lines of demarcation (physical walls or organizational charts), which separate and/or group together the RC managers who work on a common organizational process. We use the social psychology theory of relational framing to explain how the design or redesign of RC boundaries supports boundary management that

involves framing or reframing RC managers as either individuals or members of a group, which then affects their social motives (cooperation vs. competition) and behavior (Fiske, 1991; Haslam, 2004; Tetlock & McGraw, 2005).⁵

Relational framing theory relaxes the economic assumption that individuals are strictly self-interested (Fiske, 1991; Haslam, 2004). It views individual- versus group-oriented motivation as being contingent on how individuals understand their social situation or how their social situation is framed. The theory predicts that boundaries between individuals evoke an individual frame ("I") and competitive self-interested behavior. In contrast, the absence of boundaries between individuals evokes a group frame ("we") and cooperative group-interested behavior. In summary, relational framing predicts that behavior depends on whether individuals believe they are in an "I" or "we" social situation.

We distinguish between competitive and cooperative RC boundaries. Organizations typically rely on what we refer to as competitive RC boundaries, which divide the organization into several RCs (Chenhall, 2006). Competitive RC boundaries⁶ relationally frame RC managers as separated individuals because their design is based on hierarchical organizational structures with an individual manager responsible for each organizational subunit (e.g., departments, divisions), which motivates competitive self-interested managerial behavior. In contrast, cooperative RC boundaries frame RC managers as belonging to the same group, which motivates cooperative group-interested managerial behavior.

Table 1 identifies four types of RC boundaries that are implied by accounting and participation practices: organizational, communication, spatial,

³ Separable RC financial performance measurability is assumed in most research on budgeting, performance measurement, transfer pricing, and incentive compensation.

⁴ Free-riding occurs when one or more individuals benefit from a joint effort without contributing the costly inputs necessary for the group to perform (North, 1981). Social loafing arises when individuals withhold their potential inputs to an equal degree (Latané et al., 1979). Distrust can block potential contributions in difficult to monitor social situations (Milgrom & Roberts, 1992). Inequity is a common byproduct of organizational process change (Cyert & March, 1963; Lewicki, Weiss, & Lewin, 1992; Starbuck, Greve, & Hedberg, 1978).

⁵ Relational framing differs from valence framing which is more common in the accounting literature. Valence framing from cognitive psychology focuses on the effects of information that is presented such that the outcomes of actions have either a positive or negative connotation (Haynes & Kachelmeier, 1998). In contrast, relational framing from social psychology focuses on how the frame through which people understand their social situation explains and predicts their interpersonal behavior (Tetlock & McGraw, 2005).

⁶ Competitive RC boundaries "... tend to be determined by the structures of trades and professions in the broader social environment". (March & Simon, 1958, p. 179).

Table 1
Accounting and participation practices and competitive or cooperative responsibility-center (RC) boundaries^a

RC boundaries	Description	Examples
Organizational boundary: Accounting organizational design	<i>Competitive RC boundary:</i> Partitioning individual RC managers by using separate budgets, and separate accounting reports, unshared accounting information, and by referring to particular RC managers using different titles or social categories on accounting reports and other accounting information	Traditional RA provides different sets of accounting information to different RC managers (Pick, 1971; Kilmann, 1983; Rowe, 2004; Horngren et al., 2006). Labeling each RC manager as a separate entity (e.g., “Engineering”, “Marketing”, etc.) (Pondy, 1964; Rowe, 2004; Towry, 2003)
	<i>Cooperative RC boundary:</i> Grouping RC managers together using consolidated budgets, shared accounting reports and shared accounting information, and by referring to a cross-functional team of RC managers using no or a single title or social category on accounting reports and other accounting information	Creating joint project budgets (Kachelmeier et al., 1994) or bundled budgets (Miller & O’Leary, 1997). Sharing process-level accounting information (Rowe, 2004), open book accounting (Mouritsen, Hansen, & Hansen, 2001), and labeling RC managers as members of a “group” or “cross-functional team” (Rowe, 2004; Towry, 2003)
Communication boundary: Accounting system language	<i>Competitive RC boundary:</i> Designing accounting systems and accounting information using technical accounting jargon that inhibits inter-RC communication about the economic implications of competing initiatives (cf. Steiner, 1986)	Using complex technical accounting jargon in reporting accounting information (e.g., Davidson et al., 1982)
	<i>Cooperative RC boundary:</i> Designing accounting systems and accounting information using language that all RC managers understand and that facilitates inter-RC communication about the economic implications of initiatives (cf. Steiner, 1986)	Translating technical accounting terminology (e.g., accounting terms in the general ledger) into language that all RC managers can understand, for example, by using ABC (Keys & Lefevre, 1995; Cokins, 1997)
Spatial boundary: Participation proximity	<i>Competitive RC boundary:</i> Physically distancing RC managers and/or placing physical barriers such as walls between them (Steiner, 1986; Kiesler & Cummings, 2002)	Distributed teams by arranging RC managers in different rooms or different facilities (Rowe, 2004)
	<i>Cooperative RC boundary:</i> Physically bringing together RC managers in face-to-face proximity (Kiesler & Cummings, 2002)	Integrative liaison devices (Abernethy & Lillis, 1995). Collocating committees or cross-functional teams of RC managers in a common meeting room (Rowe, 2004)
Temporal boundary: Participation speed	<i>Competitive RC boundary:</i> Having individual RC managers communicate sequentially in evaluating the economics of competing initiatives	RC managers privately communicate their RCs’ productive capabilities to a common superior, who then coordinates their individual contributions (Chow et al., 1994)
	<i>Cooperative RC boundary:</i> Having a group of RC managers communicate simultaneously in evaluating the overall economics of competing initiatives	Assigning RC managers to negotiate joint plans for initiatives concurrently, for example, in a cross-functional team (Meyerson et al., 1995)

^a We focus on organizational contexts involving several RC managers from functionally differentiated RCs who work on a common organizational process, intra-organizational value-chain, or initiative.

boundary, and temporal. In addition, Table 1 describes and provides examples of several accounting and participation practices that imply

competitive or cooperative RC boundaries. For example, consistent with boundary management, competitive or cooperative RC boundaries are

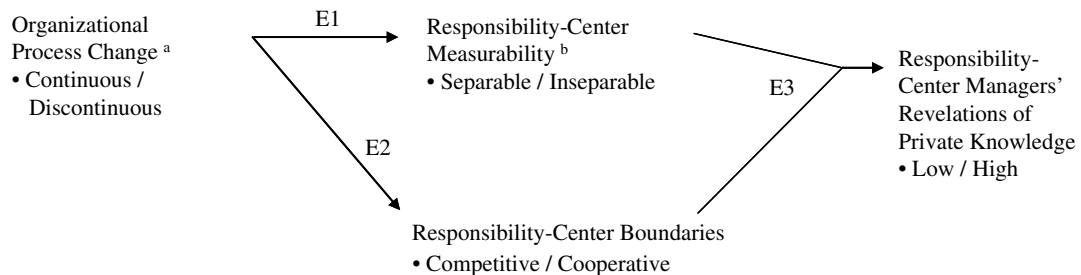
implied by providing different sets of accounting information to different RC managers or sharing process-level accounting information, using technical or plainspoken language in reporting accounting information, physically separating RC managers or having them meet face-to-face, having managers participate through a common superior or having them participate concurrently.

Model development

Fig. 1 presents the model, which has four variables and three expectations. Expectation one is that organizational process change (continuous or discontinuous) influences whether RC measurability is separable or inseparable. Expectation two is that organizational process change also affects whether RC boundaries are competitive or cooperative. Expectation three is that RC measurability and boundaries interactively influence RC managers' revelations of private information that is necessary to change an organizational process in order to improve organizational performance. The remainder of this section provides theoretical analysis to support each expectation.

Organizational process change and RC measurability

The inverse relation between RC interdependence and separable RC measurability is well documented in the accounting literature (e.g., Bushman et al., 1995; Chenhall, 2006). The punctuated equilibrium model assumes RC interdependence depends on whether central managers choose a strategy of continuous or discontinuous organizational process change. Continuous organizational process change can be planned and implemented in a piecemeal fashion separately within RCs, because there is low RC interdependence, consistent with a loosely coupled system (Weick & Quinn, 1999). In this context, RCs can be coordinated and managed as if they operate independently of each another (Thompson, 1967). In contrast, discontinuous organizational process change generates substantially higher RC interdependence than continuous organizational process change, because of the magnitude, scope, and speed of discontinuous change. Therefore it must be planned and implemented concurrently across the organizational process (that is, across RCs), consistent with a tightly coupled system (Weick & Quinn, 1999). In this context,



^a The organizational process change is based on central managers' strategic intent.

^b Responsibility-center measurability is limited to measurability of financial performance.

^c In this model each variable is dichotomized for expositional convenience.

Fig. 1. Theoretical model.^c

several RC managers are attempting to simultaneously negotiate interdependent organizational initiatives instead of focusing on performance increases within each RC (Galbraith, 1982; Thompson, 1967).

While separable RC measurability can be effective for continuous organizational process change, we predict that discontinuous organizational process can greatly increase the cost and reduce the feasibility of separable RC measurability due to higher interdependence among the RCs involved with the discontinuous organizational process change.⁷ In consequence, separable RC measurability is not expected to be used during discontinuous change. Therefore, we expect that continuous (discontinuous) organizational process change will influence RC measurability to be separable (inseparable).

E1: When central managers shift their intended strategy of organizational process change from continuous to discontinuous (discontinuous to continuous), RC measurability changes from separable to inseparable (inseparable to separable).

Organizational process change and RC boundaries

Several theories support the prediction that the need for competitive or cooperative behavior among RC managers depends on whether central managers' intended strategy is continuous or discontinuous organizational process change (Bowditch & Buono, 2005; Hill, Hitt, & Hoskisson, 1992; Milgrom & Roberts, 1992; North, 1981). We expect that central managers will choose the appropriate design of RC boundaries based on their organizational process change strategy. When central managers change their strategy, they are expected to

redesign RC boundaries appropriately. Competitive behavior among RC managers is goal congruent when organizational process change is continuous, due to low RC interdependence, and therefore central managers are expected to implement competitive RC boundaries (Milgrom & Roberts, 1992; North, 1981). In contrast, cooperative behavior among RC managers is goal congruent when organizational process change is discontinuous, due to high RC interdependence, and therefore when this is central managers' intended strategy, they are expected to implement cooperative RC boundaries (Meyerson, Weick, & Kramer, 1995).

Reframing is an important means of influencing competitive or cooperative behavior that affects social behavior by introducing a new relational frame of how people are related that fits the social situation as well as or even better than the previous relational frame (Watzlawick, Weakland, & Fisch, 1974). Recall, however, that several RA and participation practices frame or reframe the boundaries between RC managers (Table 1). Social psychology research finds that, when multiple boundaries are present, reframing or changing behavior can depend on redesigning (removing, adding, moving) all of the boundaries so as to construct a consistent frame (Ashforth, Kreiner, & Fugate, 2000; Bartunek, 1993; Meyerson et al., 1995; Rowe, 2004). For example, changing RC managers' behavior from competitive to cooperative (or vice versa) is expected to depend on reframing each of the four types of RC boundaries in Table 1 from competitive to cooperative (or vice versa). We expect that when central managers shift their intended strategy of organizational process change from continuous to discontinuous (or vice versa), each RC boundary will be reframed from competitive to cooperative (cooperative to competitive). Therefore we have the following expectation:

E2: When central managers shift their intended strategy of organizational process change from continuous to discontinuous (discontinuous to continuous), they replace all competitive RC boundaries with cooperative RC boundaries (cooperative RC boundaries with competitive RC boundaries).

⁷ In contrast to continuous organizational process change, the non-routine nature of discontinuous organizational process change also reduces the effectiveness of separable RC measurement due to increased reliance on special purpose expertise (ad hoc private knowledge) from knowledge workers (Birnberg & Heiman-Hoffman, 1993). In addition, the lack of repetitive social interaction among RC managers effectively blocks them from mutual monitoring of each other (as suggested by Towry, 2003) and it limits the value of reputation as a control mechanism (North, 1990).

RC measurability, RC boundaries, and RC managers' revelations of private knowledge

Table 2 presents the expected interaction between RC measurability and RC boundaries on RC managers' type of behavior and the levels of their revelations of private knowledge. Separable RC measurability and competitive RC boundaries frames RC managers as being independent, which is consistent with a market-like relationship (Baker, Gibbons, & Murphy, 2001). In this context, competitive managerial behavior complements separable RC measurability which motivates RC managers to reveal private knowledge much like competition and self-interest complement a system of private property rights in a market economy (North, 1981). Consistent with a competitive market, experimental evidence indicates that in this context competitive behavior increases individual performance (Frederickson, 1992; Ghosh, 2000; Rankin & Sayre, 2000; Young, Fisher, & Lindquist, 1993). Thus, in this context, we expect that RC managers' revelations of private knowledge will be at high levels.

In the context of inseparable RC measurability and competitive RC boundaries, conflict is expected among RC managers, which causes them to have low levels of revelations of private knowledge. When competitive self-interest is salient due to competitive RC boundaries, an RC manager has no reason to contribute his or her private knowledge to help increase organizational performance – unless it increases his or her individual performance. Contributing casts him or her in the role of the “sucker”, while others free-ride (Hirshleifer, 1980; Messick & Brewer, 1983; Milgrom & Roberts,

1992). Moreover, disagreement surfaces among managers when total organizational cost is reduced (Cyert & March, 1963; Hirschman, 1970).

Consistent with this explanation, competitive behavior can be a primary obstacle to discontinuous organizational process change and the improvement of organizational performance (Dertouzos, Lester, & Solow, 1989). For example, Dykman, Davis, and Smigh (1991, p. 10) report that the process of planning a new international electronic mail system “... was fraught with organizational ‘turf wars’ as it lead to conflict between different subsidiaries of an international company, as well as conflict between different departments – all of whom were trying to control the implementation and the ongoing management of the technology.” Denison et al. (1996) and Joyce, McGee, and Slocum (1997) also find that competitive behavior can lead to managerial conflict, resistance, and low performance in cross-functional teams. Finally, Rowe (2004) provides experimental evidence that when RC measurability is inseparable, competitive compared to cooperative RC boundaries leads to significantly lower group-level performance due to free riding and distrust. Thus, when RC measurability is inseparable, competitive managerial behavior can be dysfunctional.

Inseparable RC measurability also means that horizontal inequities are likely to arise among RCs involved in a process change (e.g., some RC managers must sacrifice more than others to achieve favorable group and/or organizational performance) (Ouchi, 1980). Indeed, horizontal inequities are a common source of conflict during discontinuous organizational process change (Lewicki et al., 1992; Starbuck et al., 1978). In particular, competitive RC

Table 2

Expected effects of responsibility-center measurability and responsibility-center boundaries on the type of managerial behavior and the levels of responsibility-center managers' revelations of private knowledge

Responsibility-center boundaries	Responsibility-center measurability ^a	
	Separable	Inseparable
Competitive	(1) Market-like High	(2) Conflict Low
Cooperative	(3) Collusion Low	(4) Communal sharing High

^a Responsibility-center measurability is limited to measurability of financial performance.

boundaries are expected to increase interpersonal conflict among RC managers due to their beliefs that horizontal inequities exist and therefore to motivate them to withhold private knowledge. Thus, when RC measurability is inseparable and RC boundaries are competitive, we expect that revelations of RC managers' private knowledge will be at low levels due to conflict.

In the context of separable RC measurability and cooperative RC boundaries, RC managers are expected to collude, which causes low levels of revelations of private knowledge (e.g., all managers conspire to withhold private knowledge). Collusion arises because separable RC measurability is vulnerable to unsanctioned cooperative managerial behavior – group-oriented behavior that is intended to restrict potential performance, to the detriment of the organization. Several studies provide evidence that separable RC measurability and cooperative behavior can lead to collusion within organizations (Becker & Green, 1962; Roy, 1952; Towry, 2003; Yoon, 1987; Zhang, 2006). Thus, in this context we expect that revelations of RC managers' private knowledge will be at low levels due to collusion.

Finally, in the context of inseparable RC measurability and cooperative RC boundaries, RC managers' behavior is expected to be characterized by communal sharing (Fiske, 1991) among RC managers and thus to result in high levels of revelations of RC managers' private knowledge. Cooperative managerial behavior is necessary when RCs are no longer independent due to unmeasured externalities (Hirshleifer, 1980; Milgrom & Roberts, 1992; North, 1981). For example, cooperation is needed to understand RC interdependencies and identify integrative performance gains, thereby avoiding suboptimal organizational performance. However, when RC measurability is inseparable, it is foolish for RC managers to contribute private knowledge unless a critical mass of other RC managers can be trusted to cooperate by revealing private knowledge (Messick & Brewer, 1983). Moreover, cooperative RC boundaries also are expected to motivate the group of RC managers to perform by having a standard of justice that emphasizes communal sharing even when confronted by horizontal inequities that are associated

with discontinuous organizational process change (Fiske, 1991). Thus, in this context, we expect that revelations of RC managers' private knowledge will be at high levels.

The above analysis as summarized in Table 2 provides the basis for predicting that RC measurability and boundaries have the following disordinal interactive effect on RC managers' revelations of private knowledge:

E3: When RC measurability is separable (inseparable) and RC boundaries are competitive (cooperative), RC managers' revelations of private knowledge will be at high levels and otherwise their revelations will be at low levels.

Research method

Our research strategy uses two methods called temporal bracketing and variance (Langley, 1999). Temporal bracketing divides the time length of a field study into time periods in which there are continuities of events within each time period and discontinuities of events between time periods. We use temporal bracketing to form four time periods based on the intended organizational process change (continuous or discontinuous) and/or the change in RC boundaries (for all four types of RA and participation practices in Table 1). As Langley (1999) notes, each time period can then be used to make comparisons of organizational process change between time periods.

With the variance (also called synthetic) research method “original process data are transformed from stories comprised of ‘events’ to ‘variables’ that synthesize their critical components” (Langley, 1999, p. 704; Van de Ven & Poole, 2005). Variance-method studies of organizational process change investigate by causal analysis how change in the independent variable cause change in the dependent variable. We use temporal bracketing and variance to make two types of comparisons and provide evidence on how consistent the data are with the three expectations: (1) within each time period we compare the realized and expected levels of the four variables and (2) between adjacent time periods we compare the

realized and predicted changes in the levels of the four variables.

All research methods have strengths and weaknesses (Birnberg, Shields, & Young, 1990). Langley (1999) evaluates the variance method for studying organizational process change using three criteria proposed by Thorngate (1976) and Weick (1979), which are accuracy (closeness of the theory to the data), generality (the potential range of situations to which the theory can be applicable), and simplicity (the number of elements and/or relationships in the theory). The variance method is low on accuracy but high on generality and simplicity, with temporal bracketing being medium on these three criteria.

Financial crises like in the focal division (described in Results section) are difficult to predict (and thus for researchers to have access to before and during) and therefore researchers typically conduct retrospective analysis of known discontinuous organizational process changes using archival documentation. Real-time participant observer collection of data are less common, but important due to the evidence it can provide (Van de Ven & Poole, 2005; Young, 1999). We use both retrospective archival analysis and real-time participant observation as the basis for data collection because they enable us to analyze the validity and reliability of the data through triangulation (Eisenhardt, 1989). For example, we examine and reconcile inconsistent observations in order to increase convergent validity.

The field data are contemporaneously collected during a nine-year longitudinal field study of a large division of a US aerospace contactor. These data are from three types of sources: participant observation, real-time collection of documents, and archival documents. Use of participant observation to collect data in real-time has the advantage of gaining the trust of employees in the organization and hence access to information that would be unavailable to outsiders (Anderson, 1995; Young, 1999).

When doing this field study, the first author was a full-time employee insider who became a participant observer at the beginning of the nine-year period and then an insider outsider from the beginning of year four through the middle of year nine,

starting with an academic study of interesting accounting and organizational process change initiatives at the focal division for credit toward a MS degree in Accounting.⁸ This individual was well positioned to gather documents pertinent to accounting and organizational process change initiatives in real-time as his position was to work “What ever is the current hot topic... special projects, as assigned, that identify and implement process improvements”.⁹ The third author was an outsider who supervised the independent research by the first author beginning in year four and he also acted as an unpaid observer during the development of the accounting initiative to reframe RC boundaries from competitive to cooperative that demarcates periods 2 and 3. We also had access to about 9500 pages of mostly proprietary documents for this division that were collected in real-time, including a rich set of documents that detail accounting changes, organizational process change initiatives, special studies by external consultants, interviews, surveys, chronologies of accounting information used by RC managers, and written correspondence from within several teams (Table 3). Finally, we supplement the data with publicly available archival documents from news papers, journals, and books.

Participant observation has costs including the lack of control over the research context, the possibility of unintentionally influencing observed behavior, and the potential for researcher bias. We designed the study to reduce potential researcher bias. Participant observation provides several benefits. One is that it enabled us to observe managerial conflict and resistance that is often unobservable when a discontinuous organizational process change is examined retrospectively (Gersick, 1991). Having two participants in different observer roles increased convergent validity because the two observers provide a check on each

⁸ Wallerstein, Duran, Minkler, and Foley (2005) define insider outsiders as people who are both insiders because of their existing relationships within an organization and also outsiders, due to other reasons such as educational attainment.

⁹ “Performance appraisal for Casey Rowe: General Dynamics Convair Division Accounting Functional Department”, internal Convair report (January 4, 1989), p. 1.

Table 3
Summary of the data

	Period 1	Period 2	Period 3	Period 4
Participant observation and interviews – first author	<ul style="list-style-type: none"> Proposed approximately ten continuous organizational process change initiatives (as the procurement RC manager of the cruise missile product-line) 	<ul style="list-style-type: none"> Interviewed approximately 15 RC managers who were proposing organizational process changes (as the third-party finance liaison for the advanced cruise missile product-line) Acted as liaison to central-management, ABC/ACMS steering committee, and external consultants Conducted approximately 60 three-hour interviews with various RC managers as part of ABC/ACMS development team Conducted division training seminars on ABC and other accounting changes 	<ul style="list-style-type: none"> Participated in ten meetings on the Material Management process cross-functional team (as the team leader and accounting RC representative) Participated ten months full-time on the fabrication process cross-functional team and conducted 23 two-hour interviews with RC managers in the process Participated in five meetings on the general services process reengineering cross-functional team (as the accounting RC representative) 	<ul style="list-style-type: none"> Participated in five continuous organizational process change initiatives in the accounting RC Conducted semi-structured interviews with five key central managers regarding the accounting and organizational process changes that took place at Convair
Unpaid external observer – third author	<ul style="list-style-type: none"> Met with Finance personnel, attended division meetings, supervised an academic independent study by the first author, and observed the development of the ABC/ACMS model for ten months 			
Key documentation & interviews ^a	<ul style="list-style-type: none"> Strategic planning and policy documents Budgets, accounting reports, and accounting system documentation Internal memos and email correspondence Publicly available news articles, journal articles, and annual reports 	<ul style="list-style-type: none"> Strategic planning documents Accounting reports and system documentation Detailed notes from external consultants' interviews with 31 central managers in support of a process benchmarking initiative Presentations by external consultants Presentations and notes from central managers in steering committee meetings Training materials Publicly available news articles, journal articles, and annual reports 	<ul style="list-style-type: none"> Strategic planning and policy documents Internal memos, chronologies of accounting information used in cross-functional teams, copies of presentations made, and minutes from cross-functional team and steering committee meetings Presentations by external consultants Publicly available news articles, journal articles, and annual reports 	<ul style="list-style-type: none"> Strategic planning and policy documents Budgets, accounting reports, and accounting system documentation Internal memos and e-mail correspondence Publicly available news articles, journal articles, and annual reports

^a Most of the documentation was collected in real-time, rather than archivally.

other's understanding of events and the transformation of events to levels of variables. Multiple observers also reduce premature-closure bias when understanding of events differ (Birnberg et al., 1990; Eisenhardt, 1989). The first author's insider-outsider status helped to avoid the demand-effect bias in which interviewees tell researchers what they believe the researchers want to hear (Young, 1999). Long-term participant observation also is helpful in mitigating observer bias (McKinnon, 1988) and diminishing retrospective bias that can be associated with archival data (Van de Ven, 1992). Finally, although we are limited to a single division, the multifaceted nature of theory and research method (within-period predictions by between-period predictions by four variables each with two or three levels) exert a strong disciplining force that sharply limits the potential for bias because only a narrow and theoretically predefined pattern of results could be consistent with the three expectations (Ahrens & Chapman, 2006; Campbell, 1988).

Results

We bracketed the field data into four time periods over the nine-year period between 1986 and

1994. Table 4 presents a time-line along with key environmental events and organizational process change initiatives in each of the four time periods. Changes in central managers' strategy for continuous or discontinuous organizational process change demarcate periods 1 and 2 and periods 3 and 4. Periods 2 and 3 are demarcated based on the change from competitive to cooperative RC boundaries. In order to create an audit trail, the field data are organized by headings that correspond to the four variables in the model within each of the four time periods (Table 4). Finally, at the end of each period, the evidence presented in that period is summarized and related to the three expectations. Table 5 provides a summary of the results for the level of each variable within each time period.

The Convair division

Beginning in 1935 General Dynamics' Convair Division developed and manufactured commercial and military aerospace products in southern California. Due to the cyclical nature of both defense spending and demand for commercial aircraft Convair historically experienced several "boom and bust" cycles. For example, following World War II Convair's revenues fell from

Table 4
Periods, dates, environment, and organizational process change initiatives

Dates	Period 1 January 1986–October 1989	Period 2 November 1989–July 1991	Period 3 August 1991–December 1992	Period 4 January 1993– December 1994
Environment	<ul style="list-style-type: none"> • Industry reforms 	<ul style="list-style-type: none"> • End of Cold War • Cyclical decline in commercial aircraft sales 	<ul style="list-style-type: none"> • Sale of Convair's defense product-lines • Corporate office declares Convair a discontinued operation 	
Organizational process change initiatives	<ul style="list-style-type: none"> • >200 initiatives 	<ul style="list-style-type: none"> • McKinsey & Co. process benchmarking • Four training programs (Conway, Battelle, etc.) • 174 process action teams • ABC/ACMS model 	<ul style="list-style-type: none"> • Material Management process initiative • Fabrication process initiative • Seven process reengineering initiatives • Two new ABC models to support latter two initiatives 	<ul style="list-style-type: none"> • ≈50 initiatives

Table 5
Summary of results: levels of variables in each period

Variables in model	Period 1	Period 2	Period 3	Period 4
Organizational process change ^a	Continuous	Discontinuous	Discontinuous	Continuous
Responsibility-center measurability ^b	Separable	Inseparable	Inseparable	Separable
Responsibility-center boundaries	Competitive	Competitive	Cooperative	Competitive
Revelations of private knowledge ^c	Low \$7M to \$18M/year	Low ~\$0M/year	High \$41.9M/year	Not available

^a The organizational process change is based on central managers' strategic intent.

^b Responsibility-center measurability is limited to measurability of financial performance.

^c We operationalize manager's revelations of private knowledge by how revelations reduce expected division cost.

\$644M to \$13M.¹⁰ Later, several other boom and bust cycles occurred at Convair.¹¹ These busts were memorable. Longtime Convair employees recalled out-of-work “engineers pumping gas” in the early 1960s following the end of a major defense program and when division sales dramatically declined after the Viet Nam war. Later, when President Reagan's defense build-up peaked in 1986, Convair's annual revenues had reached \$1B for the first time. However, another bust was about to occur due to the end of the Cold War and the cyclical decline in commercial aircraft sales.

In 1986 the Convair division was organized as a matrix structure consisting of three product lines by 15 functional departments (e.g., Contracts & Estimating, Engineering, Finance, Legal, Program Development, Operations) with approximately 200 functionally based RCs that were cost centers.¹² For example, the Engineering department was divided into 28 RCs including Advanced Systems, Special Programs, Systems Engineering, and Test & Evaluation. The product lines included two military cruise missile lines (standard and advanced cruise missiles), together accounting for approximately 60% of the divi-

sion's sales, and a commercial aircraft structures product line.¹³

Period 1 (January 1986–October 1989)

Background

In response to taxpayer concerns about waste, fraud, and abuse in the defense industry, reforms shifted risk and up-front investment from the government to contractors, thus reducing contractors' cash flows and leading them to having low stock prices relative to other industries.¹⁴ Between 1985 and 1987, 35% of Convair's contracts were changed from cost plus to fixed price contracts.¹⁵ In addition, the 1984 Competition in Contracting Act broke up Convair's monopoly on its two cruise missile product lines. Convair lost several competitive bids on defense contracts under fixed price contracts.¹⁶ The lost bids were attributed to

¹³ The standard Cruise Missile Line produced “... a lightweight winged aluminum missile which ... [would] ... cruise for more than 1500 nautical miles at very low altitudes to avoid radar detection and strike targets with pinpoint accuracy” (General Dynamics annual report, 1975, p. 5). The Advanced Line produced a cruise missile that was designed to evade radar detection and to fly for a longer range. The commercial aircraft structures line manufactured the central body section of the MD-11 wide-body jet aircraft (consisting of the passenger compartment section).

¹⁴ E. White, “Risky defense industry attracts bidders – consolidation grows as the stakes get higher”. *Wall Street Journal* (November 17, 1986), p. 1.

¹⁵ “Advanced cost management system project briefing”, internal Convair document prepared jointly by Convair and external consultants from Deloitte & Touche (November 1990).

¹⁶ “Firms wage contract price war – McDonnell cuts missile costs to beat GenDyn”. *The San Diego Union-Tribune* (May 10, 1987), p. 1.

¹⁰ At this time the Convair division was known as the Consolidated division (Markusen & Yudken, 1992).

¹¹ G. Johnson, “Bracing for an economic nose-dive firm was key to rise of San Diego's middle class”. *Los Angeles Times* (May 17, 1992), p. 1.

¹² “Convair standard practices manual: Organizational description”, internal Convair document (June 12, 1986).

high bid prices, which arose from high costs. As a result, Convair's central managers changed their cost management strategy from "spend everything the customer has to spend...[to]...become lean and mean".¹⁷

Organizational process change

General Dynamics corporate management predicted that government plans to reduce the defense budget would take place slowly:

"The indications are that such change will be undertaken through a gradual and rational process... The government has projected that defense spending levels will decline at an annual rate of about two percent (in real terms) over the next several years".¹⁸

In response to pressures from the corporate office, Convair's central managers attempted to reduce costs by orchestrating many continuous organizational process change programs. In excess of 200 initiatives were active within RCs that were treated as separate entities based on Convair's traditional RA system (discussed next).¹⁹ Many of these initiatives did not survive competitive selection by central managers. For example, the operations RC's Material Inventory Control On-line System initiative was selected over the finance RC's initiative to create the Convair On-line Integrated Management System. In many instances central managers coordinated initiatives from individual RCs to create broader organizational process-level initiatives. For example, central managers coordinated a limited-scale concurrent engineering pilot initiative, which demonstrated that previously separated RCs including circuit design, manufacturing planning, mass properties analysis, mechanical design, packaging, producibility analysis, requirements definition, and stress analysis could be integrated to reduce total costs.²⁰ In order to reduce

labor costs, two small focused factories were constructed in neighboring low-wage areas: El Centro, California and Tijuana, Mexico.²¹ These factories consolidated several Convair RCs including assembly, inventory management, manufacturing engineering, painting, quality assurance, and test into close proximity within a small facility for the first time. Due in part to union pressures, central managers were careful to state that these new facilities would only achieve small-scale production:

The El Centro plant's "... work force will eventually number about 100. [Similarly, the Tijuana plant's] work force will gradually build up to about 100".²²

A computer publishing pilot initiative showed that integrating several separate tasks including binding, distribution, graphic design, printing, and writing could reduce costs at Convair.²³ Other small-scale organizational process change initiatives at Convair included a paperless factory system,²⁴ an advanced machining system pilot initiative,²⁵ and a pilot study of distributed computer systems.²⁶

RC measurability

The Department of Defense's Cost/Schedule Control Criteria (C/SCSC) mandated a set of management controls that Convair was required to implement and maintain.²⁷ These criteria

¹⁷ Interview with Convair controller (June 23, 1994).

¹⁸ "General Dynamics 1988 shareholder report", corporate annual report, p. 2.

¹⁹ Interview with division planning director (March 14, 1994).

²⁰ McKinnis, C. (1991). Convair goes concurrent. *Computer-Aided Engineering*, 10, 18–27.

²¹ "GenDyn to open two assembly plants: New facilities in El Centro, Tijuana established to trim production costs". *The San Diego Union-Tribune* (March 11, 1989), p. 3.

²² "General Dynamics Convair Division, division notice no. 89-11", internal Convair memo (March 10, 1989), p. 1.

²³ Doebler, P. D. (1991). Process management: Going with the flow. *Computer Publishing Magazine*, 6, 44–55.

²⁴ McGonagle, J. M. (1984). Megabytes of assembly aids. *Production Engineering*, 31, 82–86.

²⁵ "Advanced machining" *General Dynamics World* internal corporate newsletter (May 1988).

²⁶ Bozman, J. S. (1991). A 'framework' for diversity. *Computer-world*, 25, 43.

²⁷ Fleming, Q. W. (1988). *Cost/schedule control systems criteria: The management guide to C/SCSC*. Chicago, IL: Probus Publishing.

required a traditional approach to RA in which RC measurability and RC boundaries were based on Convair's functional hierarchy.²⁸ For example, C/SCSC required Convair's RC managers to be held separably accountable in their "one responsible organizational element" for their cost budget performance.²⁹ Each RC manager was obligated to submit a written variance analysis for significant variances which was reviewed by upper management in the functional hierarchy and then reported to the military customer in a "cost performance report".³⁰ In addition, the government C/SCSC also mandated that RC managers attend the monthly Division Review meeting and be prepared to explain performance deviations relative to their own RC's cost budget.²⁷

RC managers and their employees were given strong incentives to contribute to continuous organizational process changes under Convair's "Good Ideas Program".¹⁹ Individual RC managers who proposed Good Ideas were required to carefully document task changes and quantify the amount of expected cost and budget savings in their RC. Like other organizational process changes, proposals for Good Ideas flowed bottom-up from individual RC managers and were ratified by central managers based on the proposal's relative merits. The RC managers were paid a ten percent bonus (up to \$10,000) for documented cost savings. In addition to receiving the bonus, RC managers received public recognition for their Good Idea in the Convair Weekly Log newsletter. Central managers then coordinated the Good Ideas from the various functional RCs.

²⁸ C/SCSC reporting also required the ability to report by both function and product-line, consistent with Convair's matrix organization structure. However, Convair downplayed the product-line aligned dimension, instead following "...the normal practice in industry... to manage contracts by functional organizational structure". (Fleming, 1988, p. 233).

²⁹ Fleming, Q. W. (1988). *Cost/schedule control systems criteria: The management guide to C/SCSC*. Chicago, IL: Probus Publishing, p. 35.

³⁰ Fleming, Q. W. (1988). *Cost/schedule control systems criteria: The management guide to C/SCSC*. Chicago, IL: Probus Publishing, p. 233.

RC boundaries

In addition to separate measurement of each RC manager's performance, the Department of Defense C/SCSC required individual accounting reports for each RC manager and a separate RC budget for each RC.²⁷ RC managers received accounting information and performance reports for their own RC only; information about other RCs was not shared.³¹ These same competitive RC boundaries also were used to measure and report the results of the various continuous organizational process changes that were underway.³² Also consistent with a competitive RC boundary, separate functional labels were printed on the RC manager's reports to uniquely identify the recipient (e.g., Procurement, Failure Analysis, Systems Engineering).

Convair's internal accounting system was complex and only the finance and estimating RCs had the expertise and authority to "price" expected cost savings for proposed organizational process changes. For example, pricing involved identifying appropriate cost allocations from the division's 19 overhead cost pools.³³ This required significant division-specific accounting knowledge to accomplish. Finding costs also was particularly challenging. For example, Convair's job order cost system divided costs into 183 direct cost elements, 217 indirect cost elements, and 55,609 active work orders.³³ The technical jargon and complexity incorporated in Convair's accounting system effectively blocked RC managers from engaging in real-time negotiations regarding the expected economic effects of competing initiatives.

In their day-to-day work, RC managers were physically separated from each other by office walls and geographic distance between the many buildings within the division. RC managers also were physically separated during budget negotiations. Convair implemented the C/SCSC by having individual RC managers separately meet with a

³¹ "Convair integrated management system procurement manager report" internal Convair document (December 1985).

³² "Manufacturing strategic plan benchmark performance summary", Convair interoffice memorandum (March 15, 1990).

³³ "An overview of Convair accounting", internal Convair document (May 16, 1990).

superior manager for budget negotiations in the superior manager's office. This separate sequential approach also was employed in negotiating budget adjustments when RC managers put forth proposed initiatives. Thus, throughout period 1, RC boundaries were competitive.

RC managers' revelations of private knowledge

Convair used resource allocation practices to motivate RC managers to reveal their private knowledge. RC managers were forced to carefully document expected changes in cost budgets before a process change was evaluated by central managers. This involved RC managers revealing private knowledge and promising to produce cost savings if a process change was implemented.³⁴ Expected cost savings from continuous organizational process changes ranged from approximately \$7M per year during the first half of period 1 to approximately \$18M per year during the second half of period 1, which was at a low level relative to the value of revelations in period 3.³⁵

Summary

The levels of the four variables were continuous organizational process change, separable RC measurability, competitive RC boundaries, and, relative to other periods, low levels of RC managers' revelations of private knowledge (Table 5). In comparing the realized levels of these variables to their expected levels in the model (Fig. 1 and Table 2), three of these four levels in period 1 were consistent with the three expectations. Continuous organizational process change was related to separable measurement (E1) and competitive RC boundaries (E2). However, we found only low levels of RC managers' revelations of private knowledge. We found no support for E3 in period 1. Thus, with the exception of lower levels of RC managers' revelations of private knowledge than expected in period 1, this within-period evidence was consistent with the model. No

between-period comparisons were made because period 1 was the initial period.

Period 2 (November 1989–July 1991)

The following evidence details the economic crisis at Convair, a new strategy to develop discontinuous organizational process changes, and several unsuccessful efforts to replace competitive RC boundaries with cooperative RC boundaries.

Background

In November 1989 an economic crisis shook Convair when the Cold War ended with the former Soviet Union. The news media immediately characterized this event as a catastrophe for defense contractors: "The unthinkable is now becoming a real possibility... [with]... massive defense cuts in the cards."³⁶ Within a year the General Dynamics CEO publicly declared that the defense market had "fundamentally changed".³⁷

Shortly after this historic event the Department of Defense reduced its demand for cruise missiles by 50%.³⁸ A winner-take-all competition was to be held in which the low-priced bidder would win all of the future cruise missile production contracts. Based on the unfavorable outcome of several recent competitive bids,¹⁶ central managers believed Convair's costs were significantly higher than its only competitor.³⁹ Further compounding this economic crisis was a greater than 50% decrease in commercial aircraft sales.⁴⁰

Four months after the fall of the Berlin Wall and the symbolic end of the Cold War, McKinsey & Co. was hired to conduct a process benchmarking study. A process was defined as "a logical,

³⁴ Interview with a manufacturing engineering RC manager (August 20, 1994).

³⁵ Interview with a division planning director (March 14, 1994).

³⁶ Wartzman, R., "Defense Firms Gird for End of Cold War – Prospect of Peace Has Industry Bracing for Shakeout". *Wall Street Journal* (November 29, 1989), p. 1.

³⁷ "General Dynamics denies sale rumors – Speculation about local units runs rampant after Anders' comments" *The San Diego Union-Tribune* (November 1, 1991), p. 1.

³⁸ "Advanced cruise missile encounters rough air". *The San Diego Union-Tribune* (December 8, 1990), p. 1.

³⁹ Interview with Controller (June 23, 1994).

⁴⁰ Ellis, J. "Plane makers see the ground coming up fast". *Business Week* (November 9, 1992), pp. 70–73.

cross-functional linkage of activities which crosses departmental and usually functional boundaries”.⁴¹ Before these consultants completed their study, process-level accounting information was not available at Convair. McKinsey & Co. spent five weeks constructing Convair’s processes and identifying which of Convair’s processes had the greatest potential for reducing costs to world-class standards.⁴²

Following McKinsey & Co.’s study, all employees participated in several training programs conducted by consultants from the Battelle Memorial Institute, Conway Quality Inc., and the American Samurai Institute. This training provided RC managers and employees with the knowledge to effectively participate on cross-functional teams that were needed because “systems usually overlap departmental boundaries”.⁴³ These teams were to “follow the money... [in order to]... eliminate waste”.⁴⁴ After completing the training programs, 174 process action teams composed of RC managers and employees worked to identify opportunities for major cost reductions at Convair.⁴⁵

At the end of period 2 the advanced cost management system (ACMS) was initiated by a “smart accountant who was ahead of the game in presenting solutions” using ABC concepts (hereafter referred to as the ABC/ACMS model).⁴⁶ According to the Accounting Director who initiated the ABC/ACMS model:

“A lot of decisions were being made on the wrong data. We never knew if a lot of decisions were not being made because of the lack of the right data. [The ABC/ACMS model] was an attempt to improve decisions recognizing that accounting data were influencing decisions”.³⁹

This model was to provide “an activity-view of the enterprise”.⁴⁷ The Convair Division General Manager assigned a steering committee composed of central managers to oversee the development and implementation of the ABC/ACMS model. In November 1990, the cost management initiatives (CMI) department was formed to develop the ABC/ACMS model along with external consultants from Deloitte and Touche.⁴⁸ A 10-member cross-functional team was assigned the task of attempting to collect RC managers’ private knowledge needed to construct the new ABC/ACMS model. During the six-week development period the CMI team conducted three rounds of structured interviews with 161 RC managers spanning all 11 division vice president’s areas of responsibility.⁴⁹ This model identified 600 unique activities and approximately 150 cost drivers. The ABC/ACMS model was completed June 15, 1991, marking the end of period 2. The information from the ABC/ACMS model was not shared with RC managers until the beginning of period 3.

Organizational process change

McKinsey & Co.’s final report concluded that, “There is significant value – \$235 million conservatively estimated – as a result of improving performance in the short term to close the world-

⁴¹ “Advanced cost management system (ACMS) survey #3”, internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (April 19, 1991), p. 3.

⁴² “Perspectives and recommendations emerging from the benchmarking process: Review with Convair General Manager”, internal Convair document prepared by external consultants from McKinsey & Co., Inc. (June 14, 1990).

⁴³ “Conway handbook”, internal Convair training material prepared and presented by Conway Quality, Inc., (October 13, 1990), p. 4.

⁴⁴ “Conway handbook”, internal Convair training material prepared and presented by Conway Quality, Inc. (October 13, 1990), p. 4.

⁴⁵ “Process action teams: Purpose, owner, and function”, internal Convair document (October 21, 1991).

⁴⁶ Interview with a director of planning conducted by McKinsey & Co., Inc. (June 14, 1990), p. 16.

⁴⁷ “Advanced cost management system project briefing”, internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (November 1990), p. 15.

⁴⁸ “Advanced cost management system (ACMS) steering committee meeting #1”, internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (May 10, 1991).

⁴⁹ “ACMS steering committee meeting #2”, internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (May 24, 1991).

class gap”.⁵⁰ This unfavorable gap was attributed to poor performance in Convair’s Material Management, Fabrication, and Management processes.⁵¹ The gap was substantial as it equaled approximately 50% of Convair’s controllable costs (after eliminating the cost of purchased materials which were assumed to be fixed).³⁹ According to McKinsey & Co., achieving the \$235M in cost savings and closing Convair’s unfavorable gap would require a “One-time step function improvement to meet market discontinuities”.⁵² Other consultants were hired to validate McKinsey & Co.’s recommendations. According to the Controller:

“All of the studies (McKinsey & Co., E&Y, Bain, etc.) said basically the same thing. To get larger potential cost savings required cross-functional organization. This was very difficult and dramatic”.³⁹

Consistent with a strategy of discontinuous organizational process change, we find evidence that central managers intended to rapidly pursue large-scale organizational process change. Early in the development of the ABC/ACMS model, the ABC/ACMS steering committee directed the development team to “accelerate the effort”.⁵³ They also cast votes to guide the development of the ABC/ACMS model and at least four of the five steering committee members voted that current accounting data and process were “poor” for strategic make/buy, facility rationalization, cost forecasting, and cost improvement and that new ABC/

ACMS data to support these cost objectives was a “must-have within in 0–6 months”.⁵⁴

RC measurability

Convair’s General Manager announced his strategy to “shift emphasis from individual output to the productivity of cross-functional teams”.⁵⁵ For example, each of the 174 process action teams submitted only a single report that documented their team’s plan without identifying the contributions that each RC manager had made.⁴⁵ A process action team was now treated as the smallest accountable unit within the division.

Early in the development of the ABC/ACMS model the steering committee assigned a compensation committee the task of evaluating new performance-contingent incentives in order to motivate RC managers to contribute to discontinuous organizational process changes.⁵⁶ However, the compensation committee concluded that, due to the fluid nature of the cross-functional task, creating new incentives was not advisable. The compensation committee recommended removing, rather than creating, performance-contingent incentives.³⁹ As a result, for example, the Good Ideas program was canceled (see period one).

RC boundaries

In the process benchmarking study that took place, McKinsey & Co. first recast some of Convair’s accounting information around cooperative RC boundaries based on interviewing central man-

⁵⁰ “Perspectives and recommendations emerging from the benchmarking process: Review with Convair General Manager”, internal Convair document prepared by external consultants from McKinsey & Co., Inc., (June 14, 1990), p. 13.

⁵¹ “Perspectives and recommendations emerging from the benchmarking process: Review with Convair General Manager”, internal Convair document prepared by external consultants from McKinsey & Co., Inc. (June 14, 1990).

⁵² “Perspectives and recommendations emerging from the benchmarking process: Review with Convair General Manager”, internal Convair document prepared by external consultants from McKinsey & Co., Inc. (June 14, 1990), p. 14.

⁵³ “ACMS steering committee meeting #2”, internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (May 24, 1991), p. 1.

⁵⁴ “ACMS steering committee meeting #3”, internal Convair document prepared jointly by Convair and external consultants from Deloitte & Touche (June 12, 1991), pp. 15 and 23.

⁵⁵ “Convair total quality management plan”, internal Convair document (January 17, 1991), p. 44.

⁵⁶ The ABC/ACMS steering committee expressed their interest in performance-contingent incentives at the time a new incentive plan had been implemented for the top 25 corporate and divisional managers. On May 1, 1991, General dynamics shareholders had ratified an incentive plan in which the “top 25” corporate and divisional managers received a bonus equal to their base salary each time General Dynamics stock increased by \$10 for a minimum of ten days (Dial & Murphy, 1994). The “top 25” included Convair’s General Manager and Controller. The first bonus occurred in less than three months. The board of directors elected to cancel the “top 25” incentive plan five months later, after the second round of bonuses.

agers and then using this information to create an innovative accounting model that produced several new organizational processes.⁵¹ The organizational processes were conceptualized as cutting horizontally across the division by combining activities from several RCs. For example, the Material Management process was found to combine parts of previously separated RCs including engineering, procurement, estimating, accounting, quality assurance, and operations. Other organizational processes included fabrication, aircraft assembly, and general management.⁵¹ The process benchmarking reports were used by Convair's central managers for strategic planning purposes; however, this information was not shared with RC managers in period 2. Rather, with a few exceptions discussed below, competitive RC boundaries from period 1 remained.

In 1989 Convair began to use cooperative RC boundaries on a limited basis. The training programs all RC managers attended espoused cooperative boundaries. For example, the TQM training program materials stated "All work is part of a process".⁵⁷ Building on this theme several ABC pilot projects constructed process-level accounting reports that grouped together activities from many RCs. This information was shared with the RC managers who were involved in the process. For example, the Commercial Aircraft Assembly process pilot initiative grouped activities from various quality assurance, industrial engineering, and manufacturing engineering RCs that were previously treated as being distinct departments.⁵⁸ Additionally, 21 of the 174 process action teams were organized as cross-functional teams with cooperative RC boundaries (they met in face-to-face meetings where negotiations were conducted in real-time).⁵⁹

The ABC/ACMS steering committee approved a plan to incorporate 35 processes into the ABC/ACMS model (e.g., Material Management, Fabrication, Obtain New Business, Develop Conceptual Design, Develop & Verify Products, Provide Product Support, and Manage and Support the Division).⁶⁰ The Accounting Director explained that the processes in the ABC/ACMS model "were structured around what we were trying to influence. I was experimenting. I was not sure what the right level of implementation was".³⁹

One of the first applications of the ABC/ACMS model the steering committee commissioned was to examine the process-wide "cost of collecting cost".⁶⁰ The analysis found that "the number of work orders drive 62% of cost". This revelation stirred a dialogue among the steering committee members who expressed that reducing work orders would be a simple task.⁶¹

RC managers' revelations of private knowledge

The Finance RC Manager confided in the first author that he was aware of opportunities to substantially streamline the workload in finance as a result of reduced Department of Defense C/SCSC accounting reporting requirements (see period 1) caused by the division's changes from cost plus to fixed-price contracts. He also speculated that additional opportunities existed for process improvement and cost reduction in other parts of the Financial Management process, including the finance, estimating, and contracts RCs. However, the Finance Manager did not publicly reveal these opportunities. His behavior was strategic. He explained that he was reluctant to cooperate because he expected other RC managers to withhold private information. Thus it would be foolish for him to make a sacrifice when he expected that others would free ride. The Controller explained:

"People are adverse to change – everybody at all levels. This has to be addressed at an

⁵⁷ "Conway handbook", internal Convair Division document produced by Conway Quality, Inc. (October 13, 1990).

⁵⁸ "ACMS steering committee meeting #1", internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (May 10, 1991).

⁵⁹ The title "process action team" turned out to be a misnomer. A total of 153 process action teams (88% of the total) were composed of functional managers and employees from the same responsibility center. These teams were formed *within* RC boundaries, consistent with a competitive RC boundary. "Process action teams: Purpose, owner, and function", internal Convair document (October 21, 1991).

⁶⁰ "ACMS steering committee meeting #3", internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (June 12, 1991).

⁶¹ "ACMS steering committee meeting #3", field notes (June 12, 1991).

individual level. Change creates anxiety. People don't know how they will fit in after the transition. Culture and individual willingness to change is a huge constraint".³⁹

The Research & Engineering Vice President provided similar insights:

"Functional rivalry is a big problem in goal setting... Middle management will have a great deal of difficulty relinquishing decision making authority to a multi-disciplinary design team".⁶²

McKinsey & Co. documented conflict among functional vice presidents who favored competing pet projects. In McKinsey & Co.'s interviews, each functional vice president only expressed an interest in an organizational process change that promised to extend his or her functions influence in the division while minimizing his or her function's future budget cuts. For example, the Research & Engineering Vice President hoped to implement concurrent engineering (expected to produce cost savings in quality assurance, and operations) while the Operations Vice President wanted to adopt continuous flow manufacturing (expected cost savings in several engineering RCs). The conflicting agendas reflected the vice presidents' self-interest and stifled progress in adopting discontinuous organizational process change. Moreover, realizing expected cost savings from accelerated organizational process change initiatives had stalled. For example, in an interview, a planning RC manager told McKinsey & Co. that "Dismantling bureaucracy after moving facilities off-site is virtually impossible".⁶³ Similarly, the Controller remarked "only a small fraction of budgeted overhead cost savings had been realized when parts were outsourced".⁶⁴ Acknowledging the conflict external consultants from Ernst & Young concluded that:

"It is crucial that Convair unify all the major improvement initiatives and/or projects in a coordinated effort to achieve divisional performance improvement. Without doing so, the current state of affairs at the division will continue to undermine proposed changes and substantially increase the risk of project-failure and increase costs".⁶⁵

Like McKinsey & Co. and Ernst & Young, the training programs pointed to RC managers as the key source of information about initiatives and their effects:

"Asking for ideas from the people who do the work can result in significant improvements... the people are the experts, they are the ones doing the work. They may not have the authority to fix problems, but they can see where the problems are. And many of them will have good suggestions for how those problems can be corrected".⁶⁶

However, none of the 174 process action team's revealed any useful information about discontinuous process improvements or the potential for large cost reductions.⁶⁷ Although accounting personnel interviewed several of the process action team members, no one was willing to identify and quantify potential cost savings. By the end of period 2, none of these teams had produced any measurable cost reductions and the teams were disbanded.⁶⁸

⁶⁵ "Integrated management system process value analysis report", internal Convair document prepared by external consultants from Ernst & Young, (May 7, 1990) quoted in "Advanced cost management system (ACMS) steering committee meeting #3", internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (September 5, 1991), p. 12.

⁶⁶ "Conway handbook", internal Convair Division document produced by Conway Quality, Inc. (October 13, 1990), p. 5.

⁶⁷ Interview with the Vice President of Operations (June 9, 1992).

⁶⁸ As previously mentioned, although most of the process action teams had purely competitive RC boundaries, 21 of these teams (12%) had a mixture of both competitive and cooperative RC boundaries. Like the other process action teams that were structured using competitive boundaries, these mixed-boundary teams did not reveal any private knowledge. "Process action teams: Purpose, owner, and function", internal Convair document (October 21, 1991). Interview with division planning director (March 14, 1994).

⁶² Interview with Research & Engineering Vice President conducted by McKinsey & Co., Inc. (June 14, 1990), p. 27.

⁶³ Interview with a planning director conducted by McKinsey & Co., Inc. (June 14, 1990), p. 19.

⁶⁴ Interview with Controller conducted by McKinsey & Co., Inc. (June 14, 1990), p. 18.

Finally, early in development of the ABC/ACMS model, external consultants lead the ABC/ACMS steering committee toward a less contentious strategy. The ABC/ACMS model was to be constructed by asking RC managers only for the knowledge that was needed to reframe RC boundaries. Unlike the private information needed to extract organizational benefits from a process change, private knowledge that RC managers were first asked to provide did not commit them to giving up budgetary resources. Rather information was elicited for the purpose of reframing RC boundaries to create the cooperative context that would be used to motivate RC managers to reveal their more sensitive information in period 3.

Summary

The levels of the four variables were discontinuous organizational process change, inseparable RC measurability, competitive RC boundaries, and low RC managers' revelations of private knowledge (Table 5). This within-period evidence in comparison to the model (Fig. 1 and Table 2) was consistent with the relationships in E1 and E3 (cell 2 in Table 2), however, this evidence was inconsistent with E2 because cooperative RC boundaries for all four types of RC and participation practices did not exist during this entire period. Considering between-period evidence, the changes in the levels of the variables between periods 1 and 2 supported E1 and E3 but not E2 (Table 5).

Period 3 (August 1991–December 1992)

Background and organizational process change

This period was critical in the division's response to the economic crisis it faced. Central managers maintained its strategic goal of quickly achieving large cost reductions through discontinuous organizational process change. Up to this point there was "no clear picture of anticipated benefits from cost reduction initiatives".⁵⁸ The Vice President of Operations asked "How do we get the cost out? What elements do we have a chance of influencing? What are the enablers that will allow us to eliminate cost?"⁶⁷ According to McKinsey & Co. "80% of the potential in major productivity

improvement programs is achieved only when the front-line workers, supervisors, and support personnel are empowered to identify and solve problems".⁶⁹ The consultants from Deloitte & Touche explained that "Once activities are known we can ask fundamental questions about these activities and the resources they consume".⁷⁰ Their previous clients had used ABC "to develop a business process view of the enterprise...[based on this they]...identified and evaluated improvement opportunities in cross-functional teams...[and]...developed actionable cost reduction opportunities based on structured analysis".⁴⁹ Similarly a pilot initiative commissioned by the ABC/ACMS steering committee to focus on reducing material and procurement cost concluded that "because material cost is driven by [functional] organizations outside procurement, a cross-functional team is required for process improvement".⁷¹ In addition, this same pilot initiative concluded that "the Material Management process team will initiate actions to produce near term results".⁷¹ In the second ABC/ACMS steering committee meeting the consultants from Deloitte & Touche further explained:

"Cross-functional analysis...reflects an enterprise-wide view of managing the business...[This]...prevents silo-oriented improvement initiatives...[and it]...allows for optimizing performance of the entire business, not local optimums...[through] streamlining cross-functional processes".⁷²

⁶⁹ Perspectives and recommendations emerging from the benchmarking process: Review with Convair General Manager," internal Convair document prepared by external consultants from McKinsey & Co., Inc., (June 14, 1990), p. 49.

⁷⁰ "Advanced cost management system project briefing," internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (November 1990), p. 18.

⁷¹ "ACMS steering committee meeting #4," internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (September 5, 1991), p. 7.

⁷² "ACMS steering committee meeting #2," internal Convair document prepared jointly by Convair and external consultants from Deloitte and Touche (May 24, 1991), p. 44.

Period 3 marked the first time that cooperative RC boundaries were implemented consistently at Convair. In response, RC managers began to cooperatively reveal their private knowledge about dramatic cost savings that were expected from discontinuous organizational process changes. The period-3 initiatives were managed by central managers in steering committees and they were planned by cross-functional teams.⁷³ The cross-functional teams were composed of RC managers who were collectively responsible for devising technical and financial changes for an entire organizational process.

In January 1991, the Convair Division General Manager had announced his strategy to promote “A significant thrust toward improved quality, productivity, and reduced costs including group dynamics, teamwork, work cells, openness to new ideas, and mutual trust”.⁷⁴ Later, in October 1991, the ABC/ACMS Steering Committee announced its decision to begin using the ABC/ACMS model to support the first discontinuous organizational process change initiative in the Material Management process:

“In today’s defense environment coupled with the increasing pressure on financial performance, investment restrictions and reductions, we are confronted with critical decisions to manage our business. Many of these decisions will have far reaching impacts ... As the steering committee for [the ABC/ACMS] project, we have decided to expand its role. We have directed...[the Material Management process steering committee]... to implement the [ABC/ACMS] as follows: ‘An [ABC/ACMS]-based process value analysis will be performed for the Material Management process. A cross-functional team will be assigned to understand the division’s Material Management process from requirement generation by engineering to installing [materials in] the product. This team will establish a current baseline, identify appropriate improvement initiatives, evaluate current

initiatives and develop process improvement plans. Results from this analysis will determine how we proceed with other Convair business processes using [ABC/ACMS]”.⁷⁵

Accordingly, the Material Management process cross-functional team was created by physically bringing together RC managers (or their representatives) from accounting (the first author), engineering, inventory control, procurement, and product-line management. Based on the ABC/ACMS model, the newly created Material Management process spanned five vice presidents’ functional areas of responsibility, incorporating 55 activities, 71 cost drivers, and \$63M in cost, of which 60% was non-value-added.⁷⁶ In the team’s first meeting they clarified their charter:

“The expectations expressed by the [ABC/ACMS] and the Material Management process steering committees were discussed as they relate to our team. They can be summarized as follows: select near-term, high-potential Material Management process improvement(s) using the [ABC/ACMS] model”.⁷⁷

In the second meeting the team members expressed that:

“The high level of support from the Material Management process steering committee combined with the new [ABC/ACMS] model capabilities gives our team a unique opportunity to produce significant and urgently needed change”.⁷⁸

RC measurability

The Material Management process cross-functional team was asked to negotiate plans for rapid

⁷³ Galbraith (1993) refers to the use of a (cross-functional) committee and cross-functional team as a parallel organization structure in which the cross-functional team reports to the (cross-functional) committee.

⁷⁴ “Convair total quality management plan”, internal Convair document (January 17, 1991), p. 3.

⁷⁵ “ACMS deployment”, internal Convair memo (October 30, 1991), p. 1.

⁷⁶ “Material Management process cross-functional team recommendations to the Material Management process steering committee”, internal Convair document (January 29, 1992).

⁷⁷ “Minutes of meeting #1, Material Management process team”, Convair interoffice memorandum (October 31, 1991), p. 2.

⁷⁸ “Minutes of meeting #2, Material Management process team”. Convair interoffice memorandum, (November 5, 1991), p. 2.

cost reductions through intensive lateral negotiations with team members (various RC managers) who had functionally differentiated private knowledge about the Material Management process. Team members were specialists in different functional parts of the process they worked on, so requiring that team members monitor each other within these teams was not feasible. Consistent with the team concept, no effort was made to measure how much each RC manager contributed to the initiative and the cross-functional team was held accountable as a group. The inseparable nature of this initiative was reinforced by requiring the team to present a single report to the steering committee detailing plans for discontinuous organizational process changes and large rapid cost reductions. Inter-RC negotiations, externalities among the RC managers who participated in the cross-functional team, and the discontinuous nature of the organizational process change created a control environment in which separable RC measurability was too costly and thus only inseparable RC measurability was economically feasible.

RC boundaries

The majority of the time spent creating the ABC/ACMS model was devoted to translating the specialized jargon in Convair's accounting system into language that was easily understood by all of the RC managers across organizational processes.⁶⁰ For example, based on one interview, several technical accounting classifications (indirect accounts 6111, 6387, 6391, and direct labor code 25) were consolidated under an activity called "tracking and resolving material shortages". In addition technical language in reports from Convair's integrated management system was simplified so as to be consistent with a cooperative RC boundary.⁷⁹

At the beginning of period 3 competitive RC boundaries were deemphasized and replaced by cooperative RC boundaries. For example, on July 26, 1991, the first set of ABC/ACMS reports was distributed to all Convair supervision. The cover page stated that the "[ABC/]ACMS now provides a framework needed to help us meet the challenges and critical decisions facing us today".⁸⁰ The next four pages were devoted to tables and figures displaying accounting information organized using predominantly cooperative RC boundaries. Only one small figure (1/4th of a page) depicted a competitive RC boundary by reporting separate accounting information for each RC manager. This figure was displayed in the upper right-hand corner of the first report, as a point of departure. The remaining 3.75 pages of the accounting reports (94%) were devoted to the new organizational process accounting and organizational design that implied cooperative RC boundaries by grouping the RC managers who worked on a common process together. Consistent with the new boundaries, discussion about RC manager's individual budgetary performance was eliminated from the agenda in the monthly Division Review meeting.¹⁹

None of the members of the Material Management team had worked in close proximity before. The team members participated in the context of face-to-face meetings for the first time in period 3. Team members evaluated competing initiatives and conducted simultaneous negotiations in order to arrive at a plan for discontinuous organizational process change in the Material Management process.

As the basis for developing their plan, the Material Management team members selected reports from the ABC/ACMS model with cooperative as opposed to competitive ABC/ACMS boundaries. Although RC managers were used to receiving performance reports that focused exclusively on their own RC, cross-functional team members requested predominantly group-level performance reports from the ABC/ACMS model that aggregated RC information for the entire

⁷⁹ Recall that Convair integrated management system reports were based on the Department of Defense's Cost/Schedule Control Criteria (C/SCSC) (discussed in period 1). These criteria and reports used rather technical accounting language, consistent with a competitive RC boundary. For example, the technical nature of the language mandated by C/SCSC was discussed in: Grskovich, D. L. (1991) "What is C/SCSC? In english please!" *National Contract Management Journal*, 23, 25–32.

⁸⁰ "ACMS deployment", internal Convair memo (July 26, 1991), p. 1.

Material Management process. Of the 34 reports the Material Management team used, 30 (88%) were designed using group-level or cooperative RC boundaries. The competitively organized RC information (12% of the reports) was used only in the team's early explorations to validate the group-level accounting information in the ABC/ACMS model.⁸¹ Moreover, functional RC titles (e.g., "receiving inspection", "material control", "automated warehouse") that were used to identify a particular RC manager on accounting reports previously were not displayed on the process-level reports the team used as the basis for negotiating process changes.

Consistent with cooperative RC boundaries, the ABC/ACMS model provided accounting information using simplified accounting language that all RC managers understood instead of the technical accounting jargon and myriad of codes (cost codes, overhead account numbers, technical concepts such as overhead allocations) that were used previously. The new accounting model helped to make accounting information about activities from other RCs in the Material Management process more accessible by eliminating the accounting jargon and codes and substituting plainspoken language for technical terms. This more accessible accounting language was said to be appropriate because "cost is cost to the customer".⁸² In the ABC/ACMS model, cost information was stated in simple, direct language. As a result, there was no need for an accountant to translate accounting jargon, cost codes, and complex overhead cost allocations for RC managers across the organizational process. Rather, the ABC/ACMS model enabled the RC managers on each cross-functional team to debate costs directly consistent with a cooperative RC boundary.

Also consistent with cooperative RC boundaries, central managers opened the books and began giving cross-functional team members full access to strategic planning information for the division as a whole. This information had not pre-

viously been shared with RC managers. The newly shared strategic information provided to the Material Management process team modeled the Convair division as a single entity, absent competitive RC boundaries.

The Material Management process cross-functional team's final report that was presented to the Material Management process steering committee constructed figures that emphasized the openness and connections among the various activities within the Material Management process. This report contained only two small figures (40% of a single page) that were designed using competitive RC boundaries. The remainder of the 16-page report (97.5% of the pages in the report) was devoted to figures and tables that reflected cooperative RC boundaries.⁷⁶ Once again, accounting information designed using competitive RC boundaries was used only briefly in the team's final report as an introductory segue to the cooperative process-level accounting information on which the team designed their final report.

RC managers' revelations of private knowledge

In stark contrast to period 2, in period 3 managers involved in the Material Management process cross-functional team members openly revealed private knowledge about a high level of cost savings expected from implementing specific discontinuous organizational process changes. The plan this team presented to the Material Management steering committee revealed, in total, the Material Management process teams' proposed initiatives were expected to reduce the total cost of the process by approximately 30%.⁷⁶

Contributing private knowledge about potential cost savings was costly to the RC managers because it constituted a promise to take a substantial budget cut if the discontinuous organizational process change were implemented. Revealing this knowledge, however, also often illuminated other unintended ways of reducing costs. For example, in developing one planned initiative, the Procurement RC manager revealed that his RC had 15 clerks who manually input purchase order data. This work could easily be eliminated independently of the initiative, for example using Convair's electronic data interchange capability.

⁸¹ Chronological compilation of accounting reports used by the Material Management process cross-functional team, internal Convair notebook (September 1991 – January 1992).

⁸² Participant observation, field notes (May 1991).

Although the Material Management cross-functional team members ultimately choose to act cooperatively, conflict was apparent in the team's early meetings. For example, over several meetings the Engineering RC manager remained adamant that the team should sponsor his RC's pet initiative to create an engineering material request system. However, the Engineering RC manager could not identify significant cost savings using the ABC/ACMS model. He eventually relented to pressure from other team members and agreed to support other initiatives that promised larger, quicker cost savings.

The Material Management cross-functional team members acted in a way that was consistent with communal sharing, as evidenced by the achievement of consensus on three important issues. First, after investigating the 38 initiatives and pilot projects that were in early stages of development, the Material Management process team members reached an agreement that expanding a just-in-time (JIT) operations pilot initiative to the entire Material Management process held the largest potential to reduce organizational process costs.⁸³ Second, members reached a consensus that a new discontinuous organizational process change to reduce material shortage-related costs by reengineering the various activities involved in the requirements generation process to eliminate bill of materials errors held the largest potential for additional cost savings.⁸⁴ Third, the team agreed that larger cost reductions were possible for (1) and (2) above if the boundaries of the Material Management process were expanded to incorporate an additional \$14.3M in activities from two adjacent organizational processes (bringing the total value of the costs in the organizational process to \$77.3M).⁸⁵

Further evidence of cooperation was provided by the procurement RC manager. While analyzing

one initiative he volunteered that several managers in his RC had purposely distorted revelations of private knowledge used to construct the ABC/ACMS model. According to the Procurement RC manager this was done in order to avoid cost management pressures.⁸⁶

On January 29, 1992 the Material Management cross-functional team presented its plan for discontinuous organizational process change to the Material Management process steering committee. The team identified \$22.9M in expected cost savings from expanding a JIT pilot initiative and from the new initiative to reengineer the requirements generation process.

Also consistent with the notion of communal sharing, Material Management process team members volunteered private knowledge despite their awareness of substantial horizontal inequities. Through cross-functional negotiations, it had become apparent that expected cost reductions from the proposed Material Management process changes would be uneven across the RCs in the process. The RCs that supported the front-end of the process (engineering and material control) were anticipated to win new status and little in the way of cost cuts, while RCs that supported the down-stream part of the organizational process were expected to take heavy budget cuts (procurement, quality assurance, and inventory management).⁸⁷

The ABC/ACMS and the Material Management process steering committees were pleased with the outcome of the Material Management process change.⁸⁸ For the first time, RC managers had publicly revealed private knowledge about the potential for large budget and cost reductions if carefully documented discontinuous organiza-

⁸³ "Minutes of Meeting #5, Material Management process team", Convair interoffice memorandum, (November 5, 1991).

⁸⁴ "Minutes of Meeting #6, Material Management process team", Convair interoffice memorandum, (November 22, 1991).

⁸⁵ "Interoffice Memorandum, Minutes of Meeting #6, Material Management process team", internal Convair document (November 22, 1991).

⁸⁶ Specifically, costs associated with resolving material shortages were purposely hidden by labeling the associated activity "constraint resolution". Moreover, this activity was rated as being 100% "value added" when it was known to be entirely non-value-added by RC management. Participant observation, field notes (November 1991).

⁸⁷ "Minutes of Meeting #8, Material Management process team", Convair interoffice memorandum (December 5, 1991).

⁸⁸ Interviews with the Vice President of Operations (April 2, 1993), a division planning director (March 14, 1994), and the Controller (May 16, 1994).

tional process changes were implemented. After plans for discontinuous organizational process change in the Material Management process were ratified by central managers, the steering committees, and the cross-functional teams were disbanded.

In addition to the results reported above for the discontinuous organizational process change in the Material Management process, we also have data that are consistent with the model (Fig. 1 and Table 2) for eight additional cross-functional teams and associated steering committees charged with discontinuous changes in six other organizational processes during period 3 (Fabrication, Integrated Product Development, Imperial Valley Facility, Assembly, General Services, and Product Assurance).⁸⁹ Like the Material Management process, each of the additional processes combined activities from preexisting RCs in ways that departed from Convair's functional hierarchy. Following the Material Management process team, two new ABC cost models were constructed to support the subsequent cross-functional teams. Like the previous ABC/ACMS model, the new ABC models required gathering relatively innocuous private knowledge. This information was then used, in part, to reframe RC boundaries from competitive to cooperative.

In June 1992, both Cruise Missile product lines were sold.⁹⁰ Therefore, the remaining efforts to reduce total costs by discontinuous organizational process change contemplated a division that was approximately 60 percent smaller. Consistent with communal sharing the additional cross-functional teams cooperated by identifying an additional \$19M in expected cost savings. For example, external consultants from Bain observed seven (of eight) of the additional cross-functional teams. The consultants concluded that cross-functional team members actively cooperated: "Task force members have individually borne the risk of participat-

ing in aggressively pursuing cost reduction targets...[despite]...members' incentive to 'protect' home departments".⁹¹

Summary

The levels of the four variables in the model were discontinuous organizational process change, inseparable RC measurement, cooperative RC boundaries, and a high level of RC managers' revelations of private knowledge (Table 5). The levels of these variables in period 3 were consistent with the model (Fig. 1 and Table 2). That is, discontinuous change was associated with inseparable RC measurability and cooperative RC boundaries, consistent with E1 and E2. The inseparable RC measurability, cooperative RC boundaries, and the high levels of RC managers' revelations of private knowledge were consistent with E3 and Table 2. Considering between-period evidence, the changes in the levels of the four variables between periods 2 and 3 were consistent with the model (Fig. 1 and Table 2).

Also consistent with E3, we find evidence that redesigning RC boundaries successfully changed or reframed RC managers' behavior. Although we found competition (period 1) or conflict (period 2) between RC managers, after all RA and participation practices were changed to imply cooperative RC boundaries in period 3, RC managers selected accounting reports structured using cooperative RC boundaries. In addition, all of the period 3 teams produced joint reports for the central managers in the steering committee predominantly based on cooperative RC boundaries. This evidence indicated that RC managers' frame changed from competitive to cooperative. Also, consistent with cooperation, and specifically communal sharing (Table 2), we find that in all period-3 discontinuous organizational process change initiatives, team members choose to voluntarily contribute private knowledge despite costs of contributing that were inequitably shared among team members.

⁸⁹ Results for the additional eight period-3 cross-functional teams and discontinuous organizational process changes are available from the first author upon request.

⁹⁰ "Hughes buys GenDyn missiles unit – \$450 million deal leaves those at Convair unsure of future". *The San Diego Union-Tribune* (May 11, 1992), p. 1.

⁹¹ "Business reduction challenge: First steering committee meeting", internal Convair document prepared by external consultants from Bain (November 13, 1992) (November 13, 1992), p. 3.

Period 4 (January 1993–December 1994)

Background and organizational process change

At the beginning of period 4 the General Dynamics Board of Directors announced Convair was no longer a core business and it was reclassified as a discontinued operation.⁹² As the result of this decision Convair's central managers ended their strategy of discontinuous organizational process change. Convair's Controller explained that "Change requires some type of investment – time or money. A risk Corporate was not willing to take. How big a change is possible without investment?"⁹³

Central managers returned to a strategy of continuous organizational process change. For example, one continuous organizational process change was planned and executed within the manufacturing planning RC to improve the quality of blueprints from McDonnell Douglas (the customer for Convair's remaining commercial aircraft product-line).⁹⁴ Another initiative was developed by the Finance RC to simplify the cost accounting system by eliminating unnecessary work orders and accounts. An additional Finance initiative developed improved performance measures for the new Fabrication process cells (planned and approved in period 3).⁹⁵ Each of these initiatives was small in scope within RCs, they were developed and implemented gradually, and they were not expected to generate large cost savings.⁹³

RC measurability

Central managers' emphasis shifted from team accountability to holding RC managers individually accountable for their performance. For example, in developing performance measures for the new manufacturing cells (see period 3) the Operations Vice President's goal was to "drive accountability to the lowest level... [to]... foster ownership,

motivate improvement, measure relative performance between competing cells, and identify the factors creating success".⁹⁶

RC boundaries

At the beginning of period 4 the ABC cost models that supported cooperative RC boundaries were abandoned. Process-level accounting reports and division-level strategic planning information were no longer shared with RC managers. The Finance RC resumed production of accounting information with competitive RC boundaries using the accounting system that had been designed to support the C/SCSC that was mandated by the Department of Defense (see period 1). The practice of simultaneously planning expected cost savings from initiatives through face-to-face cross-functional team meetings also was discontinued in favor of sequential participation that involved meetings between a single RC manager and the Product-Line Vice President. In implementing cellular manufacturing, competitive RC boundaries were constructed between each fabrication cell.⁹⁷ For example, each cell received its own accounting report and detailed accounting information about other cells was not shared, and the employees within each cell were physically separated from employees in other cells.

RC managers' revelations of private knowledge

Revelations of these RC managers' private knowledge were not available to us in period 4, because the division was declared a discontinued operation, and efforts devoted to continuous organizational process changes were redirected to shutting down the division before the expected cost savings were documented. Finally, on July 1, 1994 General Dynamics announced that Convair would close its doors in 1996, after more than 60 years of continuous operation.⁹⁸

⁹² "General Dynamics 1992 shareholder report" *Corporate annual report*.

⁹³ Interview with controller (May 16, 1994).

⁹⁴ "Convair teams with McDonnell Douglas", internal Convair newsletter (December 5, 1993).

⁹⁵ Data for this period-3 initiative were not reported but is available from the authors on request. Improving performance measures for manufacturing cells were proposed in "Assignments & responsibilities", Convair interoffice memorandum (April 1, 1993).

⁹⁶ Interviews with the Vice President of Operations (June 9, 1992 and April 2, 1993).

⁹⁷ "Performance and productivity measurement for cellular manufacturing: Development of a methodology & framework" internal Convair document (March 24, 1993).

⁹⁸ "1900 Convair jobs to be lost". *The San Diego Union-Tribune* (July 1, 1994), p. 1.

Summary

The levels of the variables within period 4 were continuous organizational process change, separable RC measurement, and competitive RC boundaries; the levels of RC managers' revelations of private knowledge were not available to us in period 4 (Table 5). The levels of the first three variables in period 4 were consistent with the model in Fig. 1 and E1 and E2. Because the levels of revelations of RC managers' revelations of private knowledge were not available, period 4 did not provide evidence on E3. Changes in the levels of the variables between periods 3 and 4 were consistent with the model (Fig. 1 and Table 2) and E1 and E2; no between-period evidence was available on E3 because of the lack of information available on RC managers' revelations of private knowledge in period 4.

Discussion

This section has four parts: summary of this paper, evidence that is consistent and inconsistent with the theoretical model, revision of the initial model based on inconsistent evidence, and finally limitations and implications of this research.

Summary

RA is a key mechanism for how management accounting interfaces with organizational strategies and structures. This paper provides theory-based evidence on how the design of accounting and participation practices in general, and the measurability of RC performance and RC boundaries in particular, are influenced by central managers' intended strategy for the magnitude, scope, and speed of intended organizational process change. It also provides theory-consistent evidence on how RC measurability and RC boundaries interactively affect RC manager's revelations of private knowledge that are needed to increase organizational performance.

We investigate how the design and redesign of several accounting and participation practices support boundary management strategies to achieve goal-congruent behavior during strategic reorien-

tation in the magnitude, scope, and speed of organizational process change. Managing competition or cooperation among RC managers can be critical to achieving goal-congruent behavior (Demski et al., 2002). We use the social psychology theory of relational framing (Tetlock & McGraw, 2005) to explain how managing RC boundaries by designing or redesigning accounting and participation practices can frame or reframe RC managers as individuals or as the members of a group and thereby influence whether their behavior is competitive or cooperative.

We develop a theoretical model that consists of four variables and three expectations (Fig. 1 and Table 2). To provide evidence on the validity of this model, we compare the three expectations and data from the nine-year longitudinal field study. We facilitate these comparisons by dividing the longitudinal data into four time periods, which are demarcated based on changes in central managers' strategy of organizational process change (continuous to discontinuous or vice versa) and/or changes in RC boundaries (cooperative to competitive or vice versa). We then make within- and between-period comparisons of the realized and expected levels of the four variables in the three expectations consistent with the variance research method. Overall, these within- and between-period comparisons provide support for the three expectations, although they also reveal instances in which the data and model are inconsistent (Fig. 1, Tables 2 and 5). Below we summarize within- and between-period comparisons that identify evidence that is consistent and inconsistent with the model, with the inconsistent evidence being used to revise the theoretical model.

Consistent and inconsistent evidence

Consistent with the first expectation (E1), we find that when organizational process change is continuous (discontinuous), RC financial performance measurability is separable (inseparable). This relation was found both within and between the four periods of field evidence we present. The consistency of evidence and the second expectation (E2), that continuous (discontinuous) organizational process change prompts central managers to

adopt a coherently aligned set of competitive (cooperative) RC boundaries, depends on the time period. Within-period evidence for periods 1, 3, and 4 is consistent with E2; however, the evidence is inconsistent with E2 in period 2. We believe that this inconsistency is due to the failure of central managers to manage or reframe RC boundaries from competitive to cooperative in period 2 when the magnitude, scope, and speed of organizational process change shifts from continuous to discontinuous. The result of central managers not changing RC boundaries is low instead of high levels of RC managers' revelations of private knowledge. Regarding the third expectation (E3), we have no evidence in one period, we find evidence that is inconsistent with E3 in one period, and we present evidence that is consistent with E3 in two periods.

Revision of model

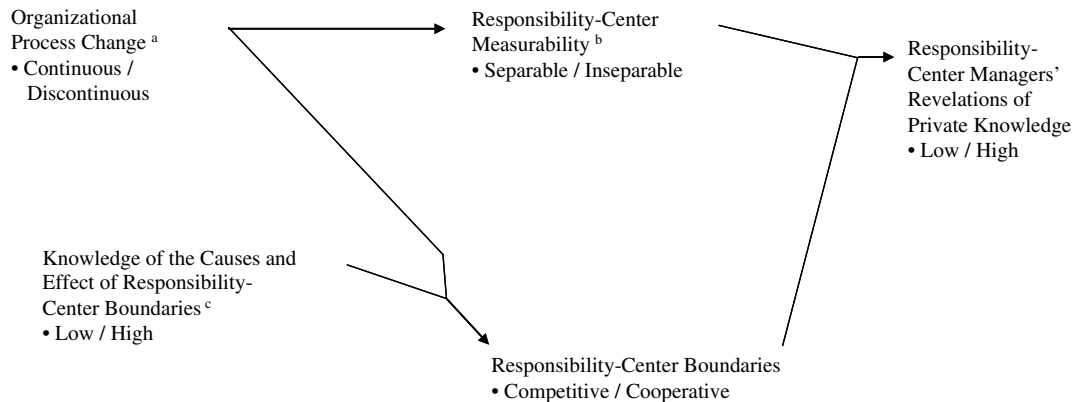
Although most of the field data provides support for the theoretical model (Fig. 1 and Table 2), the inconsistent results for E2 in period 2 (discussed above) enable us to identify an omitted variable. The original model assumes that central managers would understand the value of managing RC boundaries to be compatible with organizational process change. Instead, the external consultants provided the impetus for realigning the RC boundaries. We asked central managers in interviews after the field study what role they believed accounting played in connection with the organizational process changes. They did not mention a concept remotely similar to that of boundary management so as to influence competitive or cooperative managerial behavior. Thus, our assumption about central managers' understanding of RC boundaries proved to be incorrect. We acknowledge this omitted variable by revising the model to incorporate a new variable: knowledge of boundary management, as shown in Fig. 2. The revised model shows that organizational process change and knowledge of boundary management influence RC boundaries.

Several factors can explain why central managers have low knowledge of boundary management. First, central managers may simply lack the relevant education and/or experience. The notion that

accounting practices (e.g., ABC, open book accounting, project budgets) influence competitive or cooperative managerial behavior is not prominent in management accounting literature such as in textbooks, practice publications, or scholarly literature. Although discontinuous organizational process change has become increasingly common, it remains a non-routine event within any particular organization (Meyer et al., 1995). Within the focal division we examine, only the consultants had routine experience managing RC boundaries in connection with discontinuous organizational process change. For example, central and RC managers at Convair had most of their experience with continuous as opposed to discontinuous organizational process change. Second, based on the fundamental attribution error (Ross & Nisbett, 1991), central managers can have a biased understanding of the effect that managing organizational factors, such as RC boundaries, have on subordinate managers' behavior. For example, Rowe (2004) provides theory-based evidence that individuals who assume the role of designers of management control systems underestimate how powerfully RC boundaries influence cooperation and trust among cross-functional teams of individuals who assume the role of RC managers.

Limitations and implications

The analysis and evidence presented have limitations. As already discussed, the Fig. 1 model has at least one omitted variable that caused us to revise it as shown in Fig. 2. In addition, there could be other omitted variables related to the causes, design, and effects of RA. The model also assumes unidirectional causal relations when there may be bidirectional causal relations between these variables and linear relations when the relations may be nonlinear. Empirical limitations include evidence that is limited to one organization and the data that are available to us. In particular, no evidence is available to examine the expectation that separable RC measurability and cooperative RC boundaries leads to undesirable collusive behavior among RC managers (E3 and cell 3 in Table 2). A potential theoretical and/or empirical limitation of this research study is treating each variable as



^a The rate of organizational process change is based on central managers' strategic intent.

^b Responsibility-center measurability is limited to measurability of financial performance.

^c Knowledge of the causes and effects of responsibility-center boundaries is an omitted variable in the Fig. 1 model.

^d In this model each variable is dichotomized for expositional convenience.

Fig. 2. Revised theoretical model.^d

having two discrete levels. For example, RA boundaries are operationalized as having two levels (competitive and cooperative). Research could operationalize this and other variables with more levels or as continuums. Such operationalization could facilitate investigating relations that are curvilinear and/or complex interactions (Luft & Shields, 2003). Finally, replication is an important means of reducing bias in field-based research (Eisenhardt, 1989). We have used multiple researchers, multiple methods, and multiple observations. However, the data are limited to a single organization and therefore we lack replication across organizations. Thus, additional research is desirable in order to further examine the validity of the model and evidence.

This paper contributes to the literature concerned with RA by presenting theory-based evidence that when properly designed or redesigned, accounting and participation practices can be used to influence RC managers' behavior and communication. We also show that the goal-congruent design or redesign of accounting and participation practices depends on the magnitude, scope, and

speed of organizational process change. Related, changing from continuous to discontinuous (or vice versa) organizational process change has implications for whether RC managers' performance can or should be measured separately for each RC manager or in the aggregate for all of the RC managers who are involved with the organizational process change. A possible implication of this paper is that realizing integrative (synergistic) gains from discontinuous organizational process change can depend on motivating managers who are accustomed to competing instead to cooperate. However, we find that successfully changing managerial behavior depends on coherence and consistency in the design or redesign of the following four types of RC boundaries: organizational, communication, spatial, and temporal (Fig. 1). Finally, the field data highlights that ABC is an important part of an effective boundary management strategy, particularly for designing and redesigning communication and organizational RC boundaries.

This paper also contributes to the accounting literature by introducing the variance (or syn-

thetic) and temporal bracketing research methods to analyze longitudinal field data. We provide evidence on the usefulness of these research methods in helping to interpret, structure, and relate complex field data to theoretical expectations.

Discontinuous organizational process change is interesting, in part, because it has the potential for large gains or losses in organizational performance (Romanelli & Tushman, 1994). This paper helps identify how RA can be used in managing several RCs when, as part of committees and cross-functional teams, RC managers are asked to contribute to discontinuous organizational process change. In contrast, much management accounting research focuses on continuous organizational process change and individuals or teams from a single profession, functional area, or responsibility center (e.g., Davila, 2000; Rockness & Shields, 1984; Towry, 2003; Young et al., 1993). While this is an economically important context in which organizations usually operate, organizations increasingly are adopting intended strategies of discontinuous organizational process change (Meyer et al., 1995; Romanelli & Tushman, 1994).

Thus, an important contribution of our paper is to provide theory and evidence on how accounting and participation practices in general, and RA in particular, can be used to make managing organizational process change more successful. For example, this paper highlights how accounting and participation practices can be used to manage RC boundaries and thereby influence managerial behavior when there are changes in the rate of intended organizational process change. We hope the theory and evidence will motivate additional research on the design and effects of management accounting when intended organizational process change is continuous or discontinuous and how management accounting changes as the magnitude, scope, and speed of intended organizational process changes. Of particular interest would be research that identifies how management accounting practices such as RA, budgeting, ABC, and performance measurement interact with organizational process change to affect the behavior and communication of individual and groups (committees and teams) of managers and thus influence organizational performance.

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