Development of an Integrated Cost Management System for Small Business

Ekaterina Koromyslova, Ph.D.[1]
Carrie Steinlicht, Ph.D.[1]
[1]*South Dakota State University*
Ekaterina.Koromyslova@sdstate.edu; Carrie.Steinlicht@sdstate.edu

Abstract

Integrated Cost Management (ICM) has not been widely used by small businesses even though it has been shown to increase business effectiveness. Part of the reason for this is the lack of a comprehensive yet manageable ICM system for small manufacturing businesses. This study examines ICM methodology and concepts with the intent to build a framework for development of an ICM system that can be used by small manufacturers to effectively support decision making.

1. Introduction

Global competition is a driving force in manufacturing that compels companies to continually seek ways to build a competitive advantage in the marketplace. According to the U.S. Census Bureau, small manufacturing businesses provide 24% of all full-time employment in the U.S. (U.S. Census Bureau, 2010) Effectiveness of small manufacturing companies has a large impact on the U.S. economy and thus, it is important to determine ways that will help these companies compete.

Integrated Cost Management – a system approach to strategic cost decision-making based on sharing and integration of information across a company's business processes – is one way that could improve small manufacturer's competitiveness. However, a review of previous and current published research shows a lack of comprehensive ICM methodology for manufacturing enterprises. Much of the research that exists focuses on project cost management (Behrendt & Wulke, 2004; Nalewaik & Witt, 2009; Wulke & Kohl, 2004; Youngsoo & Sungkwon, 2004) or for cost management systems (Alarcon, Ashley, de Hanily, Molenaar, & Ungo, 2011; Anirban, 2001; Ellram & Siferd, 1998; Khoury, 2010; Seuring, 2002; Victoravich, 2010; Zbib, Rakotobe-Joel, & Rigoli, 2003). Less attention has been paid to ICM (Cooper & Kaplan, 1998; Cooper & Slagmulder, 2004; Kaplan & Cooper, 1998; Rwelamila & Hall, 1995; Saxena & Jain, 2012). There is very little evidence of ICM methods developed for small manufacturing businesses. Development of a structured systems approach to ICM will allow small manufacturing businesses to make better business decisions using best fit models and techniques.

2. Problem statement

The purpose of this study is to develop a framework for an ICM model that can be used by small businesses. To develop an appropriate framework, it is necessary to explore methods of cost management and determine the primary activities that must be considered in the scope of the ICM framework. It is also necessary to examine the tools and methods that are most important to a small business as well as the metrics that are the best indicators of

performance. From this information, an ICM model will be developed and operationalized for testing.

3. Cost management methods

Much research has been done on cost management. The importance of cost management was recognized in the early 1900's with the work of Frederick Taylor. Since that time, there have been several methods developed and used as businesses evolved, technology was developed, and markets changed. The first cost management methods were used in the 1920's using standard costing. As markets and competition became more complex and eventually global, cost management methods evolved and in 1988, activity based costing was introduced by Cooper and Kaplan (1998). Computerization allowed the development of databases which gave rise to targeted strategic management processes (SMP's) during the 1990's. At the turn of the century, SMP's became integrated (Inst. of Management Consultants, 2000). New methodic approaches to cost management appeared which considered differences between cost cutting and cost optimization (Khoury, 2010). ICM is the newest approach to enterprise cost management. This new approach is possible because of the ability to collect and analyze large amounts of data quickly from all areas of the company and its partners. ICM is a systems approach that takes information from across the organization and examines interactions of cost factors to suggest actions that optimize cost outcomes. Cost management systems using ICM have been developed but are typically add-on modules to large ERP systems (Wulke & Kohl, 2004). These types of systems are often cost prohibitive for small businesses.

4. Relevant cost management activities

Researchers have done multiple studies on supply chain cost management and project cost management which examine different methods of cost analysis and management. Examples include Ellram (2002) who defined a simplified supply chain model and then described tools and procedures for supporting strategic cost management. Seuring (2002) describes several different supply chain cost management methods arguing that cost optimization can be achieved using supply chain partnerships. Zbib, Rakotabe-Joel, and Rigoli (2003) showed how cost management methods must fit the characteristics of the supply chain at that time. Behrendt and Wulke (2004) studied project cost management and showed how costs are typically collected at a lower organizational level than the level at which they are managed. They argued that actual costs should be summarized at a higher level for proper consideration in a cost analysis.

It is also important to classify costs for effective cost optimization. Studies by Victoravich (2010), Ellram and Siferd (1998), Christopher and Gattorna (2005), and others identify major cost classifications such as opportunity costs, costs of ownership, and true costs of inventory.

The primary purpose of cost classification and cost analysis is to identify the categories of costs which have the most impact on profitability and require managerial action. This study proposes that cost classification can be represented by five analysis levels that can be described as cost "filters" (Fig. 1). A company decision maker starts at the top level and sorts overall company costs into different groups and prioritizes them. The decision maker continues to move through the levels to the bottom. At the bottom level, the influence level, the costs are classified into the most important categories in an ICM system: hidden costs, conflicting costs, and opportunity costs.

There are many areas of enterprise activity that could be included in cost management analysis. These activities overlap across functions in an organization and influence other activities and costs associated with them. It is constructive to view enterprise activities as a value chain for cost management purposes

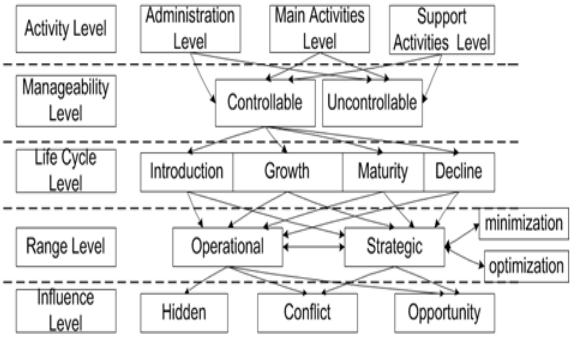

Figure 1. Cost structure analysis

(Anirban, 2011). Porter (1985) describes the value chain as a whole series of activities that add value in sequence. Each of these activities has inputs, transformation processes, and outputs. There are primary activities and support activities, each of which contributes to the overall cost and affects profits. Primary activities include inbound logistics, operations, outbound logistics, marketing and sales, and service. Support activities include infrastructure, human resource management, research and development, and procurement. Each of the activities is linked with other activities and these linkages are also important in the consideration of cost management.

In the proposed ICM system for small manufacturing companies, there are three activity levels that should be considered: the administrative level, the main activities level, and the support activities level (First level in Fig. 1). These three activity levels are detailed in Figure 2. The administrative level is a source of overhead cost that must be allocated. Cost management at the administrative level of an organization should use a cost driver analysis method because any decrease in allocated costs directly influences profit. By analyzing cost drivers, manageable sources of fixed costs (second level in Fig. 1) can be leveraged to minimize these administrative level costs.

When considering cost management in a small manufacturing company, most of the attention should be at the main activities level and then the support activities level. The main activities level includes production and

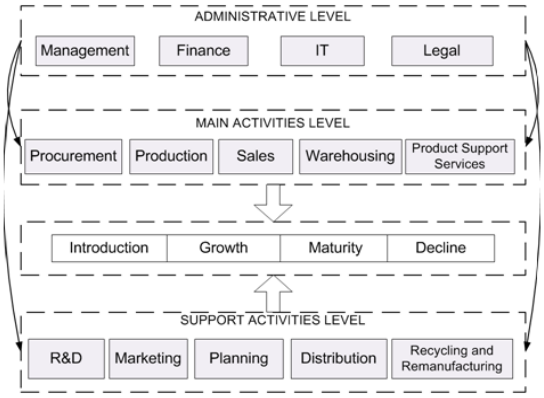

Figure 2. Cost of activity levels

operating processes relate to creating value for the customer. The support activities level includes required non-value added activities. Cost on these levels can be directly or indirectly associated with product and projected throughout the product life cycle, the third level of the cost structure in figure 1.

Each department is considered a profit center, which means that its performance is focused on increasing profit. This approach can help eliminate competition that develops between departments when they focus on cost reduction. When the focus is on cost reduction, costs are often passed on to other cost centers. When the focus is on increasing profit, efforts shift to making decisions that consider the system as a whole. The range level in the cost structure (Fig. 1) is concerned with the effect of strategic decisions versus operational decisions. By understanding the system wide effects and how they relate to overall company performance, cost can be optimized.

Different types of cost decision relationships and linkages (conflicting, indifferent, or synergistic) across the organization contribute differently to overall profitability (third level in Fig. 1). Since cost centers are linked in sequence, supply chain cost management methods can be applied (cost optimization via partnership) within a company,

as well as project cost management methods (cost breakdown and summarization).

Thus, this type of cost classification within the scope of ICM can help to achieve an optimum value of total cost within the organization. By using this method, a company can consider the interrelationships of the decisions made by all parties within the company, and how these decisions fit with the goals and strategies of the company, as well as consider how these decisions will affect the customer or the market.

5. Cost analysis methods and techniques

A focus on the most influential and manageable costs in specific areas of enterprise activity assists in the choice of methods used in cost management. There are several studies available that have studied systems used in various contexts. Cooper and Slagmulder (2004) examined five different major techniques including target costing, product-specific kaizen costing, general kaizen costing, functional group management, and product costing. One of their conclusions was that integration of various techniques can help reduce costs throughout the product life cycle. Another important idea from this research is that effective cost management systems are designed for the specific context of the company. Production volume and product variety should influence the choice of the cost management system. In another study, Zbib, Rakotabe-Joel, and Rigoli (2003) examined four different companies that had implemented ICM techniques and also determined that context was important. Different cost factors could be used for defining target customers or products and for analysis purposes. In yet another study, Ellram and Siferd (1998) showed a relationship between total cost of ownership and the most relevant cost management methods and concepts. Anirban (2011) also describes how differing cost management tools can be applied to different activities in the value chain. Therefore, to effectively manage costs in a business, it is important to select tools appropriate for the context and activities that are part of the system.

Based on previous studies in the cost management field, the following ICM framework is suggested (Fig. 3). There are four main parts in this Integrated Cost Management Framework: cost management systems, models, methods, and a company's business activities.

Figure 3 contains a combination of three cost management systems (Strategic, Traditional, and Total Cost Management), two

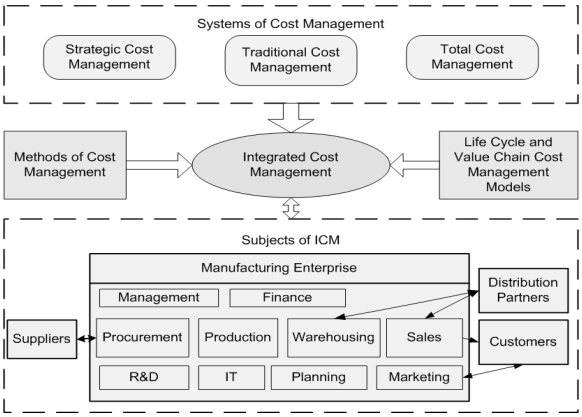

Figure 3. ICM schematic framework

management models (Life Cycle and Value Chain), and the most appropriate methods of cost management defined by each company individually. This combination should provide all the information necessary to properly analyze costs across the manufacturing enterprise.

Traditional cost management systems are accepted accounting based systems commonly used throughout industry. The Strategic analysis is included because ICM systems require a future orientation to meet goals. The third, the Total Cost Management is an integrated approach that applies specifically to project management which can serve as a basis for an ICM system for a small manufacturer.

The management models include the value chain orientation suggested by Porter (1985) and life cycle management which considers the life stage at which the product(s) exists to minimize resource use at the declining stage of a product's life cycle.

The main features of the ICM system are sharing of essential data between departments (which are considered profit centers), the company's top management, and its partners and customers; understanding how and where value for customers is created within a company and its supply chain; developing a way for integration of the different cost management systems and techniques which are a better fit for the company: complete or partial application of different cost management elements and their interconnections; and linking performance measurements across business processes (created value monitoring) and between organizational levels of a company (profit centers and higher level decision-makers).

6. Risk

Risk management is an important part of decision making. Cost management decisions carry with them an element of risk. Certain decisions are more risky than others. Cullen (2004) suggests that risk should be considered in terms of contingency planning or alternate approaches for mitigation of the risk. Others have used risk analysis, for instance using Monte Carlo simulation methods, to determine the most important risks that affect a decision (Alarcon, Ashley, Hanily, Molenaar, & Ungo, 2011).

In the proposed Integrated Cost Management framework, system enterprise risk is accounted for as one of the factors of decision making on the strategic level of cost optimization. Enterprise risk includes four types of risks: financial, market, operational, and information risk. The Composite Risk Index (CRI) is considered a control parameter for acceptance or rejection of an integrated cost alternative. CRI is calculated as a product of Impact of Risk Event and Probability of Occurrence. The acceptable level of the Index should be established by every company individually.

7. Metrics for ICM effectiveness

Despite the importance of effectiveness measures for ICM, there has been little research done in this area. Hyde, Regelman, and Kanagasabai (2008) offer a detailed methodology for development of a metrics system to measure performance in financial services. This methodology includes what and how to measure performance as well as how to use what is measured. In their research, the authors describe how different cost center objectives should use different metrics. They also show differences for short, medium, and long periods of time. Other research offers particular metrics that can be used by decision-makers (Nalewaik & Witt, 2009).

Because costs are analyzed at two levels of the organization, the operational level and the strategic level, it is necessary for the ICM system to use two levels of metrics: a profit center's performance metrics and metrics for the higher level decision-maker. The higher level metrics integrate performance information from production and operations levels, support strategic decision-making, and serve as "dashboard indicators" within the ICM system. The metrics should be balanced and should reflect not only financial information (e.g. profit, profit margin, ROI), but also production efficiency measurements (e.g., throughput, value added time ratio) and qualitative criteria (e.g. customer satisfaction).

8. Methodology of ICM framework formation

Every company determines its own approach to cost management based on existing systems, models and methods, and depending on a company's business processes and activities. Although there is no universal approach to ICM system formation, the following framework building methodology for an ICM system can be used by small businesses. The methodology is based on the integration and summarization of previous and current studies and includes cost analysis, cost management, and cost control steps to be

taken by the small businesses. These steps should be done in order.

1. A cost structure analysis should be performed to figure out problem areas and potential areas for improvements paying special attention to opportunity costs, conflict costs, and hidden costs. Cost structure analysis and contribution margin analysis will reveal weak and unprofitable products.
2. Use a Pareto analysis to focus resources on the most important customers (products) and suppliers of materials for the products.
3. Life Cycle Stage should be determined for target products. Minimal resources should be utilized when a product is in the declining stages. Methods of cost reduction should be chosen correspondingly to life cycle stages.
4. A company should determine useful metrics for ICM and their interrelationships. Balanced higher level metrics should be included in a "dashboard" reporting and control system. The goal of the measurement system is a comprehensive analysis of the impact of costing decisions on the company's performance.
5. A risk management system, which determines a procedure for choosing actions for risk analysis, should be incorporated into an ICM system. A way for risk estimation and managing should be included.
6. The next step is to choose cost reduction methods. In this step, the company considers all the decisions made in the previous five steps and chooses cost reduction methods that are appropriate for the costs identified. The methods must be complementary to the company's business strategy. Predominantly, process improvement methods should be applied in terms of cost optimization, because they can help reveal and eliminate a company's hidden costs.
7. The final step of the ICM methodology allows integration of all obtained data and estimation of potential results of alternate cost management decisions. The objective function of the analysis is a sum of costs of all enterprise activities. These costs represent dependent variables. Independent variables are cost drivers which can be determined using a parametric cost analysis or empirically.

The optimal value of the objective function (integrated cost) is the minimal value that falls within the constraints defined for the ICM system. From the ICM framework an MS Excel simulation model can be created and validated using statistical software analysis. There should be a small magnitude of error between the two results; however, it should be insignificant.

9. ICM proposed model

The ICM Model is a decision making tool which allows a company to determine and estimate different costing alternatives and focus on the optimal combination of integrated components that provide the minimum value of total costs adjusted on the control parameters' constraints. The ICM Model includes three levels of components; Input, Variable Components, and Calculated Components (Fig. 4).

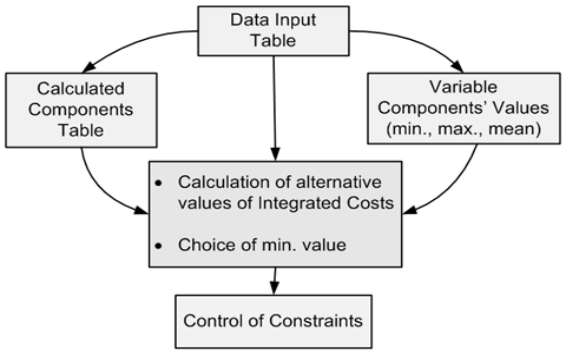

Figure 4. Simulation model structure

Realization of the ICM model in MS Excel provides a comprehensive and less expensive way for small businesses to manage their costs effectively.

Each profit center (department) has the same computer interface and inputs data, the independent variables' values, and the constraints' values. Then, the individual profit center analyses are combined at a higher decision making level to compare different

combinations of cost alternatives in the Integrated Cost Alternatives analysis (Fig. 5).

An important part of the ICM Model is constraints, which determine control parameters for calculated components. There are three types of control. First is control of constraints including time, quality, capacity, and finance. The second is control of correct integration of profit centers' data. The third is control of "dashboard indicators" which are metrics of overall company performance.

Constraints are controlled by assuring that the minimum integrated cost value is achieved by the values of the variable components within

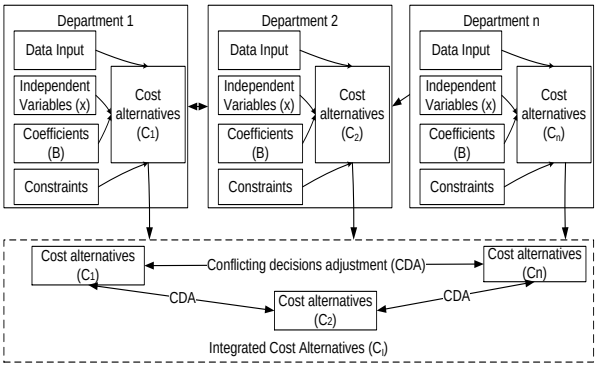

Figure 5. Profit centers' cost integration

the defined limits. If this condition is not satisfied, the next minimum integrated cost value should be considered, and so forth until the constraints' limits have been met. Also, because the profit centers' activities interconnect, some parameters of one profit center influence the parameters of another one, and vice-versa. So, the second stage of control is elimination or adjustment of conflicting decisions during the integration. The next control step is assuring that the chosen optimal value of total integrated cost provides the desired dashboard indicators. In other words, the indicators' values are not below minimum or above maximum acceptable levels.

The ICM Model simulation process can be represented by the following algorithm (Fig. 6). The obtained optimal result should be analyzed by the decision-maker, who interprets which combination of components provided the optimum.

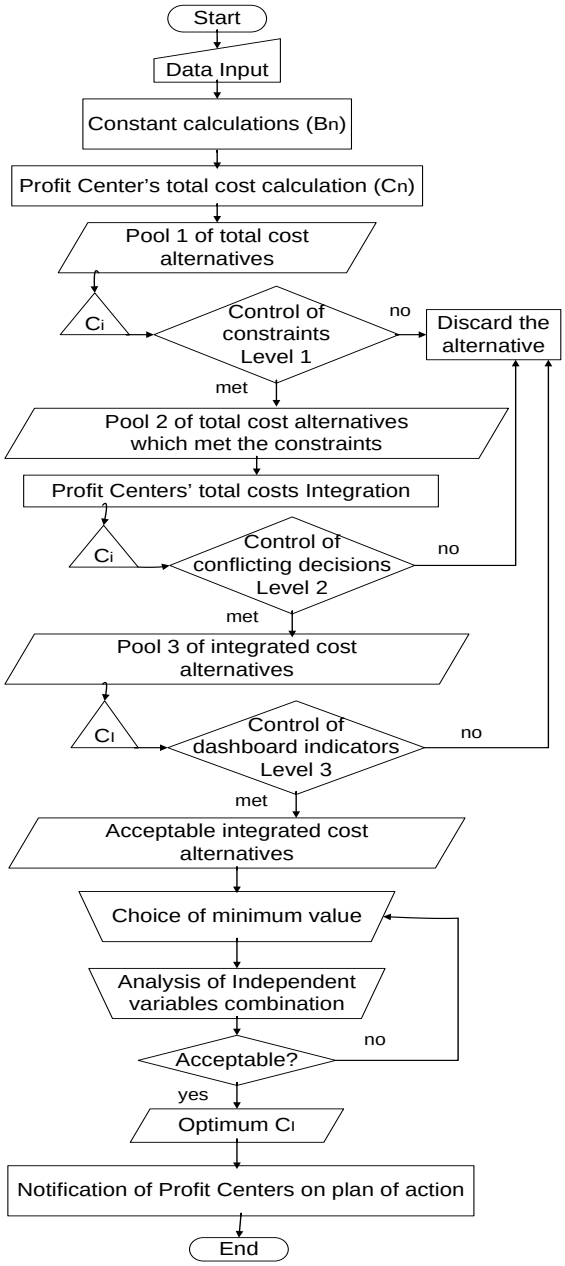

Figure 6. The ICM model algorithm

10. Preliminary results

Parts of this model have been tested at the procurement cost management stage in a company-manufacturer of kitchen equipment for public eateries. Preliminary testing indicates that this model will successfully indicate better

solutions to cost problems in small manufacturing companies. The developed model provided thirteen percent decrease of procurement cost in comparison to the original approach used in the company. More data are needed to refine the model and additional parts are still in progress.

11. Conclusions

In this study a theoretical ICM framework has been developed and built for small manufacturing businesses. Finding the correct Integrated cost management approach is burdensome for small businesses, and the created ICM framework is designed to support business decisions by providing a clear methodological approach to cost optimization using fewer resources than traditional ERP based analyses.

In this research, various methods, techniques, and contextual conditions are examined for inclusion in a comprehensive ICM framework. Three cost management systems and two models have been adopted for this framework. Nevertheless, a choice of cost management methods has the flexibility to allow companies to use different factors appropriate to the specific company's context. This is especially important in the diverse market environments in which small manufacturers compete.

In the scope of the ICM framework for small businesses, the five-level cost classification, the measurement system, and the risk evaluation system have been developed. The cost classification requires five levels of cost structure analysis and results in extraction of costs targeted for exposure. The developed measurement system combines operational and strategic balanced metrics to monitor financial and nonfinancial company performance and shows whether the optimum integrated cost was achieved. The risk evaluation system is included in the ICM framework as a constraint factor. These analyses inform the developed ICM framework for small businesses.

In this study, an MS Excel simulation model is proposed to operationalize the ICM framework. The developed ICM framework is represented by the simulation model and should be customized for each company. The simulation model validity can be tested by the error magnitude evaluation in comparison with statistical software analysis.

Future work on this project will include using the model to analyze costs in existing small businesses and determining the effectiveness of the model.

12. References

Alarcon, L. F., Ashley, D.B., de Hanily, A., Molenaar, K. R., & Ungo, R. (2011). Risk planning and management for the Panama Canal expansion program. *Journal of Construction Engineering & Management*, 762-771.

Anirban, G. (2011). Total cost management: A new approach to cost control. *Advances in Management*, 63-65.

Behrendt, V. & Wulke, R. (2004). Cost management in scheduling applications: Using the right toolset for cost management. *Cost Engineering*, 13-15.

Christopher M. & Gattorna, J. (2005). Supply chain cost management and value-based pricing. *Industrial Marketing Management*, 115-121.

Cooper, R. & Kaplan, R. S. (1998). The promise and peril of integrated cost systems. *Harvard Business Review*, 109-119.

Cooper, R. & Slagmulder, R. (2004). Achieving full-cycle cost management. *MIT Sloan Management Review*, 45-52.

Cullen, S. (2004). Essentials of cost management. *AACE International Transactions.*

Ellram, L. M. (2002). Strategic cost management in the supply chain: A purchasing and supply management perspective. *Caps Research*.

Ellram, L. M. & Siferd, S. P. (1998). Total Cost of ownership: A key concept in strategic cost

management decisions. *Journal of Business Logistics*, 55-84.

Hyde, P., Regelman, R., & Kanagasabai, K. (2008). The value of operations: Using metrics to measure performance in financial services. Retrieved from http://www.booz.com/media/file/The_Value_of_Operations.pdf .

Institute of Management Accountants. (2000). Designing an integrated cost management system for driving profit and organizational performance. *Strategic Cost Management Statements on Management Accounting*, Retrieved from http://www.imanet.org/PDFs/Public/Research/SMA/DesigningIntrCostMng.pdf .

Kaplan R. S. & Cooper, R. (1998). *Cost and effect; Using integrated cost systems to drive profitability and performance.* Boston, MA: Harvard Business School Press.

Khoury, G. R. (2010). Innovative cost optimization: A creative approach to finding new cost optimization opportunities. Retrieved from http://gkstrategic.com/pdf_image/Innovative%20Cost%20Optimisation%20-%20Gerald%20Khoury15.pdf.

Nalewaik, A. A. & Witt, J. (2009). Challenges reporting project costs and risks to owner decision makers. *Cost Engineering,* 15-18.

Porter, M. (1985) *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.

Rwelamila, P. D. & Hall, K. A. (1995). Total systems intervention: An integrated approach to time, cost and quality management. *Construction Management & Economics*, 235-241.

Saxena, L. & Jain, P. P. (2012). An integrated model of dynamic cellular manufacturing and supply chain system design. *International Journal of Advanced Manufacturing Technology*, 385-404.

Seuring, S.(2002). Cost management in supply chains – Different research approaches. In S. Seuring & M. Goldbach (Eds.), *Cost Management in Supply Chains*. Heidelberg: Physica-Verlag.

U.S Census Bureau. (2010). Statistics of U.S. Businesses (SUSB) Main. Retrieved from http://www.census.gov/econ/susb/.

Victoravich, L. (2010). When do opportunity costs count? The impact of vagueness, project completion stage, and management accounting. *Behavioral Research In Accounting*, 85-108.

Wulke, R. & Kohl, B. (2004). Cost management: Roadmap to project success - supplementing accounting systems for project cost management. *Cost Engineering*, 11-13.

Youngsoo, J. & Sungkwon, W. (2004). Flexible work breakdown structure for integrated cost and schedule control. *Journal of Construction Engineering and Management*, 616-625.

Zbib, I., Rakotobe-Joel, T., & Rigoli, R. (2003). Target costing: The key to supply chain excellence. *International Business and Economics Research Journal*, 27-34.