A Case For Using the Cost of Quality Approach To Improve ERP Implementations

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ABSTRACT
Enterprise Resource Planning (ERP) systems implementation failures continue to incur high failure rates and costs. This paper advocates a greater focus on the quality management dimension of IT project management. Specifically, understanding the Cost of Quality (CoQ) has been identified as one important issue involved in improving the quality of information technology projects and reducing the cost of failure. A review of CoQ models suggests that process models are particularly appropriate for analyzing quality costs in ERP implementations. An example of building a process model of quality costs is provided using the Markus and Tanis (2000) enterprise system experience life cycle. Models such as the one delineated can be used to identify and target areas where gaining significant cost reductions from process improvement are possible.

Keywords
ERP implementation, IT failures, Quality management, Cost of Quality (CoQ)

INTRODUCTION
The annual rate of IT project failures is reported to range between 30 and 70 percent (Krigsman, 2010a). Notable among them are many high-profile ERP implementation failures with costs in the hundreds of millions of dollars (Kanaracus, 2010; Kimberling, 2011). Results of a recent 2010 survey reported by Krigsman (2010b) indicate that 57% of ERP implementations take longer than expected, 54% exceed their budget, 41% fail to realize 50%+ benefits, and 40% experience operational disruption at Go-Live. 32% of executives and 39% of employees are dissatisfied with the implementation. Sessions (2009) estimates that annual IT project failure costs are $6.2 trillion worldwide, and $1.2 trillion in the United States, using a formula that assumes the ratio of indirect to direct costs as 7.5. Indirect costs include the costs of replacing the failed system, disruption to the business, lost revenue and market cost, lost opportunity costs on what the lost revenue could have driven, and costs to customers. Research by Bharadwaj, Keil, and Mähring (2009) sheds more light on the impact of IT failures on the value of firms. The study found implementation (new system) failures to be more damaging to firm value than operating (existing system) failures. Also, larger drops in share prices resulted from IT failures of greater severity and repeated IT failures by the same firm. With ERP implementations costing up to 7% of sales (Krigsman, 2010b), it is important to a company’s profitability and economic sustainability that failures are prevented.

Failure costs such as those described above are one component of the total Cost of Quality (CoQ) that is the sum of conformance plus nonconformance costs (Schiffauerova and Thomson, 2006; Schwalbe 2010). Cost of conformance is associated with avoiding poor quality (e.g. inspection and quality appraisal), while non-conformance costs (failure costs) occur due to poor quality. Understanding the Cost of Quality (CoQ) as part of IT project quality management has been identified as an important issue involved in improving the quality of information technology projects (Schwalbe, 2010).

Quantifying the cost of quality can be used as a communications and management tool to highlight wasted money and motivate changes where necessary (Crosby, 1979). Making such costs visible may contribute to better project decision-making and de-escalation (Montealegre and Keil, 2000). Finally, CoQ is an important component of the total cost of ownership (TCO) that is central to building the business case for and making decisions during IT project execution. A helpful tool for mitigating the risk of ERP systems, software selection, and understanding the potential return on investment, TCO analysis involves an estimate of all direct and indirect costs that might be associated with the life-cycle stages of an ERP project (West and Daigle, 2004). A key goal of TCO can be the identification of quality costs in order to focus continuous improvement efforts on quality cost savings (Ellram, 1994). Following Sörqvist (1998), quality costs can be divided into the ‘cost of poor product quality’ and the ‘cost of poor process performance’, the latter making it possible to focus on inefficiencies and ineffectiveness in the organizational processes during project execution.
This paper proposes that a greater focus on quality management in ERP implementations is needed by the adopting organization to improve its processes and prevent high failure costs. It highlights the importance of utilizing total quality management concepts, particularly the concept of Cost of Quality (CQ), as a central feature in the implementation of ERP systems as improved quality and lower failure costs tend to go hand-in-hand (Webb and Patton, 2008): “total quality control has thus … been successful in meeting the dual objective of better quality at lower quality costs” (Feigenbaum, 1956, p. 99).

QUALITY MANAGEMENT CONCEPTS AND ERP

Designed “to ensure that a project will satisfy the needs for which it was undertaken” (Schwalbe 2010, p. 295), quality management is a core function in IT project management that “must be on an equal level with project scope, time, and cost” (Schwalbe, 2010, p. 295). While much is known about ERP implementation success and failure factors (e.g., Somers and Nelson, 2004; Aloini, Dulmin and Mininno, 2007) and the high cost of failure, research on quality concepts and quality costs has been very limited.

Total Quality Management (TQM) and ERP

Research suggests that quality management can play a critical role in ERP implementations. Jha and Joshi (2007) highlight the critical success factors that TQM and ERP implementations have in common, and emphasize the relevance of total quality management (TQM) for facilitation of ERP implementations. In a study of ERP implementations with total quality management (TQM) and business process reengineering (BPR), Schniederjans and Kim (2003) found that 34% of the respondents with successful TQM implementations were equally successful at implementing ERP. Furthermore, two implementation sequences were viewed favorably by respondents: TQM-BPR-ERP (22.8%) and BPR-ERP-TQM (20.3%). Another study found that ERP implementation could be successful if preceded by a TQM focus (Li, Markowski, and Markowski, 2008). Failure mode and effects analysis (FMEA) has also been applied to improving ERP introduction in Taiwan using critical ERP implementation items for the systematic assessment of performance levels and the formulation of performance improvement strategies (Yang, Lin, Lin, and Huang, 2006). Quality audits are an important tool for quality assurance (Schwalbe 2010). Nicolaou and Bhattacharya (2008) found that post-implementation reviews of activities related to project planning, strategy, and process integration undertaken early in the post-implementation life cycle of an ERP project resulted in performance benefits to the firms in the study.

Cost of Quality (CoQ)

Apart from reports of high failure costs of ERP implementations, cost of quality in the context of ERP has not been investigated in the literature up to this point. Cost of quality includes any cost that would not have been expended if quality were perfect (Campanella, 1999). Feigenbaum (1956) outlines three major segments of quality costs associated with avoiding poor quality or resulting from of poor quality: prevention costs, appraisal costs, and failure costs. Failure costs are further divided into internal failure costs resulting from products or services not conforming to requirements or customer/user needs that are discovered during the production of a service or product, and external failure costs that arise when nonconformance is discovered after the customer receives the product or service (Campanella, 1999). A comprehensive review of CoQ models by Schifflauerova and Thomson (2006) describes the classical and universally accepted prevention-appraisal-failure (PAF) model which dominates the CoQ literature, but also presents an overview of other CoQ models including opportunity or intangible cost models, process cost models, and activity-based costing (ABC) models.

Process models of quality costs can be used for any process within an organization (Oakland, 2004). In these models, process cost is the total cost of conformance and non-conformance for a particular process that can be measured at any step of the process (Schifflauerova and Thomson, 2006). The failure costs of non-conformance should be prioritized for improvements (Oakland, 2004). Building a process model of quality costs involves the identification of key process steps and parameters to be monitored (Oakland, 2004). The following stages were identified by Oakland (2004, pp. 148 - 150):

1. Choose a key process to be analyzed, identify and name it.
2. Define the process and its boundaries.
3. Construct the process diagram, identifying outputs and customers, inputs and suppliers, and the controls and resources.
4. Flowchart the process and identify process owners.
5. Allocate the activities as cost of conformance (COC) or cost of nonconformance (CONC).
6. Calculate or estimate the quality costs (COQ) at each stage (COC + CONC).
7. Construct a process cost report.

Regardless of the CoQ model employed, companies that use CoQ programs tend to reduce overall CoQ and improve quality for the customer (Schifflauerova and Thomson, 2006). A study of cost of quality usage and its relationship to quality system
maturity found improvement benefits in the form of tradeoffs between the level of conformance and non-conformance costs (Sower, Quarles, and Broussard, 2007). Specifically, maturity of a company’s quality system resulted in a decrease of external failure costs as a percentage of total CoQ concurrent with increases in internal failure and appraisal costs. Furthermore, the proportion of total quality cost spent on prevention increases while the costs of external failure decrease. Finally, CoQ decreases over time for companies with quality systems and which track CoQ.

**Developing a Process Model of CoQ in ERP implementations**

Among the CoQ models outlined earlier, process models appear particularly suitable to ERP implementations as they can be used for any process within an organization (Oakland, 2004). Using select details from the phases of the enterprise system experience life cycle by Markus and Tanis (2000) we developed the prototype of a quality costing model of ERP implementations as shown in Table 1 to uncover issues that drive project failure. Specifically, we selected some of the typical activities, characteristic problems, performance metrics, and range of possible outcomes associated with each ERP project phase to derive key activities of the cost model and to then classify associated quality costs as cost of conformance or cost of nonconformance per Stage 5 in Oakland (2004) described in the previous section of this paper.

<table>
<thead>
<tr>
<th>ERP Project Phase</th>
<th>Key Activities</th>
<th>Cost of Conformance (COC)</th>
<th>Cost of Non-Conformance (CONC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project chartering</td>
<td>Selection of software</td>
<td>Cost associated with site visits</td>
<td>Bug fixing and rework of configuration errors</td>
</tr>
<tr>
<td>2. The Project</td>
<td>Configuration and integration</td>
<td>Cost incurred for testing</td>
<td>Costs incurred due to poor-quality software documentation &amp; training materials</td>
</tr>
<tr>
<td></td>
<td>Rollout</td>
<td>Cost for user training</td>
<td></td>
</tr>
</tbody>
</table>
| 3. Shakedown | Going live | ● Cost incurred for system performance tuning  
● Additional training costs | ● Bug fixing and rework  
● Cost of business disruption, downtime, or slow response time |
| | Transitioning to normal operations | | ● Costs associated with underuse/nonuse of system  
● Costs due to maintenance of old procedures or manual workarounds in lieu of learning of the relevant system capabilities |
| 4. Onward and upward | Post-implementation review | Personnel hours dedicated to the post-implementation review | Costs incurred due to lack of available documentation on configuration rationale |
| | Technology upgrading and ERP system changes | | Disruption costs due to upgrading/system change difficulties |

Table 1. Building a Process Model of Cost of Quality in ERP Implementations

**DISCUSSION**

Markus and Tanis (2000) note that the outcomes of one phase in the enterprise system experience cycle are the starting conditions for the next, and that “decisions and actions in a phase may increase or decrease the potential for success ("optimal success") subsequently” (p. 188). In terms of quality costs, lack of conformance in an early project phase may cause non-
conformance or failure costs in a later phase. For example, surveys have shown widespread underutilization of ERP packages after rollout. Consequently, organizations are unable to gain the full benefits/value of the system (Panorama Consulting, 2010; Wallgum, 2009) shown in Table 1 as non-conformance costs associated with underuse/nonuse of the system during the ‘Transitioning to normal operations’ activity in the ‘Shakedown’ phase. These costs may be due to lack of training during the earlier ‘Project’ phase, or due to inappropriate software selection during the ‘Project chartering’ phase where capabilities were selected that were not needed (Panorama Consulting, 2010; Wallgum, 2009). Similarly, business disruption costs during the ‘Onward and upward’ activity of upgrading or system change such as decreased stock price, drop in customer satisfaction, or decreased operational efficiencies may be attributable to the software selection in the ‘Project chartering’ phase when a system was selected that was unable to support change (Fauscette, 2009).

As “each enterprise system experience is unique, and experiences may differ considerably” (Markus and Tanis, 2000, p. 189), quality costing models are expected to be different from organization to organization. An alternative costing model could be built across the life cycle phases shown in Table 1 using key critical success and failure factors. Costs associated with ensuring the success of a project would be classified as conformance costs, and costs associated with failure factors would represent non-conformance costs. The sample model shown in Table 1 represents a first step in tracking the quality costs associated with various activities in ERP (and other new system) implementations. Similar to the Markus and Tanis (2000) framework, it can be used prospectively for project planning to identify failure costs that can be avoided, or retrospectively for quality assurance and control. Ho (2005) for example suggests audits to uncover and locate quality issues and costs that are derived as a result of poor quality at the end of each project phase before starting the next one.

CONCLUSIONS

Even though quality management is one of the core functions of IT project management, the literature on quality concepts and particularly quality costs associated with ERP implementations is sparse at best. The process approach to quality costing of ERP implementations presented in this paper goes beyond the typical focus on highly visible failure costs and incorporates both conformance and nonconformance costs. It provides a method for uncovering inefficiencies and ineffectiveness in the many activities that make up an ERP implementation to assist with identifying opportunities for significant cost reductions from process improvement that will ultimately improve the project’s TCO and ROI. From an academic perspective, the model extends the Markus and Tanis (2000) framework by integrating a CoQ perspective in the enterprise experience life cycle.

There are many reasons why companies may be reluctant to track quality costs. The ‘Cost of quality iceberg’ presented in Krishnan (2006) for example illustrates the challenge of identifying the many less visible failure costs such as complaint investigation costs, potential lost sales, or excess process costs for acceptable product that result in understating the true cost of poor quality. Other reasons range from the resistance of project and top managers to lack of knowledge of how to track the cost of quality and the benefits of a CoQ program (Sower, Quarles, and Broussard, 2007). Top management support is crucial to making it work (Crandall and Julien, 2010). In the final analysis, however, “collecting quality costs is like project planning; it is cheaper to properly plan than it is to plan a little and fail a lot” (Webb and Patton, 2008, p.27).

REFERENCES


