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Thème : “Creating Dynamic Continuous Improvement Capabilities Using Accounting Data: From Managing Optimal Processes to Identifying Feasible Improvements”

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CREATING DYNAMIC CONTINUOUS IMPROVEMENT
CAPABILITIES USING ACCOUNTING DATA:
FROM MANAGING OPTIMAL PROCESSES TO
IDENTIFYING FEASIBLE IMPROVEMENTS

by

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Abstract

When the transition of operational activities is framed not as an instantaneous optimization problem but rather a series of incremental opportunistic choices formal continuous improvement (CI) capabilities prove useful. However, despite the well documented advantages of CI management, implementation failures are discouragingly high (Jazayeri and Hopper, 1999). In the quality literature the most significant reason for reported failure is cultural resistance (Irani et al., 2003) due in part to insufficient trust (Chenhall and Langfield-Smith 2003) and learning anxiety (Busco et al., 2006). The authors suggest from this work that the introduction of accounting-based dynamic (or learning) CI capabilities could reduce this problem. This paper uses interventionist/constructivist research to design and implement a Management Control System informed by theory to provide improved dynamic CI capabilities. The researchers, consistent with a position taken by Covaleski et al. (2003), use a multiple theoretic approach as no single theory adequately addresses critical application issues. Consequently, the authors use elements from Old Institutional Economics (OIE), Design theory, Information economics, Agency and Constructivist Learning theories to introduce a model providing dynamic CI capabilities in an American factory setting. This is not to deny that different theories may explain the same phenomena, as is the case in this study, (Tolbert and Zucker, 1996) but that some may act as more informative prescriptions in the context of application. This is only a pilot study with all the difficulties and ambiguities of such. It’s value will be truly determined by future expansion and application of its insights.
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PREAMBLE

This paper uses a constructivist research approach as described by Kasanen et al. (1993). The purpose is to allow academics to develop ‘novel’ solutions to emerging problems in a manner that contributes to new knowledge. Constructive research involves the testing of models informed from theory in practice. Interventionist argue ‘that the pragmatic test of the usefulness of knowledge should be actually viewed as scientifically strong’ (Labro and Tuomela, 2003).

We feel using positive theories alone to advance theory in management accounting runs afoul of agency incentives that allow consultants to establish and significantly influence practice. CEOs, using accounting measures of efficiency rooted in minimizing unit costs, have few resources available for playful experimentation and find it much more efficient and less risky solution is to use consultancy services for less familiar tasks for which they have not developed the internal capabilities. Using this approach the CEOs responsibility is to merely to pick a consultancy group that has successfully marketed its solutions. Should they fail the CEO will bear less risk of personal failure as he exercised due diligence in the initial selection. Consultancy firms on the other hand are motivated by solutions that have an economic advantage and involve only marginal innovation (Eden and Huxham, 1996). While innovations from consultancy have occurred it is not their most important goal (Labro and Tuomela, 2003) and, in fact, we suggest the economic incentives of the situation will constrain the types of innovations evolving from consultancy and, consequently, the observations of positive economic theorists.

According to Lukka (2000 and 2002) ‘the pursuit of innovations in both practical and theoretical terms and an intensive attempt to draw theoretic conclusions based on the empirical work are cornerstones of the constructivist research approach’ (cf. Sippola, 2007). Lukka goes on to identify action research as a relatively modest intervention and Kaplan’s (1998) innovative action research as refining and expanding upon novel invention. Regardless of whether this is constructivist (strong intervention) or action research (weak intervention) the approach offers the opportunity to provide new knowledge with a more pragmatic test of truth in action.

An excellent explanation of action research is offered by Baskerville and Myers (2004). They suggest four premises that are most essential to action research. First, the theory must be established; second, “there must be a practical action in the problem setting.” Third, “the practical action must inform the theory.” Fourth, and finally, the actions taken must involve the researchers and the participants in a social setting. All of these conditions are met in this paper.

The solution applied in this paper includes insights provided from design, old institutional economics, agency, and constructivist learning theories. This combination of theoretical perspectives is necessary since one theoretical perspective alone did not provide sufficient insights for implementation as each assumes away critical application issues (e.g., frictionless
and instantaneous contracting for example) that are necessary to reduce the complexity to a manageable level but must be considered in application (Covaleski et al. 2003).

INTRODUCTION

The increasingly competitive global economy has prompted more and more businesses to adopt Continuous Improvement (CI) strategies. Some have enjoyed significant improvements in competitiveness and reduction in costs. These, however, are the exceptions. Unfortunately, CI implementation failures are all too common and results have been disappointing. In the quality literature the greatest source of this failure has been cultural resistance (Irani et al. 2003). Accounting academics have attributed these failures to control system design flaws and feel that failure to align decision rights, performance measures, and incentives are the major problem (see Brickly et. al., 1995).

This is not an unpopular idea, as numerous scholars argue that management control systems (MCSs) can provide the capability to form and implement new management strategies (Chenhall and Langfield-Smith, 1998). These systems may use rule-based, standardized procedures within formal hierarchical structures, or they may use informal relationships characterized by cooperative personal interactions (Merchant 1985) as in a business culture. As employment contracts are designed by a company facing strategic change, some scholars consider flexible MCSs as most appropriate (Simons 1990; Chapman 1998). How these should be designed, in particular to improve successful cultural change, however remains an unfulfilled mission.

On the other hand, some studies have suggested that the alignment of decision rights may be a necessary but not sufficient criterion for successful adaptation. Chenhall and Langfield-Smith (2003) report a case where this occurs. They attribute their result to a lack of trust that is insufficient to overcome cultural resistance to change. Quattrone and Hopper (2001) find inexplicable delays in the adoption of a worldwide ERP system and refer to the phenomena as economic drift due to the slow adoption of new systems. Chenhall and Euski (2007) use another time-based theory to explain the slow adoption of ABC in government agencies.

Yet it is not just a failure to explain the delay of aligned incentive systems but rather there is evidence of a dark side as well. Thibodeau et al. (2007) clearly demonstrated the power of aligning incentives in the United States Veterans Administration. In fact this organization won awards for its accomplishments yet only a few months after publication a Washington Veterans hospital was found to be warehousing injured veterans unsafely. The unintended consequences of misapplied incentives and performance indicators was demonstrated yet again in an unpublished working paper by McGowan (2006) (cite 2006 AAA conference to be added). In her paper benchmarking was used to coerce budget reductions in a Canadian hospital only to

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3 Their model refers to ‘qualitative’ time as used to actual adapt or change the operating systems through internalization and acceptance. While this is an excellent representation we feel the design models presented in this paper better inform dynamic CI design.
have the reductions met, not through the benchmarked improvements, but by cutting hospital capacity.

This is not an uncommon result, as since Frederick Taylor effectively decoupled operations from accounting (Evans and Lindsay, 2005) managerial responsibility for organizational alignment has stopped with the budgeting and the alignment of incentives. The methodology of operations management has been largely ignored by management accountants and left to the engineers. Thus engineers have created optimization models within the budgeting cycle they are content to monitor. Management accountants have largely restricted their actions to attaching budgets to pro forma expectations and the management of incentive and MBE control systems. The results of this approach has lead to slack and suboptimization with dynamic routines only being ‘re-ignited’ when shocks, often in the form of falling profits, to the system occurred. (Winter, 2000). Dynamic (learning) routines where largely restricted to the annual budgeting cycle.

However, in the last fifty years, this approach has been challenged by the gradually increase in dynamic CI routines. CI operating systems continuously adapt and modify operating routines to eliminate waste and respond to competitive requirements. This leads to decisions that are constantly re-optimizing and creating new specifications for the operating systems. Such a management system may require value-based information and a culture of learning. With these changes in operations management annual budgeting and merely aligning incentive systems by management accountants may not be sufficient to guarantee the desired results. Following this logic the authors suggest that cultural resistance may be due to the inadequate capacity of dynamic CI routines to support change activities.

Accounting profitability has demonstrated its ability to resolve resource allocation decisions in annual budgeting scenarios and we suggest it could be used for the same application in dynamic CI capabilities as well. Busco et al (2006) illustrate such a combination of accounting motivation and validation to support change using six sigma. Swayne and Harder (2003) report that their industrial survey of six sigma users found financial data like cost savings and increased sales, as well as nonfinancial data, like reduced cycle times, or improved customer satisfaction, are crucial to selling six sigma projects to management. Evans and Lindsay (2005) also report that financial data is often part of the selection, analysis, and validation of the dynamic activities of six sigma management. However, these applications still use accounting data supplied to support management control of operating routines and none are designed specifically to support dynamic routines. In addition these dynamic CI routines are expensive, complex, and difficult to use correctly.

The call for accounting based dynamic routines has not gone unheralded however. Numerous accounting methods have been suggested from lean accounting practitioners and academics –see for example, IMA (2005a, 2005b). This paper unlike the previous models specifically addresses the problem of organization change and, following the admonishment of Covaleski et al. (2003), uses multiple theories to inform a workable solution in practice. Regardless, the failure rate of consultancy offerings in practice are particularly worrisome and offer some justification for trying to design a more theoretical informed practical application. Jazayeri and Hopper (2001) for example, report World Class Management programs implementing CI cultures, typically take 15 to 18 months to show results and less than one third of the companies reported improvement.
Even with a liberal investment of resources, the reported benefits have been unacceptably low. While numerous dynamic CI models exist none have proven universally successful. Consequently, additional dynamic CI models that may reduce these failures would be a significant contribution to practice.

THE STATE OF THE ART: MANAGEMENT BY EXCEPTION AND STANDARD COSTING

While few organizations operate exclusively with this approach, scientific management concepts significantly influence the design of most organizations. This discussion addresses the relevant aspects of the general model. In practice considerable variation may be observed to exploit unique strategic advantage or cultures. Regardless of the degree of impact, the management of in-process costs in a CI culture is inconsistent with the traditional use of standard costs in budgeting systems. (IMA, 2005a, 2005b)

Changing the culture and set of beliefs regarding the nature and objectives of control in these traditional settings is required in order to introduce dynamic CI. Traditional management models in manufacturing settings emphasize Taylor’s scientific method with its Management by Exception (MBE) practices (Taylor, 1911). The scientific method is a “one best way” approach based on several assumptions:

1. The production technology is known,
2. The environment is both known and stationary,
3. Inputs are homogeneous, and
4. A single, understood goal is to be achieved (Jaikumar and Bohn 1992).

Under these conditions, experts can use dynamic routines to design the “one best way” operating routines to produce goods or services. Dynamic routines are not applied continuously in the traditional model. Once installed, management’s objective is to insure that these operating routines run as planned, this has led to a management by exception (MBE) approach to operational management that forms part of the organization’s culture within which employment contracting takes place. One example of MBE practices is to establish material and labor standards that define the appropriate way to complete processes. It is assumed that these standards represent the “one best way” that cannot be improved upon. Meeting the standards is part of the employment contract and sets the boundaries for management activities. This is an important concept since this stability allows optimization of operations within this presumed level of efficiency. This stability implies that dynamic routines are unnecessary and allows the decoupling of operations from day to day management activities.

Standard costing systems have been used to assign costs while annual budgets are prepared to assist management in its planning and control functions. Standard costing and budgeting systems, based on these principles and the assumption that existing practices are nearly optimal, allow organizations to 1) contract efficiently based on accounting data, 2) reduce uncertainty in the coordination and communication of activities, 3) allocate resources, and 4) focus problem-solving efforts on exceptions, or variances, from the established standards. All operating within
the certainty of ‘well understood’ operating routines, thus creating the bias that any variances are due to control failures and not the need to modify operating routines.

Structured responsibility center accounting systems of this type create the boundaries for rational decision making. Contracting based on accounting data determines the limitations required for analyzing operating decisions. The accounting information that results from such decisions then becomes the normative criteria for the business culture, oftentimes referred to as “how we do things around here.”

**CONTROL CULTURE: EFFICIENT PRODUCTIVITY CHANGE**

When an accounting system is closely aligned with an organization’s business strategies, an efficient basis for employment contracting can be established. Over a period of time, the scientific method of management produces, reinforces, and, its critics would say, coerces an efficient culture of control which assumes that few improvements should be made during the operating period. The components of this control culture in a manufacturing environment typically include:

1. Engineered factory production lines with “practical standards,” that are presumed to be the “one best way” to operate,
2. Specialized responsibility centers coordinated through production schedules to manage and control operations, and
3. A centralized annual budgeting system through which participants establish implicit contracts and commitments with one another to work cooperatively.

These control systems are part of the operating routines to ensure goods and services are provided as planned.

Such a culture, in which employees and managers share expectations about future behavior (Luhmann 1979), has been effective in reducing uncertainty and promoting stability as long as market demand and competitive pressures remain relatively static. Any significance change (or shock) can be handled as part of the new budget. However, the traditional control culture supported by standard costing and annual budgeting may be less efficient whenever changing market conditions require the firm to respond, adjust, and capitalize on new opportunities for future survival and growth in a more timely manner. In a scientific control culture, dynamic routines to change operating capabilities, are usually ‘re-ignited’ annually as part of the annual capital budgeting process. The ignition of dynamic routines is not usually anticipated during the operating cycle. In-process improvement is rare since operations are presumed to be designed in the “one best way.” These assumptions create a MBE system that limits, controls, and shape innovation, rather than sparking or inspiring learning and improvement (Ahrens and Chapman 2004, pp. 296-297) of operating routines as required in a CI culture. It is this use of budgeting and accounting systems that ‘effectively stifle learning and personal development by severely limiting the ability of employees to exert control or change the nature of their work activities (Winter et al., 1997) both within the operating and the budgeting cycle.
As the need for more timely and responsible adaptation of operating routines increases the ignition of dynamic CI routines becomes more frequent and their formalization as systematic routines becomes more likely. However, no one dynamic routine has dominated in practice. This paper attempts to go one step further than others which discuss accounting as merely enabling innovation. Instead, an accounting driven dynamic CI routine is proposed that directs productivity expansion and supports the appropriate cultural change.

ALIGNING ACCOUNTING TO DYNAMIC CI FOR CULTURAL CHANGE

When faced with new competitive pressures requiring more frequent operational revisions, firms may adopt dynamic CI routines but experience only limited success, or even failure. A reason for these disappointing results is that employment contracts built on the existing MBE culture provide little or no incentive for employees to actually seek improvements. Although management has adopted a new strategy of dynamic CI, the existing MCS business culture and its budget-based employment contracts may not be adequately aligned with the new strategy. Hence, the CI practices eventually prove to be disappointing, because a complementary adaptive MCS culture (Chenhall and Langfield-Smith 2003) is missing. Thus, when this is part of the normative business culture realigning the CI is a necessary component for efficient accounting-based employment contracting of dynamic routines.

The accounting system must be strategically aligned with dynamic CI processes which may entail separate ‘stand alone’ routines to provide dynamic capabilities.

A second issue relates to ‘shirking’ and ‘satisficing’ problems with current budgeting systems. Participation in standard, and target-based, costing systems insures information sharing to build more accurate budgets. But this budgeting process gives employees the opportunity and incentive to build slack into their budget goals in order to reduce the risk of budget failure. In addition there may be strategic issues as discussed by Winter (2000) that lead to satisficing and not optimal, production standards. Thus, in the traditional budgeting process, numerous researchers suggest that production standards, rather than motivating employees to utilize their knowledge and skills to improve business processes, tend to deskil, disempower, and control workers (Braverman 1974; Clawson 1980; Miller and O’Leary 1987; Hoskin and Macve, 1988; Ezzamel, Hopper and Armstrong 1991; Stewart 1992; and Walsh and Stewart 1993) since there is an presumption of optimality that does not invite innovation.

A solution to this problem may be to modify the current dynamic MCS to reduce shirking, limit the costs of satisficing, and produce more strategically nimble dynamic CI routines.

The current philosophy for variance reporting is to identify when actions are not going as planned. The CI philosophy, on the other hand, needs to identify activities most likely to add the greatest value if changed, control agency risk, and assess the value of adaptations in a timely, accurate manner. The acceptance of dynamic CI routines currently requires significant levels of trust.
CULTURE, LEARNING, UNCERTAINTY, AND TRUST

Culture may be defined as, “the pattern of basic assumptions that a given group has invented, discovered, or developed in learning to cope with its problems of external adaptation and internal integration, and that have worked well enough to be considered valid, and, therefore to be taught to new members as the correct way to perceive, think, and feel in relation to those problems” (Schein 1984). More simply, it is “the way we do things around here” (Williams et al. 1994). Using an old institutional economics (OIE) model, these are essentially the formal and informal operating and dynamic routines giving the institution the capabilities to add value to society.

Cultural norms form the bounded rationality for management decisions where “budgeting is treated as a component of the incentive-contracting system that governs the employment relation” (Covaleski et al. 2003). When profitability is an accepted norm of the business culture, accounting systems can validate new ideas and procedures. Thus, a powerful role for accounting systems is assured when new ideas can be validated by framing decisions with accounting values linked to employment contracts.

Performance measures that are not aligned with accounting contracts increase agency risk when financial measures are a critical element of performance contracts.

When accounting data is important this is a significant problem with the adoption of lean manufacturing. The adoption of lean management is expected to have negative short term accounting results that do not reflect economic value (Kroll, 2004).

Since accounting measures are widely accepted as measures of value aligning accounting measures with dynamic CI routines could offer a significant improvement in the tools used to overcome cultural resistance to change.

Starting and stopping dynamic routines in Scientific Management

Using accounting data to direct dynamic routines is consistent with traditional practice and does not challenge the current business culture.

Using a scientific management strategy, operating routines are assumed to be relatively stable within the budgeting cycle. Dynamic routines are considered to be relatively dormant only to be ‘re-ignited’ by ‘shocks’ to the system. Winter (2000) suggests this approach leads not to the ‘one best way’ but to, rather, a satisficing solution of potentially suboptimal operating routines, that are, in fact, optimal for the company. His model is built within the framework of traditional scientific management and does not explicitly examine dynamic CI. Yet his analysis provides insight into the potential design and requirements of CI routines. The underlying rationale for current dynamic routines in Winter’s model is related to the time it takes to ‘search for’ more efficient operating capabilities. His underlying assumption is that better solutions take more ‘search’ time which delays delivery of goods and services to the marketplace. The economic cost of ‘time to market’ delay is reflected in lost sales revenue. He assumes better and more efficient solutions can be found with a longer search time. Depending on the industry this may often not be a significant effect. Regardless his arguments for a suboptimal ‘satisficing’
operating routine are relevant and occur when the lost revenues from delaying market entry become too great to continue searching for better operating solutions. This creates pressure to make the operating routine/design ‘good enough’ to assure the capture of revenues. Organizations have unique ‘aspiration’ level that may vary within product families to determine when the product, and its operating routines, are ‘good enough’ to be introduced into the market place or adapted.

Higher aspiration levels will tolerate greater revenue losses than lower aspiration levels. Audi, in Germany, is a typical high aspiration organization. They spend significant time in the design of their product and its operating routines. They have a typically German view of precision and long term commitment (Krumweide et al., 2005) justifying more time on the initial design and operating routines. CI after a new product is put into production is minimal. Software companies, on the other hand, can experience significant losses if they are ‘late to market’ and continue updating their products well after the initial product launch.

Winter does not deny that improvements to operating routines continue over time but this is part of a ‘learning curve’ effect, which rarely involves changing operating routines but rather perfecting their application. However, from an accounting budgeting and control perspective the initial acceptable, or satisficing level of performance, has an important impact. Consistent with scientific management philosophy, there is a presumption that the initial operating routine is ‘the one best way’ and does not need to be modified for acceptable profitability. Consequently, satisficing supports shirking behavior and builds in slack by validating an initial suboptimal operating routine. Thus combining satisficing and scientific management tends to justify restricting further innovation and creativity as a waste of time and money.

In the subject company, the strategy of get the job done and on the market is exacerbated by seasonal cycles which mean new products have to hit the spring market. After they are up and running little further investment in development is motivated or made.

For Winter, once the satisficing routine has been selected learning stops. When the operating routines are set then accounting control using MBE becomes the focus. Management activities are effectively decoupled from operations (Evans and Lindsay, 2005). Not until there is an ‘environmental shock’ will learning be re-ignited (Winter, 2000). In the traditional budgeting model shocks are related to profitability or budget failures. This makes financial reports key players in re-igniting learning.

Two additional issues from Winter’s theorizing should be noted. The first is the aspiration level. The higher the aspiration level the more it is culturally accepted to continue searching for superior operating routines. Thus for some organizations target costing may be the primary focus for competitive advantage while for others with, lower aspiration, dynamic CI may provide significant strategic advantage. The second point is that the use of accounting reports to provide ‘environmental shocks’ to initiate dynamic routines is well accepted normative value.
Incremental versus dramatic change

There is however, some debate about the most efficient process to convert scientific management cultures to CI cultures (let alone the issues concerning when one approach is superior to the other). While virtually all change processes may be considered incremental we will classify changes by their relative impact on the existing business culture. Dramatic change involves a radical and traumatic change in cultural values in a relatively short period of time. In fact, this is an entirely subjective definition related to the individuals and the companies involved. The admonishment that ‘you will know it when you see it’ may be a more appropriate definition. Regardless, mergers and acquisitions or the introduction of lean management are usually good examples of when dramatic change occurs.

For example, Busco et al. (2007) report the dramatic changes General Electric imposed after the acquisition of an Italian electronics company. Lean management implementations like ‘world class manufacturing’ also usually require dramatic changes often taking up to 24 months (Jazayeri and Hopper, 1999). Indeed lean management advocates suggest that the entire set of tools must be adopted or risk failure. (Grasso, 2007) Their position is that Lean management consists of an articulated set of individual tools that are interdependent. And that the disappointing success rates of lean management adoption are due the failure to fully implement one or more of these tools in combination. Consequently, they feel the use of one, or a few, tools endangers the success of the lean implementation. We disagree with this position and argue that some tools are more useful and applicable in different situations and moreover that incremental application of CI tools tends to maintain unique strategic advantage and is thus, more efficient.

Another anecdotal reason for swift dramatic change was offered to the author in a conversation with a consultant. His suggestion was the change had to be rapid and overwhelming like a ‘police swat team’ so that cultural resistance could not be mobilized against it. Indeed this seems to be the GE solution reported by Busco et al. (2007).

On the other hand, several academics including Chenhall and Euske (2007), Quattrone and Hopper (2001) and Mackey and Hughes (1993) suggest incremental deliberate change may be more efficient and effective. Chenhall and Euske use a framework provided by Huy (2001) to expand the notion that time and temporal change are key mitigating factors. Quattrone and Hopper argue ‘a-centered organizations and drift should replace conventional theory’. In fact their insights are almost exactly matching the reasoning and support for design theory. They go on to “call for an alternative approach that views accounting as creating ‘centres of discretion’ (Munro, 1999). Here accounting is a process (emphasis added) of fabricating knowledge (Latour, 1999) that forms part of a broader attempt to construct organizations (Brunsson and Sahlin-Andersson, 2000) that is always incomplete (Law, 1997)” (cf. Quattrone and Hopper, 2001). To them change appears to be more of an ‘economic drift’. Others argue incremental approaches allow, in addition, the retention and amplification of unique strategic advantages. Mackey and Hughes (1993) describe an accounting system for a JIT application that adapts to market values to maintain strategic advantage.

The dangers of ‘one size fits all’ lean management can be easily illustrated in practice. One extremely successful international company in the fishing lure business correctly identifies value in design (customer focus which is a part of lean management) but finds little value in JIT
production. Another large international bakery stresses freshness and variety to please the customer finds the quality and setup focus useful but cellular manufacturing less practical. Cooney (2002) offers similar insights in the automobile industry. Thus we feel some of the tools but not all, are more valuable and can be beneficial depending upon the circumstances. With this view the authors suggest that unique strategic advantage may not include all the operational tools of Lean Management but only some of these tools or, at the very least, consistent with the idea of ‘economic drift’ and design theory, the adoption of tools in a sequential manner as their need is justified by hard evidence. At the very least an incremental approach is far less costly and disruptive than a dramatic overwhelming change.

In this paper we will present a model using incremental implementation that, because of the ‘unknown and unknowable’ nature of optimal strategic design, allows the adoption of lean management in organizations while preserving their unique strategic advantages. The key philosophical difference between the two approaches lies in the ability to predict optimal future states. When future states are difficult to predict and contingent on a sequence of choices incremental CI rather than planned implementation may offer a better management solution. Several theoretical models inform this approach.

THE THEORETICAL MODELS CHOSEN

Following the admission of Covaleski et al. (2003) multiple theoretical lenses have been employed to identify insights that inform theory. The authors have taken more liberty than this by parsimoniously selecting insights which appear helpful in the design of a functional CI dynamic. We report here a pilot study and it remains for future researchers to determine if further evolution of this approach is justified.

1. Dynamic CI capabilities and Evolutionary Economic Models

Evolutionary models inform practice with institutional models that demonstrate separate dynamic capabilities as sets of formal routines that may be used to change the organization. That is, designing stand alone formal dynamic CI routines is an efficient manner to support organizational change. Further use of repetitive routines seems valuable for changes to be internalized by organizational members.

Evolutionary models are particularly appropriate to model the role of dynamic processes in the replication and adaptation of institutions. Historically institutionalism and evolutionary theories had their roots in the work of Veblen (1898,1909). Penrose (1959) expanded these notions to the study of the capabilities to organize and add value. Capabilities are defined as the set of routines firms use to combine resources into particular goals or ends (Helfat and Peteraf, 2003). The economic model evolved from this line of research that the authors considered to inform practice was offered by Burns and Scapens (2000). Their extension of evolutionary, Old Institutional Economics (OIE) proved useful. In their model institutions are composed of sets of routines giving firm’s capabilities to provide goods and services. Working under the assumption that the objective of good management is to maintain and create value, OIE theories prove more descriptive of management goals than resource based theories. Resources in themselves are inert and add no value without use. Thus this capability, or process based view, is more descriptive of
the value adding process consistent with current CI dynamic routines. OIE argues that since economic value is created by goods and services value creating mechanisms, capabilities, should be the focus of analysis and not inert resources.

The concept of routines as the memory of the firm and source of replication and innovation with search and selection capabilities was introduced by Nelson and Winter (1982). Thus the extensions of OIE inform practice by focusing institutional management on routines that provision capabilities. When these routines are accepted, they become the business culture, or the appropriate ‘way to do things’ in this culture.

Routines are repeatable/replicable patterns or processes represented as sets of activities. The Burns and Scapens model recognizes that both formal and informal routines are institutionalized. Formal routines have clear specified procedures like budgeting systems, MBE reporting, the accounting cycle, or certain aspects of the production system. Informal routines, on the other hand, are passed on from employee to employee as part of the social and political belief about the ‘way things should be done’. They include things that are not written down about customer service, priorities, loading a truck, or handling a complaint. Informal routines usually proceed and sometimes lead to the creating formal routines.Capabilities are created by, or in combination with, both formal and informal routines. The advantage of formal procedures is their ease of replication. They have specified steps or procedures that are repeated from adaptation to adaptation and usually chronicled. Informal dynamic routines require political processes and replicate through belief training, hiring practices, leadership, inculturalization or simply time in the company (see Chenhall and Euske, 2007) that may be unique to each situation.

The authors classify informal routines as a type of ‘loose couplings’ leading to inexact and spasmodic routines. Other authors identify ‘decoupling’ as a form of (what we interpret as) cultural resistance where change is rejected by organizational constituents. In a loose coupling ‘the change does not substantially modify the daily activity of organizational actors’ (Dambrin et. al., 2007; Townley, 1997; Basu et al., 1999; Burns and Scapens, 2000; Major and Hopper, 2003). Critizing Hasselbladh and Kallinikos (2000) who claim institutionalization moves from ideas to discourse to routines in a linear fashion, Dambrin et. al. (2007) found that ‘the process of change is not linear’ but rather ambiguous and seeking compromise with a new logical justification. While this debate does not prevent incompatible formal control techniques from being applied, the invisible, informal, routines may preclude these formal capabilities from use. Lukka (2007) also discusses this phenomena where the formal accounting system is ignored in favor of informal capabilities that have been internalized by the constituent groups. Thus this need for internalization is a critical component of the formal dynamic CI routine offered in this paper.

However, Dambrin et al., while not explicitly referring to formal routines does suggest that “change seems able to develop only if some practices … remain stable” (see also Feldman 2000; Feldman and Pentland, 2003). Implying also perhaps that formal routines when correctly applied have unique advantages, they are easily replicated, or franchised, by training agents to follow specified sets of rules and procedures (i.e. routines). Acceptance of these routines allows more efficient replication (or evolution) of capabilities that are less constrained by the availability of capable political coalitions or leadership. Since they are less dependent on political skills formal
routines may be more efficient and effective than informal routines for dissemination but are more costly to develop and formalize into sets of procedures embedded in the business culture. That is, when everyone already knows and believes that this is the ‘way to do things’ adding formal routines are just an added expense. But the mere fact that they are formalized means they can be studied and learned more efficiently. Appropriate behavior systems are generally cheaper to maintain but less efficient than formal routines for novices, unfamiliar with this culture, to learn. Accounting systems by nature are formal routines and as such may be more effective or at least fill a different niche in the creation, learning, of CI routines.

Operating routines include MBE budgeting systems, production processes, or customer management systems. Examples of dynamic routines include formal sequential procedures like Capital budgeting, kanban management, Deming’s PDCA, six sigma’s DIMAC, or TOC’s five steps. Informal dynamic routines include brainstorming or political personality driven processes.

Some implementation issues however are not in the opinion of these authors adequately addressed by this theory. While Burns and Scapens recognize adaptations may be unpredictable and influenced by multiple political actors and power they do not address conditions where multiple solutions compete and the potential satisficing nature of these adaptations. That is conditions where the adaptations may be suboptimal are not addressed. The theory does not offer a concrete explanation or visualization of how choices for changes in operating routines are made. They do not address the design of dynamic process of selection, evaluation, and acceptance, or rejection of operating routine modifications.

**Use of accounting to improve efficiency of incremental dynamic routines**

Since one of the primary factors responsible for dynamic routine failures is cultural resistance (Samson 1997; Kotter and Heskett 1992) designing a dynamic CI system must consider limiting cultural resistance as well as measuring economic value.

In cultures where profitability is an accepted business value, accounting data can perform a valuable function by bounding political debate. Information that is perceived to be hard, politically neutral, and correlated with the strategy of value creation has normative value. With this potential capability to arbitrate or, at least bound the political discussion, accounting can play a significant role in the motivation, as well as improving, the efficiency of the process of selection, evaluation, decision choice, and assessment inherent in dynamic routines. Thus reducing the role of political power in the selection of adaptations could improve the ultimate productivity expansion path.

**The Contribution of Design Theory**

However, we found neither Winter nor OIE to offer insights into the process of evolutionary growth sufficient for practical application. Design theory, on the other hand, does offer useful insights into incremental institutional adaptation under uncertainty involving reallocation of resources among agents as changes are made (see Liedtka, J., (2000) for a brief description beyond the issues raised here). Reallocation of resources can lead to cultural resistance when agent’s welfare is perceived to be threatened by adaptation.
Design theory is particularly appropriate when the final optimal design is in question. Not only is the final design outcome, to borrow from Deming, ‘unknown and unknowable’ but each transitional state is also unpredictable as well. Each incremental change creates a new set of opportunities not previously observable. Since opportunities for current design choices are contingent on the selection of preceding design choices, the final expansion path cannot be accurately predicted. In addition it introduces the notion of compromise solutions that improve the company and are socially feasible.

It is in this selection process where design theory provides significant insight. As at each stage the choice of actions are potentially influenced by the political coalitions or actors since the outcome of any change has the potential to alter the agent’s current power and status. Consequently, any change which may be perceived as detrimental to their current welfare may be resisted. Explicitly, in this model, is the recognition that chosen adaptation to the operating routine may be in the form of a compromise to make the solution acceptable or feasible.

For example, suppose a modification to a machine specification will increase the need for maintenance but, if successful, will eliminate the need for production engineers. Consequently, maintenance will increase in size and prestige but the engineers will be less involved and less important. Based upon the objections of the engineers a compromise solution to not fully automate the process may be selected since both coalitions will agree to this change. Accounting profit projections demonstrate that partial automation will meet current budget needs. Thus the lower aspiration level meets budgeting expectations and represents an acceptable compromise for the maintenance and engineering staff. The compromise reduces the motivation to resist the change in the operating process even though it appears suboptimal to a fully automated solution. But once the partial automation is in place new, unforeseen compatibilities and opportunities are presented. In the next CI cycle the machine, may in fact, become fully automated but only when it is feasible and acceptable. It follows then, given resistance to change may contribute to failure, avoiding cultural resistance should improve the feasibility, potential acceptance, and the success of different alternatives.

Thus in situations where future opportunities are not completely predictable the incremental suboptimal but feasible solution may be preferred for CI. Using incremental CI as in design theory, reduces potential cultural resistance and allows CI to protect strategic advantage when future opportunities are unknown and unknowable.

The Problem of self selection bias

However, when optimal solutions are unknown and unknowable then the dynamic routine can only direct and manage the process of discovery to improve the efficiency of productivity expansion. Explicitly the first step in CI heuristics is to select an activity of interest that may offer the best opportunity for value improvement. To achieve this purpose the problem of self-selection bias must be addressed. As CI continues, agents can shirk by astutely selecting projects that minimize personal risk instead of choosing more risky but potentially more valuable solutions. Efficient design theory then requires a dynamic routine that reduces self-selection bias. Such a formal heuristic removes the opportunities for shirking through self-selection.
Thus accounting can bound the decision set available to increase the efficiency of design choices. Using an accounting-based selection rule for CI activities reduces potential bias created from opportunistic behavior. Consequently overcoming opportunism presents a strong theoretical argument for a formal dynamic CI over informal routines.

This theoretical explanation provides insights useful in implementation. The influence of political coalitions and personal utility is explicitly included in the theory. It suggests that the economically ‘best’ solution may not be the most ‘feasible’ solution. It may not be a matter of what should be done but what can be done. To increase the probability of success managers select incremental satisficing solutions that will work. Once cultural resistance is considered the feasible productivity expansion path resulting may appear suboptimal yet it may ultimately arrive at a better solution by increasing the probability of successful adaptation.

New operating routines, using these theoretical understandings suggest that successful incremental design choices are based, at least to some extent, upon some agreed upon cultural acceptance.

Quattrone and Hopper (2001) for example, may have been observing this phenomena when investigating alternative approaches to ERP adoption. They refer to the phenomena as economic drift and call for research in organizations where productivity expansion paths cannot be predicted in advance and where “control is no longer about prescribing ‘right’ courses of action but rather describing ‘possible’ courses of action.”

The control system now, as suggested by Quattrone and Hopper, may be the dynamic routine itself. There is no optimal predetermined path to benchmark against. That is, since the goal cannot be explicitly quantified no traditional variances used with current operating routines between budgets can be meaningfully calculated. Only the implementation of the dynamic routine itself can be evaluated.

The contribution of Agency theories

While employment contracting is extensively modeled in agency theory, the insights from this work are limited. Agency research cannot define the proportional impact (Covaleski et al. 2003) of design considerations required in application. In spite of the limitations, however, agency insights can provide direction in the sense that more or less of a characteristic will increase or decrease risk. Thus, agency theory insights can help to define dynamic CI characteristics influencing contracting efficiency.

While extensive insight into employment contracting is offered by agency theory the insights may be questionable for contracting for the management of dynamic routines. One limitation with using agency theory is its underlying assumption of the instantaneous optimal realignment of employment contracts with strategic change. This is not a significant problem when using a scientific management strategy, since optimal stable state conditions are established and changed only rarely, usually only during the budgeting process, the control problem of interest is the management of stable operating routines and budgeting but not CI.
Typically, agency models assume instantaneous realignment and full knowledge of the cause and effect relationships for contracting. However, agents in a CI culture, by definition, must learn “new ways of doing things” which are not instantaneous. Consequently, agency theory adds little insight to efficient learning strategies. A more efficient alternative theoretical model is required for this purpose.

**Dynamic CI capabilities require trust to succeed: The Agency solutions**

The agency solutions to cultural resistance seem to focus on the concept of trust. However, when adopting new operating routines, learning “new ways of doing things” is rarely instantaneous. Sufficient trust however allows the assumption of instantaneous adaptation to hold. Until the implications of the new routines are understood, agents must absorb the uncertainty, and personal risk, of failure. That is, until agents learn the new cause and effect relationships of actions on contracting norms, they must absorb the increased risk that their actions may damage their welfare.

*Thus, adaptation of operating routines increases agency risk until new operating routines are understood.*

Consequently, increasing risk has the potential to encourage employee resistance. With dynamic CI, operating routines are constantly in flux. Because of the more frequent adaptations with a CI culture it is possible to introduce new operating routines before previous changes are fully understood. Under these circumstances to avoid resistance agents must have increasing trust their failures will not be opportunistically exploited to their detriment. Without sufficient trust agents may shirk and resist change to avoid the increasing detrimental risk (Chenhall and Langfield-Smith, 2003). Trust is a key intervening variable to avoid cultural resistance to change efforts. Consequently the management of trust becomes a key management component of dynamic CI.

*Dynamic CI should consider methodologies that influence the level of trust.*

The lack of trust explains the failure of even appropriately aligned employment contracts when the perceived risk of failure with new operating routines is greater than the trust available (Chenhall and Langfield-Smith, 2003). One solution to potential resistance is to provide more compensation to agents in order to match the level of perceived risk or to introduce new more ‘worker friendly’ management procedures to increase trust. While these methods have often worked in practice, this paper suggests, another alternative to complement these techniques, to design dynamic routines to explicitly consider agency risk. If this is possible it follows, then, that the design of dynamic CI routines can reduce cultural resistance by manipulating the level of trust.

**Trust in Accounting or Accounting for Trust: the six sigma dynamic routine**

The interaction of trust and accounting in organizational change was reported by Busco et al. (2006) using a General Electric acquisition of an Italian company. In this example a dynamic CI
heuristic called Six Sigma was used to change operating routines and the subsequent business culture. In many circumstances Six Sigma requires changes to be justified and then later validated by profitability criteria – see for example Evans and Lindsay (2005) etc. In the Italian company accounting became the language of the business to direct, evaluate, and assess the success or failure of operational changes because of its normative validity established by GE.

Since accounting profitability is a common normative value for most business cultures Busco et al. demonstrate how accounting can be used to mediate between competing choices and to subsequently validate cultural change as well. Consequently, accounting is a well-established dominant form of contracting (Sunder, 2002) in business organizations that has been and can be used for dynamic routines.

**TYPES OF TRUST: ORGANIZATIONAL (FORMAL) OR PERSONAL (INFORMAL)**

Organizational trust promotes efficiency by allowing employees to coordinate their activities under uncertainty. When there is strong organizational trust, MCSs (using budgets) can focus on supporting “resource (dynamic routines) and communication (operational routines)” goals (Ouchi 1977, 1979, 1980; Merchant 1985; Macintosh 1994) and do not have to consider behavioral issues.

There are, however, different kinds of trust that may require unique consideration. Chenhall and Langfield-Smith (2003) differentiate personal trust from organizational trust. Personal trust requires the more demanding condition of common values and beliefs. Organizational trust does not. Organizational trust grows from repeated operational exchanges, as in accepted routines, reinforcing the legitimacy of operating procedures and cultural norms (Sako 1998). These formal structures use contracting to “guarantee trust” and establish the basis for developing shared values and understandings (Livet and Reynaud, 1998). Thus with the repetition of formal dynamic CI routines, agents develop an understanding and trust of dynamic processes and the implications of their results.

More importantly this trust relates to formal dynamic routines that can be more easily implemented and propagated across an organization. Thus designing formal dynamic CIs to reduce the need for trust can also be an effective mechanism to overcome resistance to change.

*Thus if formal dynamic CIs can reduce the need for trust then the probability of cultural resistance may be influenced as well.*

Unfortunately, current dynamic routines use little accounting, relying instead upon annual financial results which provide only dated, highly aggregated accounting validation (after 18-24 months) of adaptive activities. These systems lack both the timeliness and the level of detail needed to significantly reduce short-term agency risk. In fact, because they take so long to validate changes they increase the cumulative level of agency risk managers must tolerate. This may explain the extraordinary investments in resources needed to implement holistic lean management and their disappointing success rate.
Unfortunately, dated validation of new, operating routines only serves to obscure cause and effect relationships at the operational level and increase uncertainty about the real economic impact of these activities. This makes the development of mutual trust in new employment contracts difficult.

In such an environment, if employees cannot use accounting to align a new business culture with employment contracts, they are forced to trust that the new activities will prove profitable sometime in the future. In particular, salaried employees who are expected to be motivated by company profitability, rather than incentives such as piece rates or quality levels, may lose confidence in implementing innovations required for continuous improvement.

**The Role of Timely feedback on Agency Risk**

Timely assessments feedback can effectively improve efficiency. Itami (1977), demonstrated that more timely feedback allows more rapid elimination of wasteful activities. However, Itami’s model does not specify a process for how adaptations are made. It merely points out that more timely or, as he labels them, adaptive variances, lead to more efficient change as inefficient operations continue for a shorter period of time before discovery. Itami’s model, as in many agency models, assumes that changes will be made efficiently. More timely feedback in and of itself may not be sufficient to gain economic advantage. However more timely feedback to validate the results of dynamic routines can reduce the time agents must bear uncertainty about their results, and hence, the risk related to changes in operating routines.

Timely, accurate, assessment reports can decrease the uncertainty related to adaptations. Once the dynamic routine has modified an operating routine an accurate accounting report can validate the impact of the change thus eliminating the short-term uncertainty related to the new activities. The more timely the accounting report, the less time the agents must tolerate the uncertainty of potential failure and the less trust is necessary for them to accept these changes. However relevant assessment feedback is bounded by the *completeness* of the information.

A complete measure must capture all the economic attributes of a transaction. An incomplete measure is less useful for assessment. They may, in fact, merely create greater uncertainty about the true economic consequences of the adaptation. This means the information system must include the costs of all the processes influenced by the operating routine modification. While this is not perfectly possible it does provide a standard to evaluate the appropriateness of measurement systems.

*More complete economic measures reduce risk by providing more accurate assessment measures of operating routine adaptations. Agency risk related to dynamic CI can be reduced by design strategies that provide more accurate timely feedback on the economic consequences of operating routine modifications.*

**Managing Economic Impact: Limiting Loss through Incremental Reporting**

In addition to uncertainty, the potential loss function also influences the level of agency risk. Lesser potential economic loss for agents means less risk from decisions with uncertain
outcomes. Thus, in addition to timeliness, feedback on most incremental of operating routines reduces risk by offering less potential loss. At the very least all the activities in the operating routine measured must be included. From a practical point of view this means one complete job. Only one complete job, regardless of size, will span at least one replication of each of the bundle of routines required to produce the goods or services. For our application this included the machine setup, run, and packaging routines.

**Managing Participation Costs: Risk Sharing and Collaboration**

Dynamic routines initiated through environmental shocks operate within an “incomplete market” that is ideal for budget-based employment contracting in which employees’ knowledge and effort are not observable by management. “In complete markets, all information is public, enabling owners to construct contracts with employees based on the level of effort that the employees would supply as well as on the employee's skill” (Covaleski et al. 2003). Agency theory (Baiman and Evans 1983; Penno 1984) suggests that in incomplete markets, participative budgeting, in which agents share private information with owners, is superior.

Individual learning, however, is a private matter in which effort and private information are not clearly visible. Participation, as defined in agency models, would appear to at least partially apply to dynamic routines, since agents may not have complete information about cause and effect. Unfortunately, private information and unobservable effort still create the opportunity, and accounting-based contracts provide the incentive, for shirking and building slack into cost estimates because the optimal solutions are unknown among agents and principals. In fact, according to Winter (2000) there are clear market incentives to stop the search for optimal solutions which then establishes the legitimacy of suboptimal operating routines.

*Limiting this problem through risk sharing and visibility is suggested by agency theory and should be considered as an element in the design of the dynamic CI.*

**USING CONSTRUCTIVIST LEARNING THEORY**

Busco et al. (2006) suggest learning anxiety is a significant source of cultural resistance and that accounting systems are useful in overcoming this source of resistance to change. Thus dynamic CI characteristics that influence the ease of learning can be useful. Since instantaneous learning is assumed in agency models, little insight into designing learning systems can be offered from agency theory. However, an alternative theoretical perspective, using constructivist learning models from the educational literature, provides implementation insight. In constructivist learning, people build new knowledge from “what they already know and believe” (Bransford et al. 1999). The constructivist approach to learning relates new ideas to preexisting, familiar ideas that have already been validated to be effective and profitable. This is a very efficient way to learn (Baron et al. 1998; Black and William 1998).

In our model, this pre-existing knowledge is the prior business culture. Constructivist learning parsimoniously merges new ideas with pre-existing knowledge. The efficiency of this approach is linked to the way the brain processes new knowledge. Juxtaposition is a powerful and basic
It is the relevant differences between the new and the old that make the new idea unique. In this sense, new knowledge is additive (or constructive). A new idea is “all the things the brain has in common already” plus these “relevant differences.” For example, to understand the new idea of blue fire hydrants, the brain takes the pre-existing knowledge of a red fire hydrant and only adds one piece of information – the new color. The closer the fit between the new and pre-existing concepts, the less there is to learn and the more brain-friendly is the new idea (Mackey 2004). The less ‘learning anxiety’ is experienced. The easier they are to learn and embed into current understanding. New ideas are context-related (Schank, 1990). Limiting the variations in context will make learning easier. In fact, the more incremental the new knowledge is from the old, the easier the new concepts are to learn.

Consequently, utilizing existing contracts with a similar accounting validation may be more efficient than introducing new, unfamiliar contracts that ignore costs and are based solely on customer satisfaction, error rates, or delivery times.

Formative Assessments

Finally, formative assessment (determining the correctness of ideas as the new culture is forming), rather than merely summative assessment (determining the correctness of new ideas after the culture is in place), is a key component of constructivist learning. An apt analogy is learning how to swing a golf club. Learning requires mastering a set of sequential activities. Formative evaluation breaks the swing into its incremental “formative” components – i.e., the stance, the positioning of the ball, the hands, etc. Using the formative assessment approach, each component is evaluated separately as it is formed or put into action. Thus, each step logically follows the learning-assessment-learning sequence until the entire golf swing is mastered. Summative assessment, on the other hand, would only use a final assessment of the flight of the ball to determine appropriate understanding and acquisition of the golf swing. The results of such an approach are obvious when the learner takes his first golf lesson. If his stance is incorrect, then all the other following activities he learned are likely flawed as well, since they all have been constructed on a flawed premise. With a summative assessment, the correction of the stance requires every step that follows his initial incorrect stance to be rebuilt. This process can be very difficult since the body is erroneously convinced that the flawed constructs are correct. Formative assessments allow corrections early in the process so that only the golfer’s stance, and not the entire process, needs to be corrected. Earlier assessment reduces the uncertainty and the level of learning anxiety.

Unfortunately, as any golfer will attest, when misconceptions occur, they may be nearly impossible to reverse. To avoid this problem, efficiencies in learning are gained by evaluating new ideas in a timely manner through formative incremental assessment and facilitating collaborative consensus among learners. Without formative assessments\(^1\), dangerous and inefficient misconceptions can occur and lead to an accumulation of knowledge that is based upon false assumptions. The problem is that ideas built on a foundation of pre-existing

\(^{4}\) In perceptual learning “contrasting cases” allows students to notice features more efficiently (Gagne and Gibson 1947; Garner 1974; Gibson and Gibson 1955). The power of contrasts also works for conceptual learning (Bransford et al. 1989).
knowledge take on the strength of the original familiar ideas. Should the new learning be incorrect, these errors will be confounded by distorting subsequent conclusions. To avoid this problem and to minimize errors, timely formative assessments are necessary.

Thus learning theory is consistent with the previous literature and theoretical conclusions about dynamic routine design. However, constructivism does more than just validate previous insights it offers further design insights as well.

**Collaboration**

A second design feature suggested by constructivism is collaboration for active learning. Schank (1990) identifies specific steps the brain uses to store memories. The final step is discussion. Collaboration allows individuals to discuss their new insights to better formulate their understanding of the new ideas. Collaboration is also important since this utilizes active learning (i.e., learning by doing). Working collaboratively also “increases the quality of feedback” for learners (Bereiter and Scardamalia 1989; Fuchs et al. 1992; Johnson and Johnson 1975; Slavin 1987). Collaboration is more than simply sharing private information. When learning new cultures, the private information may be incomplete and incorrect. Thus, collaboration is not the same as participation, which assumes full knowledge of cause and effect. Rather, collaboration includes the actual learning of cause and effect by demonstrating and modifying one’s understanding through discourse and actions. In a learning model, participants share private information to modify and validate their understanding of new actions and applications of processes. Collaboration in an agency setting allows risk sharing among participants and reduces perceived individual risk. But the learning aspects of collaboration are ignored by agency as instantaneous re-equilibrium is assumed.

Thus, constructivist learning theory suggests that after the AIS identifies specific incremental problems, workers (i.e., managers and employees) should collaborate in a drill-down analysis to find a correctable root cause for the problem. Collaboration enhances learning (and spreads the risk of failure among participants) while developing a consensus on the best solution.

To summarize, constructivist’s learning is improved by adaptive variances since incremental economic reports provide a formative assessment of CI changes. In order to change the business culture, evidence must be presented to verify that changing the way things are done will increase company value. A CI culture includes a belief that there is always a way to improve. Selecting and evaluating a series of changes that are validated with the CI-AIS allows employees to learn using contracting data. This is, unlike current MCSs where nonfinancial measures of assessment dominate and are not validated by timely accounting measures of value. Existing dynamic CIs

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5 First, the story is summarized into the key elements of the experience. Then, activities are sequenced into a story. Each event triggers the next. By stringing events or thoughts together in a related story, each subsequent thought is placed into the context of the previous event. Since memories are context-embedded, the context enhances recall. Contexts with characteristics similar to new ideas provide additional learning anchors to enhance recall. Third, the brain uses “learning anchors” to index key concepts allowing events to be easily recalled. Fourth, we tell the story using conversational language. Not only does discussion build and strengthen synaptic connections, but also conversational language is generally more powerful because it is used more often. The strength of a synaptic connection increases with use. Thus, conversational language is more brain-friendly than technical language.
lack formative economic assessment and thus, require much higher levels of trust to succeed, making them prone to failure.

**Using Perfect standards**

As suggested by Quattrone and Hopper (2001) a move to evaluate the feasible rather than to what appears to be an optimal solution may be more appropriate as a theoretical basis for a CI routine. However, a common philosophy of CI heuristics is the drive to perfection and the elimination of all waste. Regardless of countervailing arguments, the drive for perfection seems to be a integral part of the kaizen philosophy and, in fact, appears to be a dominant characteristic of CI.

*From a theoretical perspective this thrust to perfection can legitimize the use of perfect standards as a target.* Perfection, of course, is ‘unknown and unattainable’. The role of the CI is to move the productivity expansion path in the direction of improving value as efficiently as possible. Introducing this one change to perfect standards modifies the role of variance reports to the identification of opportunities for improvement and not control of planned performance levels. *From a learning perspective it is an efficient adaptation since the normative, pre-existing managerial accounting systems maintains the same appearance as before.*

While MBE using negotiated or historical standards provides useful measures for contracting. For in-process improvement, the use of perfect standards, rather than practical or engineered standards, allows the variances to capture more opportunities for improvement and limits opportunities to build in slack. Any variance from perfection is considered waste. *The larger the waste variance the greater is the potential for identifying an inefficient practice caused by current process activities.* Unlike negotiated variances, AIS measures, based on perfect job standards, will provide waste variances that should reflect a greater potential for process improvements while limiting opportunities to create negotiated or hidden slack.

This approach effectively converts the accounting system from a control mechanism for operating routines into a dynamic routine as a key component of CI heuristic. The ‘waste’ variances from this system effectively improves design theory decisions by bounding the selection of incremental choices. The measures however, need to be sufficiently acceptable to be perceived as political neutral to allow them to select ‘opportunities for improvement’. Thus the measures must be accurate enough to articulate with the existing accounting measures of costs in order to demonstrate cause and effect for contracting purposes. This means changes can be validated as the improvements to the operating systems as they are subsequently reported.

This revision to a CI dynamic from an operational control routine can have contracting implications as well. Since the unknown is not measurable production planning and goal setting becomes more uncertain. In the illustration presented in this paper a disturbing event did occur where the unanticipated excess capacity presented problems. The plant foreman tried to fill the capacity that was discovered during the shift with a product that was always in short supply in the summer. Unfortunately the plant manager was trying to run down inventories and found out about his decision after the fact. *This event lead to the production manager taking away the*
foreman’s decision rights to revise scheduling. An authority that had always been taken for
granted within the company’s informal business culture

Future improvements can never be budgeting with the certainty of currently attainable standards. Thus Quattrone and Hopper’s conjecture of moving to ‘control of the process’ rather than control of a projected result may be the appropriate new form of contracting.

Consistent with design theory, the application in practice may be satisficing but it must have cultural acceptance to meet the feasibility criteria. In the application, perfect standards need only be the answer to ‘if everything ran perfectly how long would it take’ or, the previously perceived as unattainable, vendor formulas. This is not the real perfect standard but rather a cultural acceptable interpretation. On average, the largest waste variances using this method should identify better opportunities for improvement over existing practice. Even when better opportunities exist, waste variances are superior for cultural change since they are perceived as politically neutral and bound the set of feasible solutions to be considered (limiting conflict). They reduce uncertainty about cause and effect as the dynamic CI system reports the success or failure of change activities. Such performance measures are culturally acceptable in both pre-existing and current cultures, providing a basis for validation, analysis, and change in CI routines with minimal risk and learning anxiety.

THE APPLICATION

This American Canning Factory (ACF) is a family owned company with over 25 million dollars in annual sales. It had grown successfully through two generations but was approaching a profitability crisis as the third generation came into control. The company had developed a strong business culture built from its experiences applied over many years. Clan control (Ouchi, 1979) built on established relationships was the dominate management approach. With embedded informal knowledge of routines providing the basis for operational capabilities. Most employees had been with the company for many years and there was a deliberate policy to promote from within that was rarely violated. Effectively this maintained the knowledge about operating routines informally within the company. Most of these workers were long time employees who learned the business from the bottom up and many had never worked elsewhere. Turnover in this group was extremely low. Some employees were quite old and had virtually spent their entire adult lives with the company. A mandatory retirement age did not exist. Only a few employees with special skills were hired from outside as needed.

The canning business has a pronounced seasonality with extreme capacity needs in the summer months. This meant keeping the core employees that formed the knowledge base of the company fully employed all year but ramping up every spring for the summer rush where 24 hour operations were annually anticipated. Using the existing capacity of even one shift of the core staff in the winter was always a challenge so that custom packaging was developed to fill this capacity. With a philosophy from the beginning of ‘customer satisfaction’ product lines had expanded with each new idea while few had been dropped. Custom canning was implemented and jobs where solicited literally worldwide. This proliferation of product lines combined with pronounced seasonality lead to challenging issues when bidding for custom work to fill idle capacity. The plant ran four different production lines, two of which (the canning lines) were the
focus in this research. The company makes almost 300 different products. Each line has a tightly integrated system of machines sequentially linked by conveyor belts. For each line, the filler machine is where the product is mixed and packed and is designed to be the constraint that paces the canning line. Consequently, treating these lines as cells was relatively straightforward.

The company was similar to many organizations that had flourished without detailed costing information. Product line profitability or costs had not been issues management worried about. The boss’s motto was to ‘satisfy the customer’. And this had resulted in a profitable business for over 80 years. Winter’s aspiration level for new product was to get the product to the customer. Little data was available for product line analysis nor was it perceived to be needed as the synergies with existing products were very large. Since the company distributed their product lines as well. Different products had significant economies in distribution set by the size of the trucks and routes that could be used. Thus to be added to the product line the incremental contribution of new products had only to be relatively modest. ‘Can we make it in the factory and deliver on our trucks and make some money’ was the only criteria. They had a rough handle on the average cost per case each year and they could ball park what it cost to run a truck. Consequently nothing more was needed. There were no models in place to eliminate product lines. In fact, the capability to produce the founding brand from the 1920’s still existed even though it was rarely produced and there was no way to estimate the cost of maintaining these capabilities.

Using an OIE perspective there were few formal systems tied to the operating routines in the factory. Production was scheduled weekly using ad hoc measures consistent with company experience and market demand week to week and monthly. Managers and experienced workers taught new employees the job. Formulas for mixing the product and expected yields were provided by the vendors. An inventory system was in place to track the necessary materials and measure waste but the costs for production for each job were not recorded. A yield efficiency measure compared the difference between the vendor projections and actual output. This was expressed as a ratio. For example, 98% meant the company yielded 98 cases when the vendor’s formula suggested a yield of 100. Staffing levels where set by the foreman from his experience and judgment. Thus, most of the routines providing the capability to make product where informal and utilized the knowledge and support of the social and political environment. Some changes had been attempted but with little success. Successful changes had involved the introduction of new products (like a syrup line, or water) or machines (like a cooler for the production line)\(^6\). These involved the introduction of new machine-based technologies not modification of existing processes. Production systems tracking quality, etc. were introduced when required by the customer. But quality in their sense simply meant meeting the vendor’s specifications by testing and was not extended to ‘building-in’ quality.

However, it should be clear this was a confident ‘can do’ culture that prided itself on getting the job done and overcoming obstacles. Introducing change into this long entrenched and largely

\(^6\) This cooler represented a significant investment that had been made just prior to the researcher’s appearance. The researcher immediately observed the flaw in the company’s analysis. They calculated their return on the capacity of the cooler and not on the capacity of the line to which it was attached. Thus the constraint capacity should have been used especially since they had no dynamic routines in place to increase the lines capacity. It was a particularly sensitive issue that required appropriate tack on the part of the researcher.
‘learning from doing’ culture would be challenging. There had a strong business culture held together with a common learned set of beliefs. They believed strongly that the methods they had developed ‘to get the job done’ were best.

While profits and growth had been quite satisfactory for earlier generations the larger family had concerns as evidence that costs were excessive under current operating conditions came to light. Subsequently, these suspicions were confirmed by an industry benchmarking study that placed the company in the bottom half with respect to packing costs. Preliminary cooperation with a local CPA firm was so successful they were motivated to consider further changes and the researcher was introduced to the family. A sense of profitability crisis, and the need for change was strongly supported by the family and widely understood within the company.

For example, support for this feeling of crisis and the need for change was advertised by what appeared to the researcher to be a contrived event. The boss entered the meeting room and yelled out in his familiar gruff manner to the new controller who was trying to install budgeting practices. “I hear you’re starting budgeting systems!” The controller responded in a subdued voice. “Yes we are.” The boss then responded in a loud voice. “It’s about (the term for a local water project) time!” Thus the boss’s strong support for the project was broadcast and became a funny anecdote for discussion.

The initial belief was the company had too many SKUs. To their thinking this brought two problems; the inability to accurately cost different products (which was important when bidding for custom orders and negotiating with vendors), and the potentially prohibitive costs of maintaining the capability to make so many different products. They were squeezed by vendors and competition on bids for custom packing. As was the common belief among consultants and ABC proponents, they were convinced the high product variety was driving costs but not necessarily production inefficiencies.

The researcher was viewed as a low cost, low risk method of bringing in needed skills. He had just become available as a partial pay sabbatical opportunity has disappeared and he was recommended by the local CPA and another business family familiar to them. An initial modest contract was offered to analyze the costing problem and suggest a solution as the family considered this an employment contract to solve a management problem. The researcher himself originally looked at the assignment as a way to replace a lost partial pay sabbatical opportunity and took the contract as an opportunity to acquire additional industrial experience.

After an initial evaluation and attempt to cost different SKUs the futility of costing inefficient processes became clear. It was impossible to separate systemic inefficiency from product cost drivers. While variety was a cost driver, the inefficiencies where a much more significant problem, as without knowing the efficient level of production it was impossible to accurately attribute costs to products. Management knew costs were high and it became obvious that significant savings could be obtained from process improvement. A project to install a new costing system involving CI routines was accepted based upon a series of short term contracts.
**Embedding the researcher into the company**

The strength of interventionist research is the participation with the actor’s within the company.

According to Lukka (2005) the core belief here is that the researcher’s intervention may offer him/her an effective route to the inner structures and processes of the research target, thereby making him/her able to connect prior theoretical understanding with practical knowledge, know-how, possibilities, and purposes. The researcher’s intervention is viewed as fruitful, at the extreme, and even an entirely necessary avenue for relevant new knowledge. (cf. Sipola, 2007)

Accordingly the embedding of the researcher successfully into this strong culture proved crucial. Although some researchers disagree on this point, Labro and Tuomela (2003) seemed somewhat embarrassed and divided themselves on this point of compensation. They argue that only the researcher’s expenses should be covered if at all. Kaplan (1998) however, disagrees and argues that compensation builds commitment. We note that there is an interesting difference in skill levels between these authors. Labro and Tuomela were relatively inexperienced with their projects appearing to be part of their dissertations. On the other hand, Kaplan and his team have significant experience and insights to offer a company. The researcher was more of the latter with twenty years of experience and a significant applied publication record. The industrial environment was familiar to him and he was easily able to add valuable insights to other areas. Through his time, on site, he became a sounding board for ideas with the controller and other management. Due to the strong informal culture of this company it is doubtful an outsider could function, be supported, or have access to information needed to apply the model without being considered a member of the company or establishing creditability.

Because the company was paying for the work they took the process and its progress seriously. Because of the cost, lack of expertise and trust in working with outsiders (trust was a critical part of their cultural belief system) expensive sophisticated consultants were not considered until the end of the researchers experiences with the company. What was needed was some incremental approach to build an understanding and develop confidence that current approaches could be improved. Overwhelming the actors with too many ideas would lead to immediate resistance from learning anxiety.

Trust as demonstrated by Chenhall et al (2003) and Busco et al.(2006) became a crucial criteria as the dynamic model was introduced by an outsider. In addition to being considered a paid employee, there were actions that embedded the researcher into the fabric of the company.

Consistent with a clan control approach the boss wanted the researcher to be visible to observe his actions but the visibility worked quite effectively to embed the researcher as part of the team and gain his acceptance as he was observed by his colleagues as well.

**Trust building habits: Trust in Accounting and Trust in Accountants**

The researcher’s office was a cubical with an open door beside the company’s public meeting place between the company and staff. Further most of the management staff from all areas, about 14 people, had offices radiating directly off this meeting room. This allowed all employees walking through the room to observe the researcher’s behavior. But on the other hand the diligence, access of the research to all company activities, and access to upper management created creditability and introduced the researcher into the company. This was extremely useful
to understanding the functioning of the company and for eliciting information and building cause-effect models.

In addition, the researcher developed a routine that created for him considerable creditability and visibility with key members of the company as well. The boss had a tradition of being the first person on the job in the morning to make sure the changeover and start up of the factory shifts preceded smoothly. This was very early in the morning. The researcher who drove a distinctive, old white vehicle which he was instructed to park in a visitor’s space at the front of the building consistently arrived early as well to simply to avoid traffic. As an unintended consequence this included the researcher in a small coffee group of old-timers who made a point of matching the boss’s habits with a ‘first thing in the morning coffee’. Soon the researcher as ‘the junior man’ was included in the joke about who had to make the coffee in the morning. He became accepted by the old timer’s group. From them he learned the reasons for current systems and historical background and they provided him with informal insights as needed. More importantly all the employees observed his car on their arrival to work. Since he arrived so early he also left early which was easily observed. Only the boss and family members left early. Thus the researcher became more embedded in the fabric of the business and associated with the boss.

Thus, as Busco et al.,(2006) observed, the trust in accounting was associated with trust in the accountant. In this case it was the researcher. This furthered using accounting as a basis for trust in change as the researcher made a point of explaining the model and ideas behind it to all that expressed an interest.

**THE ACCOUNTING-BASED DYNAMIC CI ROUTINE**

Consistent with the design of current dynamic routines like six sigma, the Deming cycle PDSA, or other in-house inventions like the US Coast Guard (FADE), or the Royal Mail, our dynamic CI cycle has four repeated stages which we call (in the absence of a more catchy phrase) – search, drill-down, analysis, and assessment. Virtually all the existing dynamic CI routines follow this rough structure.

As informed by OIE (Burns and Scapens, 2000) the dynamic CI routines can be ‘stand alone’ and need not articulate with the accounting system. This matches the plasticity of the information system with the needs of continuous change. Therefore, consistent with the current design of existing CI routines ours is recursive and involves four steps similar to most dynamic routines:

- Prioritizing problems using perfect standards (the search activity),
- Analyzing the root cause of problems using CI tools (finding the root cause),
- Collaborating to design changes using current and projected cash flows (changes to the process), and
- Validating changes using CI accounting systems (final assessment).

We will now examine each stage in detail and indicate how they are informed by theory.
First: Prioritizing Problems Using Perfect Standards

For dynamic CI routines, as informed by information economics, the smallest complete measure of analysis, is a single job should be the costing objective. In addition, ranking jobs by waste variances allows the AIS, and not management, to select activities for improvement. This reduces the costs of action selection as informed by design theory. By selecting the activities with the greatest accounting-specified waste, the probability that improvements will be aligned with employment contracts is enhanced. This bounds the set of actions selected to the accounting system. From a cultural change perspective, changes motivated by pre-existing norms reduce the learning anxiety. Accounting-based employment contracts allow individuals to make decisions within the bounded rationality of existing budget data.

The jobs investigated are automatically ranked by the CI dynamic routine with no debate nor hint of political preference and without the need for political support. Because of the perfect standards, very few jobs have a positive (or favorable) variance (see Exhibit 6). Most jobs have negative (or unfavorable) variances. This is a critical philosophical difference between this costing system focused on CI dynamics and the traditional MBE system. In the CI system, unfavorable variances do not indicate work is inefficient. The importance of the nonvalue-adding variances is that they highlight a particular opportunity for improvement. The job with the greatest variance is the largest outlier and should represent a significant opportunity for improvement.

Second: Analyzing the Root Cause of Problems Using Continuous Improvement Tools

The second step in the CI budgeting cycle is to identify the root cause of the waste variance. The strategy for this step is to drill down to discover root causes that will lead to improvement. A root cause analysis is then performed on the worst three jobs and the best three jobs. The reasons for the waste are classified as either systems-related or product-related failures. Systems-related failures are activities that, if corrected, will improve production for all products and generate savings across all product lines. Product-related failures are activities that are due to the particular jobs, or products, themselves. The difference in these two classifications is important for subsequent strategic analysis.

This ‘drill down’ requires group participation and collaboration to further, as informed by agency theory, reduce agency risk and improve decision making. Numerous tools are available and may be developed on an ‘as needed’ basis. This ‘as needed approach’ is consistent with the incremental adoption of lean management tools. Training only advances as the need is identified by the collaboration of the group. This group consensus reduces the need for trust and learning anxiety as the group supports learning new activities pushing employees outside their comfort zones. This is an entirely feasible approach. Convergys Corporation, for example, a member of the S&P 500 and a Forbes Platinum 400 company, supplies over 40 specific improvement tools on its continuous improvement website (http://www.convergys.com). Evans and Lindsay (2005) define tools ‘as proven methods that assist in making fact-based decisions’. Included in the portal are self-paced training modules and other support materials. The tools can supplement both the ‘drill down to root causes’ and the subsequent analysis.
Third: Collaborating to Design Changes Using Current and Projected Cash Flows

The third step in the CI dynamic routine involves analysis using more of the aforementioned tools. Collaboration, as informed by learning theory, is an important learning activity, with visible discussion and shared ideas agents can cooperate, as informed by agency theory, to share knowledge as they learn new ideas. This is also the occasion for the negotiation of alternative choices as informed by design theory. Once a root cause is identified, employees with various perspectives will collaborate to share knowledge and find solutions. As with the prior step, collaboration within existing accounting-based employment contracts reduces agency risk and limits shirking opportunities since deliberations are visible.

Fourth: Validating Changes Using CI Accounting Systems

While this system need not be articulated precisely with operating accounts, as informed by OIE, the costs must reflect the accounting results to achieve assessment validity, (as informed by learning theory) and articulate with employment contracts (as informed by agency theory). Changes must be linked to the investment decision using the most timely complete (information economics) measure for subsequent assessment and validation of the process changes. In this accounting based system this can be done with the very next job – if a systemic change has been made in process design which influences all jobs – or with the next product run of a particular SKU – if the changes are product specific. Thus using accounting-related reports gives a timely feedback consistent with the profitability norms of both pre-existing and CI cultures. Without this validation their use to improve incremental design choices would be suspect. Of course this is only a satisficing solution (Winter, 2000) operating within the current value creation strategy.

Learning within the bounded rationality of incremental waste opportunities, a new set of beliefs in CI evolves. As decision makers receive validation of their decisions, they learn the CI process and affirm the CI culture. As this process is repeated, validating each change with AIS reports, employees learn new cause and effect relationships about changes in the process but also about the incremental CI culture. This knowledge reduces their uncertainty about the outcomes of CI efforts and enhances their trust in dynamic CI routines. Thus, the risk of, and reasons for, resisting CI are reduced. Because improvement as measured by pre-existing profitability norms is evident and the level of individual uncertainty is reduced, employees require lower levels of trust to cooperate with the new culture.

This dynamic CI routine, using waste variances, is repeated and embedded in a CI culture as a capability for incremental improvement outlined in design theory. The dynamic CI routine encourages acceptance of a new culture with specific design considerations to reduce agency risk and encourage learning.

OVERVIEW: MAKING EFFORT AND ADAPTATION VISIBLE

We describe a formal model providing dynamic CI capabilities to manage CI of operating routines. Because they are formal systems they provide an observable productivity expansion path for improvements, providing data and a structure to support the analysis and learning of improvements, and then a timely assessment to validate the change process and eliminate cause
and effect uncertainly arising from changing operating routines. An observable productivity expansion path with timely validation is important for cultural change to avoid the accumulation of agency risk leading to cultural resistance. However, the same process enhances learning activities as well. From a learning theory perspective, prioritizing waste activities directs learning a new CI dynamic culture and the subsequent management of these processes. From a constructivist learning perspective, each investigation offers an opportunity to introduce cultural change into “the way things are done.” Consequently, once validated by the accounting system, each new change then reinforces the validity of previous changes and adds support for a new culture of CI (Sako 1998). Each solution offered moves the company incrementally to a TQM culture as sources of waste are systematically eliminated.

Installing a more visible CI process will reduce the problem of unobservable actions. This insight leads to a conclusion that increasing the visibility of agency activities will reduce the need for accounting contracts and lessen agency risk to the company from unobservable actions. For example, accounting reports of work were now provided daily and could be provide in real time electronically to the entire company. Group participation and collaboration makes problem-solving and learning efforts more visible to management while spreading the risk through group decision making and enhancing learning through visible discussion and collaboration. With visible processes in place, agents’ learning activities are accounting-directed and are not self-selected. Thus, effort levels are more observable, removing many of the traditional agency problems concerning effort and knowledge asymmetries. Making the learning activities more visible will further reduce contracting inefficiencies.

Visibility can move control from MBE to observation of dynamic CI processes without a loss in efficiency.

**CREATING THE TOOLS: BUILDING AN ACCOUNTING-BASED CI ROUTINE**

Few existing CI dynamic routines utilize accounting to motivate and assess change. Six sigma is one of the few documented to do this (Busco et al., 2006), Evans and Lindsay, 2005). But six sigma is relatively complex and demanding. The process of creating the dynamic routine followed design theory as each stage of the design was presented weekly to the group allowing training and adaptation of the design to assure acceptance.

**DESIGNING THE DYNAMIC CI ROUTINE**

Consistent with other CI approaches the focus of the cost report is on the management of the process or the set of activities forming the operating capability subject to CI. The process then is the set of routines that provide the firm with the capability to produce goods and services. For the firm this is the packing cost per case which does not include materials. The smallest ‘complete’ measurement object is an individual job since this includes all the activities in the work cycle. At the same time job costing was a particular management need so this unit of measure was sanctioned by both theory and the needs of the culture. Consistent with the design

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7 Swayne and Harder (2003) reported the top three measures used to quantify success for six sigma were ‘cost takeout, productivity, and revenue generation’. Evans and Linsay (2005) go on to state that financial measures are crucial to ‘sell’ six sigma changes to upper management.
theory, the information reported on the job cost card was developed collaboratively with the CI team. This CI team included members throughout the value chain. This collaboration allowed each political constituency to both influence and learn the new dynamic CI routine as it evolved. Through various iterations and field tests the design includes input from all related influenced political coalitions. For management daily reporting of individual jobs allowed a new visibility of day-to-day factory operations.

At the same time different constituents could be satisfied that the new system would meet their needs. At the same time the information and format communicated across activities the interests of each constituency. The production managers, for example, wanted the filler efficiency ratio kept as a measure of the yield on ingredients since this was a normative pre-existing measure of performance. While this same information was impounded in the new report in the material waste variances, it remains part of the measurement system but is strictly speaking redundant. The marketing manager wanted variable and fixed costs highlighted to help him in preparing bids and analyzing the profitability of custom jobs. While this was useful for him it exposed the rest of the team to the implications of variable and fixed costs. This made them aware of what costs they needed to influence to improve marketing’s competitive position.

We feel this sequential process of development (design theory) reduced learning anxiety (agency and learning theory) and was retained because of the researcher’s awareness of the need to reduce cultural resistance. The rule of thumb applied by the action researcher was only to change from previous measures as absolutely necessary and to only offer information and reporting changes as understood by all the managers in the team. In fact the efficiency ratio was added back into the report only when it was brought up in collaboration. While it was explained that the measure was redundant there was no problem with including it in the report because it enhanced learning transfer from old constructs to the new ones. Agents could apply the old familiar with the new unfamiliar to reduce learning anxiety.

In addition, this collaboration resulted in the inclusion of fixed and variable costs for both runtime and setup time, and packing costs. The data has been modified but the report is identical to that used in the company. An actual report in Exhibit 5 illustrates these points. The filler efficiency is the actual production rate divided by the expected rate expressed as a percentage. The rest of the report data include fixed and variable costs for both run and setup time as well as waste.

The concepts of waste and nonvalue adding costs were new CI terms introduced to the team to replace MBE concepts. Waste was broken out as nonvalue adding costs. Packing costs, referred to as ‘case costs’ in the vernacular of the firm, were culturally relevant as a pre-existing norm, since these were controllable by the cell and are critical to the bidding of custom jobs. The unit packing cost was critical performance metric for the culture. Again this was information already embedded in the report but it was made more explicit to reduce the anxiety of the marketing group and fit into its ‘case cost’ culture. The support costs for each production line were grouped into separate cost pools and reassigned as capacity costs using the scheduled capacity on the filler machine. Cost pools, and cause and effect relationships were determined through staff interviews. To improve accuracy, five cost pools were selected – general overhead, materials, hourly labor, supplies, and power. The costing object is each production run of a particular
This was an important step since the accuracy of the costing system was critical to the assessment and learning process.

**Cost assignment: time in the cell**

Since the filler paces the line, this creates a theory of constraints application. The capacity of the constraint sets the capacity for the entire production system, so improvements at the constraint have an immediate and measurable impact on productivity. Overhead costs are assigned based upon the time in the cell using scheduled/capacity available for production (Mackey and Hughes, 1993), (Mackey and Thomas, 2000), (Kaplin and Andersen, 2007).

Each job run was assigned ingredients costs, variable manufacturing costs, variable setup costs, fixed setup overhead costs, fixed value-adding overhead costs, and non-value adding waste. For each category, total standard costs and actual costs, as well as unit costs with variances, were calculated. Variable manufacturing costs are calculated using perfect standards which include hourly labor costs, power, supplies, and repairs. Variable setup costs only include hourly labor, supplies, and repairs. Power is not used when the machines are stopped for setup. Fixed costs are assigned based upon the scheduled capacity in minutes of filler runtime. Nonvalue adding waste is assigned both a variable and a fixed capacity charge for the cost of the production capacity provided. This is done since this perception of the impact on fixed costs includes both short-term and long-term savings associated with the elimination of waste. Adding capacity through reduced waste is the long term saving. Shift and runtime costs are related to the variable costs. The fixed capacity costs should also result in long-term savings. They are included because management uses full costing to articulate with the financial statements.

**The Full Costing Paradox**

While many lean advocates support incremental costing we feel full costing was more appropriate to this culture as it was a pre-existing cultural norm. Providing information on variable as well as fixed costing provided the necessary information for incremental analysis without challenging their culture. Essentially full costing reflects the values of the constituent groups within the company. At the canning company, product and waste costs are assigned using full costing. This is preferred for CI strategic costing for several reasons. First, fully allocated costs that are articulated with the financial statements are consistent with the existing business culture’s interpretation of cost. This allows the unit costs to be consistent across the organization. Second, assigning fixed costs based upon available capacity provides a better measure of the costs of providing capacity. Using a full capacity denominator produces an idle capacity variance that can be used to signal the reduction of waste and the need to revise cost driver rates.

Reducing the fixed cost standard per minute reflected increased capacity utilization while increasing fixed costs per minute reflected improved productivity as less time was required to produce products. The dynamics of this system began to cascade and influence other operating systems as slack in connecting operational routines became exposed. Thus increasing fully applied fixed overheads raised the issue of control of overhead costs.
The unintended and unknowing result from changes reflects the progress of design theory. Each change exposed a new set of opportunities, some unanticipated prior to the change. The real importance of assigning fixed costs in the short term is the influence the costs have on justifying a CI culture because more value is placed on eliminating waste.

**Materials costs**

Each of ACF’s products has a unique formula using proprietary syrup and other ingredients like sugar and foaming agents. The company’s vendors provide the yield specifications for each product. For example, one product may produce 200 cases while another product (of equal initial volume but more dense) produces 300 cases. Each has their bill of materials specifying the mix of proprietary syrup, sugar, foaming agents, and other inputs. Specifications like these were used to set standards at ACF based on perfect yields. This total quality approach makes no allowance for waste, even though it might reasonably be expected using negotiated standards under MBE. This idea of waste elimination is consistent with most current dynamic routines like six sigma, Deming PDSA cycle, or kanban management. If the production activity is perfect, then the machine and ingredients specifications will be met exactly. The objective of the reporting system is to identify the cost of total waste, not just the unexpected or un-negotiated waste.

**OPPORTUNITY #1: SUGAR-FREE FLAVORS**

**Systemic Improvement**

One instance of a CI decision at ACF involved sugar-free flavors. According to the variance reports, a sugar-free product had one of the largest waste variances for the month (see Exhibit 6).

It should be stressed that waste must be reported in terms of monetary cost in order to tie variances to the overarching cultural norm of profitability. When productivity yield measures alone were used at ACF, important problems were ignored and opportunities for improvement were neglected. By themselves, productivity measures prompted no action because they were detached from and unrelated to the shared value of profitability held by all employees at ACF.

To illustrate, run inefficiency/waste of Papa’s Soda is translated in terms of profitability, indicating a $1.73 negative variance from the perfect standard per case (Exhibit 6). No other product had a negative variance this high. Focusing on Papa’s Soda, drill-down analysis for the process by the work team indicated that the equipment used to produce this product was adding syrup at levels higher than the vendor specifications. It was agreed that new equipment needed to be purchased in order to correct the problem, reduce the waste, and increase the profitability of Papa’s Soda and other lines using the same equipment.

Interestingly, this problem was systemic and common to many more products. In this instance, the analysis of the greatest outlier job offered opportunities to improve all the processes, not just a single product line.
OPPORTUNITY #2: THE LIFT TRUCK

Superficial or Immediate Solution

A second example at ACF involved a lift truck on a product line. According to the perfect standards, this job was excessively expensive because of downtime. The drill-down investigation indicated that the product for this job required a longer drive to the storage area than other products. At the time, only one lift truck was available and periodically the production line had to be stopped to allow the lift truck to catch up. Consequently, excessive inventory piled up at the packer. Eventually, the entire production line with the new CI-AIS had to be closed down and the downtime was charged to the cost of the product. Based on perfect standards, the variance report clearly revealed that the time wasted in moving inventory with only one lift truck was making the product too expensive. The decision was then made to purchase an additional lift truck to reduce downtime and improve this particular product’s profitability. Because the AIS highlighted the problem as a top priority in terms of profitability, the necessary remedy was obvious and straightforward to everyone who participated in the collaborative decision process. Hence, the beginning of a CI culture was launched.

SUMMARY AND RESULTS

Despite their proven value, the adoption of dynamic CI routines has been unacceptable slow and expensive. Cultural resistance has been suggested as a primary reason for this failure.

Accounting budgeting systems have demonstrated the ability to reduce organizational conflict through allocation of resources and employment contracting for many years. However, there are significant agency issues when the introduction of innovations are driven by consultancy practice. Consequently, this project attempted to determine if using insights from research to inform application would provide new more useful opportunities. Consequently, a constructivist research approach informed from theory was used to develop an accounting-based dynamic CI model in an American factory focusing specifically on the problem of cultural resistance. First theories were used to inform the sources of cultural resistance as risk and learning anxiety and inadequacies in the design of dynamic CI routines. Then the position taken in this paper by the researchers was that cultural norms causing resistance are learned behavior and that learning theories should inform application. Consequently theories of application in unstable environments should use of learning as well as economic theories to the design of applications.

The results of this application were impressive. Over the six months of development and implementation, throughput for the work center in our research case improved 35 percent, and after a period of two years the company was, and perhaps still, using the dynamic CI for process management. This, according to Labro and Tuomela. (2003) means our intervention passed the strong empirical acceptance test. Further, however, the use of perfect standards has been published and received an award in a professional journal (Mackey and Pforsich, 2006). In a more lengthy presentation of the operating system twenty-four of twenty-six professional management accountants in a blind review indicated the systems would be useful to their companies (Mackey, 2006).
This paper describes the design and application of a formal accounting-based dynamic CI routine informed from theory to give organizations the capability to efficiently adapt operating routines in a continuous manner. Unlike current MBE accounting control systems this model is not based upon optimization models but rather assumes incremental feasible solutions as informed by design theory. Such a system, informed by theory, provides a formal dynamic routine to support CI capabilities. In general, when accounting-based employment contracts exist, agents make decisions within the bounded rationality provided by the accounting system. To motivate a change in culture using accounting-bounded information, a dynamic CI routine must be capable of repetitively: 1) identifying high priority waste items for evaluation, 2) facilitating the collaborative process of root-cause analysis, 3) support the process of proposing change activities, and 4) provide assessment of changes that lead to adopting new cultures. The new accounting based dynamic CI routine provides a repetitive cycle of identifying the next activities for analysis, drill down to identify root causes, analysis of change alternative, and follow up assessment in a more efficient manner than current alternatives.

As predicted by Covaleski et al. (2003) one theory did not adequately inform the application, therefore, multiple theories in combination were applied to provide a workable solution.

**Informing Design from Old Institutional Economics**

OIE introduces a model of the firm focusing on the creating of capabilities better linked to value creation than resource based economic models. The management of individual routines in an interactive manner justifies our focus on process based dynamic CI routines. This recognition of the separate role and need for dynamic processes, as expressed currently in six sigma, kanban management, or Deming’s cycle, justifies the development of our model. The OIE view of processes over resource management informed a superior model for our analysis.

**Informing Design from Design Theory**

Design theory supports the incremental transition of change from one set of opportunistic choices to the next. Each choice reveals previously unanticipated opportunities for improvement. Each set of opportunities offers the potential for political conflict forcing the consideration of the best feasible solution. Using a design theory lens optimality is not the only consideration rather feasibility must also be considered to provide compromise solutions that will be acceptable to the organizational culture. This theory informs the use of satisficing accounting measures of value to limit the set of feasible choices and improve their analysis. An insight from this model is that the optimal solution is not necessarily ignored rather the progress to the optimal solution may take several iterations. On the other hand design theory informs that each decision leads to a new set of unforeseen opportunities which through incremental progress may lead to a better solution. Optimal change alone is not sufficient but rather feasibility is a critical factor as well. In this environment incremental dynamic CI enhances the efficiency of the process by bounding the solution set for discussion.

**Informing Design from Information Economics**
Itami (1977) suggested that more frequent complete variance reporting reduces the cost of out-of-control conditions. Our interpretation of this in practice was to use the timeliest complete measure possible as the costing object for the dynamic CI. In this case only one complete job included setup, run, and packing activities. Thus the complete job and not the time period or cost center becomes the costing objective for dynamic CI.

**Informing Design from Agency Theory**

From design theory, accounting contracting improves the efficiency of the change process by bounding the solution set to activities validated by profitability criteria. This becomes particularly important when change activities are laden with the potential for opportunistic behavior and there are no other consensus generating normative devices.

The agency theory insights into risk and moral hazard issues were very helpful to the design of the dynamic CI. Agency theory, provided direction in seeking mechanisms that limit risk while using accounting contracting to validate CI. By breaking risk into components of uncertainty and potential economic loss, managing these elements informed the reduction of cultural resistance. Thus incremental solutions were preferred and sought as only one job was examined at a time to limit both uncertainty and risk. A third design feature suggested by agency theory was the elimination of cause and effect uncertainty through timely, complete and accurate accounting assessment reports. When agency contracts are accounting based timely feedback on the impact of changes on accounting measures reduces the risk managers faced from their actions and allows a reduced level of trust to avoid shirking and cultural resistance.

While there is some debate about the definition and role, or even existence, of trust in agency theory the trust in the system and the researcher was a relevant variable in dynamic CI design. In a way, this strengthened the interventionist role of a qualified academic. As cultural change became a matter of learning and justifying new approaches, teaching skills became important and indeed impounded into the design.

**Informing Design from Constructivist Learning Theory**

While previous theories of OIE, design, and agency describe the characteristics of the change process they do little to inform the mechanics of learning. Alternatively constructivist learning theories provided more pragmatic guidance for field implementation. By treating normative values as learned behavior, the application of learning theory to the problem of cultural change is informed. As agents learn the cause and effect relationship of their actions, they can better predict the results of their actions and reduce the risk of failure. Thus efficient learning can reduce the risk to managers and increase their trust in the stability of the dynamic CI itself. Thus better learning and design for learning enhances change by reducing the amount of uncertainty surrounding changes the trust in the dynamic CI cycle is increasing.

From our application in this social context, the theories that explain mathematics, sciences, or languages seem to apply to social settings where agents learn a new culture. Formative learning techniques are not merely superior for learning but also coincide with insights about the reduction and limitation of risk from an agency perspective. The shared collaboration that
supports active learning also reflects the idea of participation and reduced individual risk by shared decision making in teams. Learning theories provide the insight that attaching new ideas to pre-existing normative structures is the most efficient way to learn. Consequently, the normative legitimacy of accounting constructs makes learning easier by providing a pre-existing normative value to rationalize change. The efficiency of formative assessment rather than summative assessment argues for the timely assessment and validation of new ideas.

Consequently, the participative learning and formative validation techniques used in the dynamic CI seem to have effectively reduced the resistance to change. Whether this will be sufficient in all circumstances is an open research issue, but the results of this application seem promising in this case.

**Informing Design from Dynamic CI methodologies**

All of the commonly used dynamic CI routines are process based. The objective of kaizen is to eliminate all waste in the form of nonvalue adding activities. This characteristic informed the use of perfect standards and the strategy of identifying nonvalue adding waste as the target for elimination. In this system control is exerted not through MBE but rather management of the CI routines. The CI routines have created more visibility and group risk sharing to eliminate the opportunities for shirking. It is much closer to the ‘visual control’ offered by JIT and lean accounting systems.

**CONCLUSION AND FUTURE RESEARCH**

The first three steps of a constructive research approach are to identify the problem, use existing research to offer a new solution, and apply the solution. After identifying the problem of resistance to cultural change, this paper offers a solution for implementing and managing CI using existing research and then applies it in practice. As offered by Kaplan (1998), the elements of the application that have merit will be amplified and developed in future improvements in the fourth innovative action research stage – improvement.

The model seems to be effective in introducing a new business culture requiring employees to learn a new “way to do things.” Oftentimes, this prospect of learning and changing is met with resistance by decoupling from the new offered routines. Agents resist change activities when their tolerance for risk is exceeded due to learning anxiety. This paper demonstrates a formal dynamic CI designed to explicitly support the search, discovery, learning and implementation, and then the assessment of change activities to control risk and enhance learning.

Quattrone and Hopper (2001) also noted the results of different implementation approaches in practice. Contrasting the implementation of SAP in two multinational organizations, a prescriptive approach involving a redesign of processes to coincide with “world class” practices, was contrasted with an incremental approach, installing SAP to fit existing practices and to continue incrementally. They concluded that “control is then no longer about prescribing ‘right’ courses of action but describing ‘possible’ courses of action.” Following on Munro’s “centers of discretion,” they argue that research is needed to study “how accounting destabilizes organizations” within the context of creating knowledge. Our work complements this appeal.
This conclusion leads to additional insight. Might, in fact, some of the cultural resistance to the implementation of CI cultures be optimal? Might, in fact, the ‘all or nothing’ implementation of CI tools create inefficiencies that would not occur with an incremental solution? Unfortunately, the converse could be argued as well. Upton and Kim (1998) found a propensity for successful improvement strategies to continue even when providing declining returns. Thus, an inefficient productivity expansion path may evolve when the in-process reports alone are used to provide CI guidance.

Interestingly the lean accounting offerings suggested by consultancies or professional bodies do not include design factors that would reduce the level of personal risk relying instead entirely on belief systems (IMA, 2006a, 2006b) for this purpose, belief systems and visible controls requiring significant investments in training and consultancy to learn alien accounting approaches only indirectly related to existing practice.

However, the approach advocated in this paper has thus far proved to be promising in just one situation. Further analysis and research is both justified and necessary to examine the generalizability of this model. However, success from a single application need not be completely generalizable to advance knowledge, or benefit from such research (Kaplan 1998), because solutions evolve with practice. The acceptance and value of such research will be demonstrated in its continued use and evolution.

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EXHIBIT 1
Characteristics of a Control Culture

1. “One best way” – practical standards
2. “Get the job done on budget and on time”
3. Budget based MBE analysis
4. Employee disempowerment
5. Built-in budget slack
6. Individual performance
7. Following the rules
8. Responsibility centers

EXHIBIT 2
The Change Process

<table>
<thead>
<tr>
<th>The Learning Process</th>
<th>The CI Process Loop</th>
<th>Business Culture Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Identification</td>
<td>The AIS prioritizes wasteful activities for sequential investigation.</td>
<td>Projects with the greatest waste can be most easily justified for change.</td>
</tr>
<tr>
<td>Incremental Solutions</td>
<td>Root cause analysis for CI is limited to one activity at a time.</td>
<td>Focusing on one project at a time limits the threat to employees and makes learning easier.</td>
</tr>
<tr>
<td>Validation</td>
<td>The pre-existing norm of profitability justifies the improvements made to the waste activity.</td>
<td>The change in costs justify changing existing normative procedures.</td>
</tr>
<tr>
<td>Repetition</td>
<td>The next most wasteful activity is selected and the process is repeated.</td>
<td>Through repetition, employees learn the implications of sharing ideas and collaboration, enhancing the new culture.</td>
</tr>
</tbody>
</table>
## Floor Cost Report: Grandpa's Soup 1111

**Run Date**: 1/9/2004  
**Filler efficiency**: 90.00% Plus Setup 95.00%  
**Actual Production**: 13057

### Variable Costs

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Actual</th>
<th>Budget</th>
<th>Variance</th>
<th>Actual</th>
<th>Standard</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$45,000.00</td>
<td>$46,000.00</td>
<td>$1,000.00</td>
<td>3.446</td>
<td>3.523</td>
<td>0.077 [1]</td>
</tr>
<tr>
<td>Variable Mfr (Runtime)</td>
<td>$3,000.00</td>
<td>$3,000.00</td>
<td>$</td>
<td>0.23</td>
<td>0.23</td>
<td>- [2]</td>
</tr>
<tr>
<td>Setup Cost</td>
<td>$139.92</td>
<td>$109.94</td>
<td>($29.98)</td>
<td>0.011</td>
<td>0.008</td>
<td>(0.002)[3]</td>
</tr>
</tbody>
</table>

### Manufacturing Overhead Costs: Fixed Capacity Costs

<table>
<thead>
<tr>
<th>Setup ovhd</th>
<th>Actual</th>
<th>Budget</th>
<th>Variance</th>
<th>Actual</th>
<th>Standard</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Adding (runtime costs)</td>
<td>$1,354.62</td>
<td>$1,354.62</td>
<td>$</td>
<td>0.104</td>
<td>0.104</td>
<td>- [5]</td>
</tr>
</tbody>
</table>

### Fixed & Variable Costs

<table>
<thead>
<tr>
<th>Nonvalue Waste (downtime)</th>
<th>Actual</th>
<th>Budget</th>
<th>Variance</th>
<th>Actual</th>
<th>Standard</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$180.00</td>
<td>0</td>
<td>($180.00)</td>
<td>0.014</td>
<td>-</td>
<td>(0.014)[6]</td>
</tr>
<tr>
<td>Shift/overtime</td>
<td>$7.73</td>
<td>0</td>
<td>($7.73)</td>
<td>0.001</td>
<td>-</td>
<td>(0.001)[7]</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$49,751.87</td>
<td>$50,519.24</td>
<td>$767.37</td>
<td>$3.81</td>
<td>$3.87</td>
<td>0.059[8]</td>
</tr>
<tr>
<td>Actual Floor Cost</td>
<td>$3.81</td>
<td>$3.81</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Packing Costs</td>
<td>$4,751.87</td>
<td>$4,519.24</td>
<td>($232.63)</td>
<td>$0.36</td>
<td>$0.35</td>
<td>($0.02)[9]</td>
</tr>
</tbody>
</table>

[1] This row presents the actual, standard, and variances for ingredients in total and per case.
[2] This row assigns variable runtime costs using perfect production and standards. Thus there are no variances.
[3] This is the setup variance based upon estimated historical perfect standards. Thus actual, budget and variances in total and per case are available.
[4] These are the fixed setup costs with the same treatment as the variable setup costs.
[5] These are the fixed variable runtime costs with the same treatment as the variable runtime costs.
[6] This is the waste calculated by the excess time used over perfect standards. It includes a fixed and variable portion.
[7] This is a special calculation used to deal with shift differentials due to evening or day shifts.
[8] This is the total production costs including all variances.
[9] This is the total packing costs and does not include ingredient costs. This is an important figure for strategic decisions and was requested by management.
### Exhibit 6 - MONTHLY CONTINUOUS IMPROVEMENT REPORT

**Line Floor Cost Report**

**1 LTR: RANKED BY TOTAL VARIANCE PER CASE**

<table>
<thead>
<tr>
<th>Item#</th>
<th>Product Name</th>
<th>Date</th>
<th>Efficiency Run</th>
<th>Efficiency Units</th>
<th>Total Cost var/case</th>
<th>Ingredients var/case</th>
<th>Packing var/case</th>
</tr>
</thead>
<tbody>
<tr>
<td>1201</td>
<td>Papa's Soda</td>
<td>29-Apr</td>
<td>22%</td>
<td>769</td>
<td>$ (1.73)</td>
<td>($0.72)</td>
<td>($1.01)</td>
</tr>
<tr>
<td>1550</td>
<td>Papa's SF</td>
<td>13-Jun</td>
<td>23%</td>
<td>212</td>
<td>$ (1.66)</td>
<td>($1.32)</td>
<td>($0.35)</td>
</tr>
<tr>
<td>1566</td>
<td>Papa's Gravey Style</td>
<td>3-Jun</td>
<td>46%</td>
<td>923</td>
<td>$ (1.22)</td>
<td>($0.91)</td>
<td>($0.31)</td>
</tr>
<tr>
<td>7600</td>
<td>Blueberry Gravey</td>
<td>9-May</td>
<td>76%</td>
<td>2533</td>
<td>$ (0.05)</td>
<td>($0.02)</td>
<td>($0.04)</td>
</tr>
<tr>
<td>6803</td>
<td>Grandma Ale</td>
<td>10-Apr</td>
<td>83%</td>
<td>3961</td>
<td>$ (0.03)</td>
<td>($0.01)</td>
<td>($0.03)</td>
</tr>
<tr>
<td>5515</td>
<td>Sparkling Creek Water</td>
<td>16-Apr</td>
<td>67%</td>
<td>400</td>
<td>$ (0.01)</td>
<td>$0.00</td>
<td>($0.01)</td>
</tr>
</tbody>
</table>

1 Formative assessments refer to corrective feedback that takes place during the learning process. This is contrasted with summative assessments which are the evaluative and corrective testing of new ideas after the learning process is complete.