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Walden University

College of Management and Technology

This is to certify that the doctoral study by

Sheila Petcavage

has been found to be complete and satisfactory in all respects,
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the review committee have been made.

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Walden University
2016

Abstract

Applying Costing Models for Competitive Advantage

by

Sheila Petcavage

MBA, Baldwin Wallace University, 1993

BA, Baldwin Wallace University, 1977

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

Walden University

January 2016

Abstract

Making good supply management decisions is essential to competing in the global market, as these decisions often account for more than 60% of the average company's total costs. The purpose for this single case study was to explore the strategy that a large manufacturing firm in northeast Ohio used to identify costs when making effective purchasing decisions. The total cost of ownership (TCO) theory was the conceptual framework for the study. The data collection included a semistructured interview with a senior level supply manager and a focus group consisting of mid-level supply managers. Member checking provided verification of the interpreted participants' responses. Methodological triangulation included 2 company documents pertinent to the supply management department that resulted in 4 emerging themes: identifying total costs, tools for implementing TCO, supplier rating and management, and detailed recordkeeping. The findings of this study revealed a simpler approach to capturing and organizing data than was acknowledged in the literature reviewed. The findings showed TCO supported purchasing decisions that often resulted in domestically or regionally purchased products rather than offshore buys. Therefore, reassessment of true total costs by senior manufacturing supply managers might impact social change as more procurement decisions forego sourcing offshore and bring manufacturing of products back to local communities.

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Dedication

This achievement is in part the result of a long friendship and working relationship with my colleagues and mentors, the late Dr. Kenneth Killen and Dr. Richard Pinkerton. Both of these gentlemen have been instrumental in the development and direction of my career as I transitioned from industry to academics.

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I also want to acknowledge my husband and family who offered understanding and unwavering support through this long journey.

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Section 1: Foundation of the Study

Improving productivity is important for an organization to survive. Increasing sales or decreasing costs to produce marketable products can increase productivity. If a company can reduce the cost of goods and services, it can improve profitability (Agus & Hajinoor, 2012). Costing models can help reduce overall costs. Models such as the total cost of ownership (TCO) focus on gathering all cost elements associated with any purchasing decision type. The TCO model emphasizes collecting all costs before making an optimum purchasing decision. When gathering all cost elements that make up the costs of major purchasing decisions, the results are better supplier choices and improved productivity (Ellram, 1995; Gass, Schmidt, & Schmid, 2014). Many small and mid-sized enterprises (SMEs) can benefit from additional information on the use of cost collection models in order to make better purchasing decisions. The purpose of this qualitative exploratory single case study was to explore how larger companies used costing models like TCO to reduce costs and increase profitability. When shared with SMEs, this research could lead to increased corporate competitiveness in SMEs, resulting in successful businesses contributing to society through increased employment, tax contributions, and socially responsible actions.

Background of the Problem

Often purchasing departments spend 60% or more of the company's revenues on materials to produce products (Vanteddu, Chinnam, & Gushikin, 2011, p. 204). Purchasing decisions require an inclusive cost review. Focusing on only a few or the wrong costs might not result in productivity improvement (Dabhilkar, 2011). Fratocchi,

Di Mauro, Barbieri, and Nassimbeni (2014) and Zhang and Huang (2012) documented the negative cost impact of sourcing domestically and offshore based on unit price alone, rather than total costs. Anecdotal evidence showed negative results of purchasing decisions based simply on the quoted unit prices with little consideration of risks or hidden costs (unanticipated costs) when buying offshore (Gray, Skowronski, Esenduran, & Rungrusanatham, 2013; Wakolbinger & Cruz, 2011).

Horn, Schiele, and Werner (2013) reported that many companies, especially SMEs, still do not use a cost model such as TCO when making purchasing decisions. Ellram (2013) thought the complexities and high costs of implementing TCO accounted for the limited use of costing models by SMEs. TCO implementation requires an integrated approach to activity based costing (ABC) accounting, enterprise resource planning (ERP) software, and a mathematical programming model (Degraeve, Labro, & Roodhooft, 2005). Many SMEs do not have resources to provide easy accessibility to the data needed for TCO supported decisions. Procurement professionals claim the cost to establish accurate TCO methods often outweigh productivity benefits. Therefore, given little alternative, practitioners reject TCO and costing models and revert to selecting suppliers using unit price as the major criteria.

Problem Statement

Many businesses, including SMEs, often make purchasing decisions without a cost model, which can lead to detrimental underestimation of TCO for product or service (Johnson, Sawaya, & Natarajarathinam, 2013). Use of unit price alone in making purchasing decisions can account for as little as 28% of TCO (Holweg, Reichhart, &

Hong, 2011, p. 338). Conversely, hidden costs and unforeseen risks can add an unexpected 72% to the total cost of the purchase (Holweg et al., 2011, p. 338). The general business problem addressed in this study was that many leaders of companies, including SMEs, fail to gather all of the costs when making outsourcing buys, diminishing profitability. The specific business problem addressed was that senior level supply managers often lack TCO strategies to make purchasing decisions.

Purpose Statement

The purpose of this qualitative, explorative single case study was to identify TCO strategies that senior level supply managers use to make purchasing decisions. The senior level and mid-level supply chain managers from a large firm in northeast Ohio, who used costing model methods such as TCO, answered interview questions to reveal *how* they used TCO at their company. The opportunity for constructive social change is in sharing the strategies for using costing models with other companies, such as SMEs, who struggle with TCO implementation and use. Sharing the results of this study with SMEs may lead to increased profitability, resulting in successful businesses contributing to society through increased employment, tax contributions, and socially responsible actions. In addition, reassessment of true total costs could result in reshoring procurement decisions, bringing manufacturing of products back to domestic localities.

Nature of the Study

In order to identify how business leaders use the TCO model to make buying decisions, I used a qualitative single case study. Qualitative research allows the researcher to study implementation and execution of a complicated process such as TCO

(Crowe et al., 2011; Yin, 2014). In addition, smaller sample sizes and personal participative interaction, both indicative of qualitative studies, derive detailed information not gained from quantitative approaches (Borrego & Bernhard, 2011). Where quantitative methodology effects rigor, a qualitative approach results in greater richness and depth achieved through open-ended interview questions (Östlund, Kidd, Wengström, & Rowa-Dewar, 2011). Many quantitative research approaches test hypotheses and identify the statistical significance of the findings (Tacq, 2011). Tacq (2011) described quantitative research as a statistical method resulting in a numerical collection of data, limited in the ability to describe a phenomenon. Mixed method research combines the strengths of both the qualitative and quantitative methods (Klassen, Creswell, Plano Clark, Smith, & Meissner, 2012). However, as mixed methodology includes a quantitative aspect, the introduction of a hypothesis results in preconceived conclusions, challenging the researcher's ability to explore the topic with an open mind. Therefore, a qualitative approach best addressed the research question postured in this study.

The research design best suited to address the research question was an exploratory single case study. A case study strategy allowed for in-depth exploration of the TCO process as applied within the company under study (Cronin, 2014). Anderson and Shattuck (2012) supported a case study design when advocating collaboration between researchers and practitioners indicative of this research, as case studies are exploratory and location specific. Yin (2014) characterized the results of case studies as holistic in assessment with data triangulating from various sources. In considering alternative methods, designs such as narrative and grounded theory methods did not meet

Walden's requirements.

In addition, I considered ethnography and phenomenology; both having characteristics useful to this study. Ethnographic research focuses on patterns of action that are socio-cultural as opposed to cognitive (Wägar, 2012). A mini- and extended ethnographic study offers insight into the cultural interactions between people in the workplace (Wägar, 2012). The focus of this study was on gaining an understanding of the facts rather than the meaning behind the action. As the focus of this study was to determine the strategy rather than the application of the strategy, an ethnographic approach was not germane to this study. Phenomenological researchers identify the personal experiences of the participants (Gray, 2013). Though personal application of TCO surfaced in the focus group session, the intent was to uncover the process, not the personal variances in its application. Use of methodological triangulation resulted in the opportunity to identify common dynamics within the data, allowing for separation of facts from feelings. Heale and Forbes (2013) reported use of two or more rigorous methods in data collection results in a more complete representation of the results. A case study design uses triangulation in data collection focused on the process, not the participants, throughout the various data collection methods.

Research Question

The overarching research question for this study was as follows: What strategies do senior level supply managers use to gather total cost of ownership when making purchasing decisions? Interviews with purchasing practitioners at a company, using a costing model such as TCO, provided insight into ways of gathering costs prior to

making supply decisions. Exploring TCO strategies identified methods that could help SME's make more effective, informed purchasing decisions.

Interview Questions

The interview questions included:

1. How do you access total costing information on purchasing decisions?
2. What resources do you use to gather and track total costs?
3. What process do you use for gathering total costs for a purchase?
4. What types of purchase items require this process before making a purchasing decision?
5. How much of this process uses automation?
6. What systems or tools offer automated availability to this costing information?
7. What costs have you identified as most critical for effective supplier selection?
8. What process is in place to follow-up on total costs incurred after the product or service is complete?
9. What method of cost collection did you use before this TCO approach to cost collection?

Conceptual Framework

The conceptual framework used in this study was the business model of TCO. TCO originated in the mid-1900s from efforts to optimize activities within a firm (Cavinato, 1992; Ellram, 1993). Early on, Ellram (1995) suggested a transactional cost component structure to capture total costs of products purchased for operations.

Researchers evaluated the use of TCO in supplier selection, strategic decisions, outsourcing, and offshoring decisions (Carbone, 2004; Weber, Hiete, Lauer, & Rentz, 2010). The key construct underlying TCO is the identification of all costs: preownership, ownership, and post ownership (Gass et al., 2014; Ellram, 1995). Central to this research, literature validates the benefits of TCO in appreciably reducing purchasing costs and increasing productivity (Caniato, Ronchi, Luzzini, & Brivio, 2014).

Operational Definitions

Throughout this study, I recurrently used the following technical terms. Literature provides varying definitions for many of these terms (Gray et al., 2013; Schiele, Horn, & Vos, 2011). Consequently, several terms are defined to delineate the meaning of those terms for the reader as applied to this study:

Activity based costing (ABC): ABC is an accounting technique used in resource allocation to assign direct and indirect costs to products (Tsai, Chang, Lin, Chen, & Chu, 2014; Tsai, Yang, Chang, & Lee, 2014). This cost accounting approach allows for matching costs with cost drivers critical to gathering costs for TCO.

Costing decision model: A costing decision model is a template identifying cost factors for purchases (Ellram, 1995). Tsai, Yang, Chang, and Lee (2014) outlined the process of building a costing model supported by ABC costing data.

Marginal returns: In all industrious processes, adding more of one element of production, while holding all others constant will at some point result in lower incremental per-unit yields (McConnell, Brue, & Flynn, 2012). The process loses value when marginal costs outweigh marginal benefits (Faff, Ho, Lin, & Yap, 2013).

Outsourcing: Outsourcing involves using external organizations to complete tasks a business no longer desires to complete internally. Companies focusing on core competencies see outsourcing as a strategy to improve costs and competitiveness (McIvor, 2013).

Offshoring/Reshoring: Offshoring refers to procurement of goods and services from low cost developing countries (McIvor, 2013). The term also describes the transfer of operations to another country. It is important to note some researchers refer to offshoring as a movement of operations to a low labor country while maintaining ownership of the facility (Kumar, Zampogna, & Nansen, 2010). Reshoring is the reversal of offshoring where purchases and operations move back to the country of origin (Gray et al., 2013).

Supply chain: A supply chain is a network of organizations linked together in different processes and activities producing value in the form of products and services (Pettersson & Segerstedt, 2013). The strength of the supply chain provides the competitive edge in the market for the organization.

Total cost of ownership(TCO) model: The concept of TCO is the base of the costing model capturing all costs associated with and incurred over a product's expected life cycle (Caniato et al., 2014).

Assumptions, Limitations, and Delimitations

This study was specific to large companies using a costing model when making purchasing decisions. The participants consisted of the senior level supply managers and mid-level supply chain managers from a large manufacturing firm in northeast Ohio. I

targeted the supply management within this company to explore their strategies for gathering costs before making supply decisions. The following assumptions, limitations, and delimitations set the parameters of this study (Simon, 2011). Recognizing these inherent characteristics of scholarly research allowed me to adjust for these shortcomings.

Assumptions

Assumptions are things considered true and basic to the study (Simon, 2011). The first assumption central to this study was that the organization targeted for this case study would be as forthcoming as promised in sharing their process for collecting costing information. To encourage open cooperation throughout the interview process, the identities of both the organization and the interviewees remains confidential. A second assumption was that the interview questions, designed to maintain focus on the TCO cost collection method, would garner responses with detailed information as to how individual corporations use TCO. A third assumption was that the use of a case study method would result in the opportunity to study this business problem first hand, creating greater breadth and depth in documenting the application of the TCO costing method.

Limitations

Limitations of a study are conceivable weaknesses that are out of the researcher's control (Simon, 2011). A limitation of this study was the single case study design. This study focused on the implementation of an internal process within a company, and internal processes and operations differ from company to company. If the subject of the study were not representative or typical of the larger population, the results would not be

transferable to the broader population (Yin, 2014). To mitigate this limitation, I selected a large company that uses a classic approach to implementing TCO.

Delimitations

Delimitations are design parameters defining the scope of the study and within control of the researcher (Simon, 2011). The delimitations of this study were the sample and methods for gathering data. The intended subjects for this single case study were purchasing practitioners at a large company in northeast Ohio. Application of costing models may vary from company to company; as such, these practitioners delimited the study. An upper level manager participated in a semistructured interview. A semistructured format allowed me to ask follow-up questions achieving greater depth of data gathering. In addition, a focus group of mid-level managers, facilitated to allow free flowing brainstorming, elicited information beyond my initial expectations. Use of more than one data source delimited the study.

Significance of the Study

Ineffective procurement decisions can negatively affect the productivity and profitability of a company. A tool for evaluating the cost of doing business with a supplier can result in optimal procurement decisions. In this study, I explored how large companies use cost models such as TCO when making purchasing decision. SMEs could benefit from understanding how companies use TCO in supplier selection to improve productivity and the profitability of their organizational supply chains.

Contribution to Business Practice

Organizational procurement professionals are the ultimate authority for controlling the majority of the organization's expenditures. Vanteddu, Chinnam, and Gushikin (2011, p. 204) reported purchase items accounted for more than 60% of the average total costs for manufacturing firms, far outweighing internal production costs. Horn et al. (2013) inferred automotive companies outsource 75% of the bill of materials required to produce a vehicle (p. 31). Clearly, procurement cost reductions can dramatically affect the bottom line.

However, literature affirmed consideration of unit price alone often drove supplier selection (Ellram & Siferd, 1998; Zachariassen & Arlbjørn, 2011). Unit price often includes less than 40% of the TCO (Ellram, 1993, p. 6; Schneider, Bremen, Schönsleben, & Alard, 2013, p. 245). Consequently, decisions made with unreliable cost information can cause irreparable harm to the company (Ellram & Siferd, 1998; L. M. Ellram, personal communication, September 25, 2014). Hidden costs omitted in buying decisions can negate gains from lower unit prices (Weber et al., 2010).

Literature from the field expounds on costing models designed to capture all costs. Concepts include life cycle costing, zero-base pricing, all-in costs, and the cost-ratio method (Ellram & Siferd, 1998; Zachariassen & Arlbjørn, 2011); all narrowly aligned with the TCO concept. However, TCO is often considered too complex or situation specific, with too few businesses using these methods (Zachariassen & Arlbjørn, 2011). Exploration and understanding of how large companies implement cost models

such as TCO when making purchasing decisions can benefit SMEs in supplier selection to improve productivity and the profitability within their organizations' supply chains.

Implications for Social Change

Procurement decisions can lead to significant investments and have far reaching effects. Practitioners' use of costing models could drive reassessment of true total costs that could result in reshoring procurement decisions. Researchers like Horn et al. (2013), credited current reshoring trends to reassessment of total costs resulting in the move of manufacturing of products back to America, as shown through case studies in low-wage countries. Increased manufacturing domestically could result in creating jobs in local communities.

A Review of the Professional and Academic Literature

This study explored how organizations successfully use a cost model such as TCO for supplier selection and purchasing decisions. The research question addressed asked what strategies senior level supply managers use to gather TCO when making purchasing decisions. An in-depth exploration of what strategies senior level supply chain managers use when applying cost models such as TCO could lead to increased knowledge for SMEs in supplier selection to improve productivity and the profitability within their organizations' supply chains (Yin, 2014).

Scholarly literature supports the need for a costing model when making procurement and supplier selection decisions. Though various cost models have surfaced over the last 2 decades, the TCO model is predominant in the academic literature. TCO provides exceptional benefits when successfully implemented, although the cost of

implementation can outweigh the value of the benefits (Ellram, 1995; L. M. Ellram, personal communication, September 25, 2014; Holweg et al., 2011; Morssinkhof, Wouters, & Warlop, 2011).

Ellram's (1995) seminal work discussed the importance of practitioners' expert judgment in TCO identification of the primary cost drivers. In case studies of three industrial firms, Degraeve, Labro, and Roodhooft (2005) echoed the uncertainty of identifying all required cost factors in TCO, labeling cost factors stochastic. Regardless, much of the research uncovered in this literature review addressed portrayals of a total cost approach to decision making. The gap in research on *what strategies* organizations effectively use to apply TCO and other costing models for making purchasing and supplier selection decisions poses a significant risk to firms' competitiveness, productivity, and profitability (Degraeve et al., 2005; Ellram & Siferd, 1998; L. M. Ellram, personal communication, September 25, 2014; Horn, Schiele, & Werner, 2013), particularly for SMEs.

The concept of TCO dates back to the mid-1900s. Researchers authored the bulk of literature detailing the concept and evolution of the TCO theory in the 1990s. Ellram (1993, 1995), Ellram and Siferd (1993, 1998), Degraeve and Roodhooft (1999), and Caniato, Ronchi, Luzzini, and Brivio (2014) are some of the lead researchers in this field of study. In the summer of 2014, I interviewed Lisa M. Ellram, Distinguished Professor of Distribution at Miami University of Ohio and leading contributor to TCO research (Caniato et al., 2014) to discuss the current use of costing models.

The databases used to support the literature review for this doctoral study yielded more than 200 articles with more than 85% coming from peer-reviewed sources. As many articles dated outside of the last 5 years, articles referenced for this study numbered 136. These articles reported on the development of TCO, the various approaches to costing models, and case studies documenting TCO applications. Other topics included the use of the ABC accounting system in support of TCO, the benefits and limitations of the TCO model, the detriments of not using a costing model for procurement and supplier selection decisions, and the lagging implementation of costing models such as TCO; as did textbooks included in the review. Table 1 presents a synopsis of the sources referenced in the literature review.

Table 1

Synopsis of Sources Referenced in the Literature Review

Reference Type	Total	Fewer than 5 years	Greater than 5 years
Research-based peer reviewed journals	103	89	14
Research-based nonpeer reviewed journals	6	6	0

Strategy for Literature Search

Primary sources providing information germane to the topic included refereed journal articles, relevant textbooks, dissertations, and professional websites. Electronic databases contained the majority of literature reviewed for this study. Databases used in accessing recent peer-reviewed articles included Business Source Complete/Premier,

ABI/INFORM Complete, ProQuest Central, ProQuest Dissertations and Theses, Emerald Management Journals, LexisNexis Academic, EBSCO, Academic Search Complete/Premier, SAGE Premier, OhioLINK Electronic Journal Center, and Google Scholar. The key words and phrases used in the database searches included *total cost of ownership, TCO, activity based costing, ABC, offshoring, reshoring, costing decision models, low cost countries, outsourcing, cost factors, cost drivers, purchasing types, ABC inventory analysis, production theory, structural equation modeling, confirmatory factor analysis, and baseline studies*. Institutional libraries accessed included Walden University, Kent State University, the Miami University of Ohio, and Cuyahoga Community College.

The material in this section contains a thorough examination of the current and seminal peer-reviewed literature that relates to the research topic including articles addressing the limitations, weaknesses, and potential for future research. Costing models and the TCO concept of supply chain management (SCM) are integral to this study. The literature review discusses the benefits, implementation, limitations of the TCO model, and studies done on other approaches to costing models. Discussion of outsourcing and offshoring decisions, as well as reshoring of products back to American manufacturing facilities, emphasizes the need for a costing model when making purchasing and supplier selection decisions.

Application to the Applied Business Problem

The purpose of this explorative single case study was to discover the strategies used by leaders of larger companies in apply costing models such as TCO. Research has

shown that better supplier choices and improved productivity result when businesses use costing models to identify all costs before selecting suppliers (Degraeve, Labro, & Roodhooft, 2000; Gass et al., 2014). Sharing the knowledge gained from this research study could create opportunities for SMEs, who struggle with TCO implementation, to effect better supplier selection decisions by using costing models (Östlund et al., 2011).

In a study analyzing operational and financial effects of cost-oriented sourcing from China, Horn et al. (2013) analyzed contractual data of real projects. A sample of 214 sourcing projects sent to China by a Western-European original equipment manufacturer (OEM) supplied the data (Horn et al., 2014). The researchers found less than 25% of the projects successful in terms of operational and financial performance. Though literature documents the benefits and implementation of TCO, it also details the complexity and limitations of the model. Studying how larger companies overcome the implementation issues could offer insight for smaller organizations to benefit from TCO as well.

Total Cost of Ownership (TCO)

At the heart of this study was the theory of TCO. TCO began with efforts to optimize the spending activities within a firm (Cavinato, 1992; Ellram, 1995). The objective was to capture all costs associated with a purchasing decision, to ensure the decision is an efficient use of company resources (Caniato et al., 2014; Cavinato, 1992; ; Ellram, 1993).

Historical perspective. Since the 20th century, researchers have pursued a method for causal allocation of costs of doing business with an individual supplier.

Ellram and Siferd (1993) surveyed 521 members of the National Association of Purchasing Managers, with 114 or 25% of those surveyed responding. The survey asked high-level purchasing directors, vice-presidents, and managers about their outlook on gathering total costs of purchases. Eighty-five percent of the participants indicated the real costs of purchases lost in traditional accounting systems that tracked direct costs rather than transaction or activity costs (Ellram & Siferd, 1993). Too often indirect costs became hidden costs, untraceable to a specific buy or supplier. Nonetheless, Schneider, Bremen, Schönsleben, and Alard (2013) defined through an empirical investigation based on the theory of transaction cost economics (TCE) that the identification of transaction costs was crucial. In a study identifying the use of TCO at a Belgian steel producer, Degraeve and Roodhooft (1999) presented a multiperiod, multisupplier mathematical optimization model based on TCO information for a specific product line. They discovered the existing traditional cost management tools of the company were ineffectual for cost driver identification. Traditional accounting systems in place at most companies made it difficult for buyers to access costing information needed in sourcing decisions (Degraeve et al., 2005).

A formal TCO approach, implying tracking all costs associated with the acquisition, use, and postuse of the product, surfaced in the 1980s (Ellram & Siferd, 1993; Gass et al., 2014). Based on case studies of 11 organizations that were using formalized TCO approaches in supplier selection, Ellram (1995) developed an activity flow chart grouping costs into the above three categories. Acquisition (preownership) costs include costs related to activities identifying a need and selecting a source (Burt,

Petcavage, & Pinkerton, 2010). These costs involve design costs, supplier evaluation expenses, supplier visits, prototypes, sampling costs, planning, and financing costs (Burt, Petcavage, & Pinkerton, 2012). Use (ownership) costs consist of unit price, transportation, tariffs, inspection, quality, cycle time, conversion, and costs associated with consumption of the product (Burt et al., 2012). Postuse (postownership) costs entail field quality problems, repair costs, environmental costs, warranty, product liability, and disposal costs (Burt et al., 2012). All costs affect a firm's profitability performance (Agus & Hajinoor, 2012; Caniato et al., 2014; Degraeve et al., 2005). As these costs can be as high as 80% of the total production costs in some industries, it is imperative companies track and control this large cost pool (Zachariassen & Arlbjørn, 2011, p. 450).

In early works, Ellram (1993) conducted studies from an academic perspective and posited TCO as a philosophy as much as a tool, aimed at collecting the real cost of a supply relationship. Beyond the initial price, researchers sought the total cost of the buying decision, including the cost of doing business with a specific supplier. Degraeve et al. (2000) conducted a study at a Belgian ball bearing company combining a total cost approach with ABC accounting and mathematical programming. Using a management information system (MIS) programmed in LINGO to consider simultaneously supplier selection and the inventory management decision over several time-periods, the researchers were able to consider the entire value chain during an entire life cycle of an item, capturing the cost of doing business with specific suppliers. Through this research, they determined that other costs could often outweigh unit price significantly. These other costs included quality rework costs, line interruptions, paperwork, and other

administrative costs. Sonmez and Moorhouse (2010) supported this approach for service buys as well, with quantitative survey results from 309 global development managers suggesting the unit price to be the least important criterion for professional services at times.

The following scholars proposed various methods to capture total costs. In a study of 11 organizations actively using TCO, Ellram (1995) identified the dollar-based and value-based approaches, differentiating between standard and unique TCO models. Dollar-based models calculate TCO as the sum of the costs of quality, technology, logistics, and such. Value-based TCO models track the above costs as well as some nonmonetary measures (Caniato et al., 2014; Ellram, 1995). In an explorative single case study involving a large industrial Danish manufacturer, Zachariassen and Arlbjörn (2011) conducted interviews with relevant representatives of both the buying firm and its supplying firms. The focus of their research was on indirect and life cycle costing in identifying cost drivers of capital goods buys before making decisions. Discussion of data from this single case study revealed that situational factors contribute to the application of TCO in different contexts. However, as this study was a single case study, findings were not capable of computing regularities of occurrence for transferability of results.

Users of life cycle costing utilize Ellram's (1995) activity flow chart, grouping costs into the three categories of pretransaction, transaction, and posttransaction (Caniato et al., 2014). Zero-base pricing required a close supplier relationship to understand the supplier pricing structures (Burt et al., 2012; Ellram & Siferd, 1998). Zero-base pricing built a price from the cost up rather than negotiating from the price down. All-in cost,

similar to TCO, considered all monetary rather than value-based costs (Burt et al., 2012). The cost-ratio method evaluated the standard cost of the part and any additional costs incurred in using a specific supplier. Converted into a *cost ratio*, these costs express the additional cost as a percentage of the buying firm's total dollar cost from that supplier (Burt et al., 2012). A common denominator of all cost methods is the recognition that the purchase price of an item is only one, and often a minimal component of the TCO.

Holweg et al. (2011) reporting a gap in the existing cost models for conducting a holistic cost and risk assessment when outsourcing and offshoring purchasing decisions, developed a framework for the financial assessment of global sourcing. The researchers empirically tested this framework applying it to three case studies and reported the need for a model as global sourcing ventures sometimes fail to produce expected benefits due to unforeseen costs. Degraeve et al. (2005) agreed and stated the success of TCO implementation was case-by-case and done generally at large organizations. Ellram and Maltz (1995), in an article reporting the results of a case study done at a major industrial and consumer goods manufacturer, reported use of TCO analysis as limited due to the amount of work and resources required to conduct a thorough analysis. Caniato et al. (2014) later reported wide spread use of the TCO concept within the supply chains of the companies they studied in the tinting industry worldwide. In their study, Caniato et al. drew on contributions made to TCO theory building during the previous 15 years to develop a detailed TCO model, which they tested with live data from one of the largest manufacturers worldwide of colourant dispensing machines. Following costs down the

supply chain, the researchers gathered cost data at various points of sale. The analyses involved five case studies within the tinting supply chain.

TCO theory evolved to include goods and services transactions (Caniato et al., 2014; Walterbusch, Martens, & Teuteberg, 2013). However, researchers like Pettersson and Segerstedt (2013), who measured supply chain costs from 30 companies across 10 business sectors of Swedish manufacturing, identified conventional transaction cost accounting practices as a barrier to TCO applications. Case studies done by Ellram and Siferd (1998) and Degraeve, Labro, and Roodhooft (2000) identified activity-based costing (ABC) accounting as a solid foundation for the TCO method. ABC accounting captured procurement costs by activities performed, as well as transactions conducted in the buying process (Pettersson & Segerstedt, 2013); measuring time costs against the benefits of finished-goods inventory. When paired with ABC accounting, TCO provided a more accurate delineation of activities and use of resources. Degraeve et al. (2000) developed a costing model that supported the TCO concept with ABC accounting cost data, which they tested at Cockerill Sambre, a manufacturer of ball bearings. Using a similar model and building on the Cockerill Sambre study, Degraeve et al. (2005) advanced the TCO model sustained by an enterprise resource planning system (ERP) such as Oracle, ABC accounting, and mathematical programming calculating product life costs. An MIS programmed in LINGO concurrently considered supplier selection and inventory management decisions over several operating cycles. Degraeve et al. examined three product lines encompassing over 2000 different component types purchased from 90 different suppliers. Using this model, Degraeve et al. (2005, p. 55) reported savings of

10% for two of the three product groups at the Belgian ball bearing plant. Degraeve et al. (2005) stated in this study, the benefits of TCO adoption outweighed the implementation cost of the process. However, the researchers acknowledged the high cost of developing, installing, and maintaining such a system for the long term (Degraeve et al., 2005).

Works such as Bode, Wagner, Petersen, and Ellram's (2011) study of 3,945 firms in Germany, Austria, and Switzerland examining the correlation of 12 variables relating to supply chain disruptions, and Dogan and Aydin's (2011) use of Bayesian networks in a study of tier-1 suppliers in the automotive industry expanded the TCO focus. Such works took TCO beyond an intra-firm analysis to an inter-firm analysis; focusing on external supply chain cost analysis to capture total costs throughout the expanse of the supply chain. Cavinato (1992) termed it holistic supply chain costing; arguing that information increased supply chain competitiveness, cost advantages, and product innovation as each company throughout the supply chain benefitted (Vanteddu et al., 2011). Based on interviews involving 274 firms over a period of six years, Cavinato identified 18 factors inspiring the customers' *perceived value*, expanding the TCO concept to the end customer. Jitpaiboon, Dobrzykowski, Ragu-Nathan, and Vonderembse (2013) agreed, stressing the value of conjoint research and development, and collaborative efforts in managing inventory and costs across all companies within the chain. Based on the logical structure of international business (IB) theory, Casson and Wadeson (2012) developed a model to consider country of origin and countries of suppliers' location throughout the entire supply chain. Lorentz, Töyli, Solakivi, and Ojala (2014) argued the importance of a strong managerial decision-making process to support successful supply chain

functioning. They supported this argument with empirical data collected as part of the Finland State of Logistics 2010 survey.

Pettersson and Segerstedt (2013) concurred, adding that supply chain cost (SCC) reduction lead to competitive advantage for all links in the chain; their conclusions resulting from a study involving 30 companies representing 10 different business sectors comparing cost collection methods to a preconceived model for measuring SCC. Hilmola and Lorentz's (2012) research triangulated supply chain administration costs across all companies within the chain, through a mixed-methods approach that tested a model of a Bayesian robot decision-maker assessed by means of a case study. The use of mixed methodology allowed for testing several propositions about the nature and determinants of decision-maker confidence in relation to supply chain disruptions from trade and transport facilitation. As supply managers follow a strategy of globalization, the measurement of supply chain performance becomes critical (Arlbjørn & Lüthje, 2012; Casson, 2013). Extended supply chains can affect supply chain performance. Long distances can result in longer lead times, increased levels of inventory, lengthier cycle times, reduced quality of product, and greater logistics costs (Arlbjørn & Lüthje, 2012; Caniato et al., 2014; Ellram, 2013). Leaders of companies cannot ignore these increased costs and maintain competitiveness and profitability.

Purchased goods now account for a substantial portion of companies' total costs, 75% in steel, and 90% in petrochemical companies (Vanteddu et al., 2011, p. 204). Supplier selection, based often on price and direct costs, is a key component affecting a company's competitiveness. Addressing the far-reaching ramifications of TCO on supply

chain configurations, Vanteddu et al. (2011) developed a model considering inventory costs and supply chain cycle time reduction costs. Inventory related costs and responsiveness related costs were the main variables studied in the model. A dimensionless parameter identified as the coefficient of inverse responsiveness (CIR) improved the scalability and simplified the analysis and interpretation of results. The researcher used the model to test systems of two suppliers of an OEM in Detroit, a local supplier in Flint, MI and a remote supplier in Mexico. In this particular study, the researchers reported lower costs from the remote supplier because of lower manufacturing costs at downstream stages of the supply chain. Effective supply management offers a competitive advantage for industrial organizations as supply chains now compete against supply chains in contrast to individual companies competing against each other (Arlbjørn, de Haas, & Munksgaard, 2011).

Benefits of TCO. In most firms, the cost of purchased goods and services substantially surpasses the internal manufacturing costs. Vanteddu et al. (2011, p. 204) reported that goods and services accounted for more than 60%, while Zachariassen and Arlbjørn (2011, p. 450) estimated expenditures as high as 80% of total production costs. Consequently, a key performance indicator (KPI) for supply chain management is low total costs (Ellram, 1995; Israelsen & Jørgensen, 2011). As a result, scholars supported a need for a costing method such as TCO resulting in optimum purchasing decisions and effective supplier selection (Ekici, 2013; Morssinkhof et al., 2011). Case studies documented substantial gains in productivity and profitability resulting from new cost information introduced in the purchasing decision-making process (Degraeve et al., 2005;

Salawu & Ayoola, 2012). Degraeve et al. (2005) documented an application of TCO achieving a 10% cost savings over traditional procurement strategy, when researching procurement practices through a case study done at a European multinational steel company (p. 55).

The TCO approach brings the total cost of an item into view supporting improved purchasing and supplier selection decisions (Eckhaus, Kogan, & Perlman, 2013; Ekici, 2013; Ellram, 2013). Implementation of TCO provides important data for analyzing, negotiating, and reducing the total cost of the product thereby improving productivity and profitability (Degraeve et al., 2005). Ellram (1993) conducted an in depth study on nine firms utilizing TCO to define the concept and benefits. In eight of the nine firms studied, the participating organizations introduced TCO through a pilot study, starting with a small controlled group of items. Ellram followed the firms through full implementation. Results of the study included identification of five categories of TCO advantages: “supplier performance measurement improvement, decision-making (TCO forces consideration of trade-offs), communication, comprehension, and continuous improvement” (Caniato et al., 2014, p. 2; Ellram, 1993). Ultimately, TCO focuses on long-term cost management efforts serving as a calculated procurement strategy; in short, it is a strategy for improving a company’s competitive position (Dogan & Aydin, 2011).

Implementation concerns of TCO. Despite its likely benefits, three decades of research yields limited empirical evidence of TCO implementation. Simplistic in theory, early researchers recognized the difficulty and complexity of implementing a TCO method for purchasing and supplier selection decisions (Degraeve et al., 2000; Ellram &

Siferd, 1998). Though Degraeve et al. (2005) argued the benefits outweighed costs; even these researchers admitted TCO required an extensive management accounting system to capture the relevant costs of purchasing activities. Degraeve et al. recommended an ABC accounting approach, an enterprise resource planning (ERP) system such as SAP or Oracle, and mathematical programming interlinked to capture total costs effectively, characteristic of the TCO supplier selection methodology they constructed from live case studies of three industrial components groups in a ball-bearing firm. Such systems incur high capital costs to develop, install, and maintain (Degraeve et al., 2005).

Revisiting Ellram's (1995) study of 11 leaders of organizations using TCO, Ellram and Siferd (1998) identified and summarized the challenges and barriers to TCO implementation in three categories. Issues related to proper use and relevance resulted in time-consuming development trends of TCO models. Secondly, norms within the organizational culture could derail TCO implementation. TCO could require changes in systems, job definitions, accountability, and other disruptions that could foster internal resistance, even at the highest levels within the organization (Ellram & Maltz, 1995; Ellram & Siferd, 1998). The greatest issue was the availability of the costing data needed to make TCO supported decisions. In early research, Ellram found no organization that had systems in place to provide data in the format needed to execute TCO analysis. Later studies by researchers such as Degraeve et al. (2005) identified adequate systems. However, systems such as ABC accounting and ERP systems could be very costly to implement. After conducting exploratory case studies of 11 organizations focusing on

developing a qualitative, in-depth understanding of TCO practices, Ellram and Siferd cautioned of potential costs of TCO development exceeding benefits of the approach.

Lagging implementation of ABC accounting. Another barrier to TCO implementation is the lagging acceptance within the accounting community of ABC accounting system (Askarany & Yazdifar, 2012; Chiarini, 2012; Li, Sawhney, Arendt, & Ramasamy, 2012). Accountants developed ABC costing concepts in the US manufacturing sector in the 1980s. The system addressed the limits of traditional costing systems in providing relevant, timely, and accurate information for effective management decisions (Li et al., 2012; Salawu & Ayoola, 2012). Businesses gather data relating to operating costs through use of an ABC accounting system. Managers assign costs to functional processes such as marketing, quality, or operations and determine the cost driver for the activity (Chiarini, 2012). Managers then determine which product or service initiated the activity associated with the cost. As a result, companies can understand which product and service adds to profitability and contributes to loss (Chiarini, 2012).

Jänkälä and Silvola's (2012) quantitative study on the effects of the use of ABC on the financial performance of small firms showed greater efficiencies in use of resources, attaining better cost efficiency, competitiveness, and improved performance overall. The researchers developed a path model illustrating the hypothesized relationships between the past financial performance of 154 small firms, the use of ABC, and the subsequent financial performance. Structural equation modeling tested the data collected by surveys and archival data. Results of this study supported benefits of use of

ABC in improving financial resources. However, the researchers learned small firms willing to adopt ABC accounting had solid, past profitability with resources able to finance a change in accounting systems.

ABC data allows a leader of a firm to optimize supplier selection decisions when used in tandem with TCO (Degraeve et al., 2005; Schulze, Seuring, & Ewering, 2012). TCO data needs to be specific at a very detailed level and is often very hard to gather (Caniato et al., 2014; Carbone, 2004). Activity based cost drivers interpret intra-firm, non-financial activities as cost information assigned to particular products allowing for the collection of total costs (Degraeve et al., 2005; Schulze et al., 2012). Practitioners must account for each activity appropriately to exploit supply chain effectiveness (Casson, 2013). ABC accounting shows what drives costs and where improvement in cost performance will significantly affect business performance (Askarany & Yazdifar, 2012; Tsai et al., 2014). This accounting approach can also connect costs to individual purchases and suppliers, allowing for a KPI of supplier performance measurements (Carbone, 2004; Israelsen & Jørgensen, 2011).

Studies showed (Caniato et al., 2014; Degraeve et al., 2005; Ellram, 2013) the TCO costing method sustained by ABC accounting lowered total costs. In a case study involving management accountants at 40 manufacturing companies in Nigeria, Salawu, and Ayoola (2012) used descriptive statistics to analyze data acquired through questionnaires and discovered that companies were unwilling to accept inaccurate cost data and inappropriate allocation of overhead costs from traditional cost systems. These companies studied were eager to adopted ABC (Salawu & Ayoola, 2012). However, in

general, corporate adoption of ABC accounting, congruent to adoption of the TCO method, lags behind most traditional accounting techniques (Askarany & Yazdifar, 2012; Salawu & Ayoola, 2012). Companies in Nigeria not adopting ABC cited the high cost and complex implementation processes as reasons for maintaining traditional costing systems (Salawu & Ayoola, 2012).

Using hierarchical regression analyses on data gathered from 518 accounting managers of U.S. manufacturing plants (evenly distributed between those using ABC accounting and volume based costing), Maiga, Nilsson, and Jacobs (2013) reported inconsistent positive impact of ABC accounting on organizational and financial performance. Furthermore, in a quantitative study using a questionnaire to query 2000 Chartered Institute of Management Accounts members in Australia and New Zealand, Askarany and Yazdifar's (2012) findings suggested an association between the reported adoption rates for ABC accounting and the diffusion process approaches used to measure the adoption rates. Follow-up interviews revealed potential mixed adoption reports resulting from misunderstandings of both the practice and process of ABC. Using the conceptual framework of the diffusion theory, Askarany and Yazdifar discovered that the perception and understanding of the ABC concept varied among organizations, as did the success rate of implementation. The data suggested that lack of a common understanding of the ABC accounting system accounted for the differences in implementation as well as perception of its success. Nonetheless, information garnered from the ABC approach was more effective for costing decisions than that gained from traditional approaches to costing (Askarany & Yazdifar, 2012).

Schulze, Seuring, and Ewering (2012) advocated for the shift by companies to an activity-based cost accounting tool, characterizing the traditional intra-firm system as ineffective in tracking TCO through the entire supply chain. Traditional accounting tools prohibit the exchange and comparison of cost data among the various members of the supply chain. To support their claim, Schulze et al. conducted a single case study at a large European company to study a conceptual framework for introducing ABC accounting throughout the supply chain. The results of the study showed that an ABC costing tool implemented across the supply chain could support effective supply chain decisions. In addition, the researchers identified significant inter-firm cost savings (Schulze et al., 2012).

Reshoring of Products to American Facilities

Managing an increasingly global supply chain is more difficult and costly than initially expected (Ellram, 2013; Horn et al., 2013; Larsen, Manning, & Pedersen, 2013). Supplier selection and cost comparisons become difficult, yet increasingly significant when sourcing internationally. Horn et al. (2013) conducted case studies highlighting errant offshore projects where costs exceeded expectations and benefits. Longer supply pipelines, lower quality, on time delivery, decreased reliability, and ineffective service can offset low unit purchase prices (Degraeve et al., 2005; Denning, 2013; Horn et al., 2013). Negotiating and contracting in a foreign language, qualifying foreign suppliers, and travel and transportation can create extensive additional costs to procuring products and services (Horn et al., 2013; Weber et al., 2010). Furthermore, inherent to global procurement activity is the increased risks; with farther distance comes increased risks of

supply chain interruptions, longer lead-times, potential increases in labor costs, volatile fuel costs for transportation and the need to carry more inventory (Ellram, 2013; Holweg et al., 2011; Kam, Chen, Wilding, 2011).

Unexpected (hidden) costs of implementing offshore decisions surprise supply managers who fail to estimate properly the costs of offshoring (Holweg et al., 2011; Horn et al., 2013; Larsen et al., 2013). Recent trends in moving manufacturing back to America (Arlbjørn & Mikkelsen, 2014; Ellram, 2013; Kazmer, 2014) provide a strong argument for the use of a cost model such as TCO in procurement, manufacturing, and supplier selection decisions. Gray, Skowronski, Esenduran, and Rungtusanatham (2013) described reshoring “as a reversion of a prior offshoring decision” (p. 27). Horn et al. (2013) reported businesses underestimate the costs of participating in international business, citing case studies where failed projects resulted in costly replacement buys. Schneider et al. (2013) supported this supposition reporting the costs of unexpected activities ranked among the top reasons for the reshoring of manufacturing and product sourcing. With many costs unanticipated, 47.20% of international projects fail in terms of operational performance resulting in costly replacements back in the domestic market (Horn et al., 2013, p. 32).

Outsourcing/offshoring. Outsourcing and offshoring practices started in the 1960s (Lewin & Volberda, 2011). These practices continue to be major strategies for achieving sustainable competitive advantages (Ellram & Maltz, 1995; Kumar et al., 2010). Businesses seeking high efficiencies on low value-added activities pursue low cost production locations (Lewin & Volberda, 2011; McIvor, 2013; Mihalache, Jansen, Van

Den Bosch, Volberda, 2012). Manufacturers in high labor cost countries gravitate to lower labor markets, frequently overseas (Kitcher, McCarthy, Turner, & Ridgway, 2013). Often the result is fragmented production systems and complex supply chains (Christopher, Mena, Khan, & Yurt, 2011; Rodrigue, 2012).

Outsourcing (previously referred to as a make/buy decision), uses external organizations to complete tasks a business no longer desires to complete internally (Brewer, Ashenbaum, Carter, 2013; Kitcher et al., 2013). Companies centering on core competencies see outsourcing as a strategy to improve costs and competitiveness (Burt et al., 2012; McIvor, 2013). However, outsourcing comes with high risks and hidden costs if not carefully investigated (Holweg et al., 2011; Mihalache et al., 2012; Sinha, Akoorie, Ding, & Wu, 2011; Wakolbinger & Cruz, 2011). Researchers emphasize treating outsourcing as a strategic decision in order to achieve expected benefits (Dekkers, 2011; Rehme, Nordigården, Brege, & Chicksand, 2013; Vitasek & Manrodt, 2012); divergent from early frameworks, which addressed the make/buy decision tactically through a focus on cost as the key-deciding factor.

Maltz, Carter, and Maltz (2011) supported a strategic approach, identifying the fervor to outsource offshore as a *pervasive influence* on purchasing and corporate strategy (p. 797). Horn et al. (2013) agreed with the implication that psychological expectation and pressure drove many offshoring choices, citing instances evidenced in case studies of purchases outsourced to lower wage countries in Asia that were unsuccessful. Gray et al. (2013), Horn et al. (2011), and Lewin and Volberda (2011) referred to this as the *bandwagon effect*. Wang, Singh, Samson, and Power (2011) referred to offshore

advantages as *perceived* (p.419). Often buying decisions failed to consider longer supply chains, requiring a more sophisticated approach to supplier selection; thus, falling short of the perceived benefits (Horn et al., 2013).

McIvor (2013) recommended adopting a supplier relationship strategy to manage the risks of outsourcing while leveraging supplier capabilities. In addition to cost efficiencies, firms sought quality of work, levels of education and talent, and opportunities for leveraging innovation and reaching new markets (Holweg et al., 2011; Lewin & Volberda, 2011; Vitasek & Manrodt, 2012). Kähkönen and Lintukangas (2012) reported a strong correlation between strategic supplier management, and competitive advantage and business performance. For instance, the offshoring of business services such as call centers could be very advantageous for organizations (Lewin & Volberda, 2011).

However, not all global sourcing endeavors are successful (Brewer, Wallin, Ashenbaum, 2014; Holweg et al., 2011; Schneider et al., 2013). Schneider et al. (2013) reported that a study of offshored projects from the German metal and electrical industry saw 16 – 25% reshored within four years for reasons including unexpected expenses (p. 243). Transaction costs resulting from unexpected coordination activities related to offshoring was one of the top reasons for reshoring (Dabhilkar, 2011; Schneider et al., 2013). Few cost models calculated the wide-ranging risk or captured the dynamic nature of cost drivers such as energy, transportation, labor inflation, or carbon-offset costs (Holweg et al., 2011; Horn et al., 2013).

Reshoring. Changes in the business environment have buyers revisiting offshoring decisions (Fratocchi, Di Mauro, Barbieri, & Nassimbeni, Zanoni, 2014; Zhang & Huang, 2012). The market conditions are changing as labor and production costs in coastal China rise (Ellram, 2013; Zhang & Huang, 2012). A historic rise in oil prices is mitigating gains from lower labor rates; which are also on the rise (Holweg et al., 2011; Horn et al., 2013). Increasing considerations for wealth and welfare are closing the wage gap between the west and the east, as countries like China seek to raise the standards of living for their citizens (Arlbjørn, & Mikkelsen, 2014; Kinkel, 2014; Pearce, 2014). Additionally, favorable factor costs such as low labor rates do not intrinsically result in lower sourcing costs (Casson, 2013; Horn et al., 2013). This is evident in the recent reshoring trends documented in the current literature (Ellram, 2013; Holweg et al., 2011; Horn et al., 2013).

Market conditions are changing and recent research shows that 38% of firms think that a direct competitor has reshored; 14% reported plans to reshore (Gray et al., 2013, p. 27). Gray et al. (2013, p. 27) reported a \$1 billion outlay by General Electric to bring appliance manufacturing back to America from China. A Boston Consulting Group study (as cited in Gray et al., 2013) published a list of companies reshoring that included NCR, Coleman, Ford, Sleek Audio, Peerless, and Outdoor Greatroom Company.

Gray et al. (2013) agreed changes with outside cost drivers contributed to reshoring. Rising cost of fuel associated with transportation costs, rising cost of labor, and increasing production costs in low cost countries are changing the perception of offshore benefits (Ellram, 2013; Gray et al., 2013). Shipping by sea incurs a minimum

cost of \$2600 and a four to six week lead-time (Kumar et al., 2010, p. 1876). Moreover, inventory in transit accrues additional carrying costs. Kumar, Zampogna, and Nansen (2010) estimated shipping and inventory carrying costs added 17% to cost (p. 1876).

Reshoring resulted from purchasing practitioners' reassessments of true total cost of offshoring (Gray et al., 2013; Lorentz et al., 2014; Schiele et al., 2011). Anecdotal evidence showed purchasing decisions based on quoted unit prices with little consideration of the risks or hidden costs of buying offshore (Gray et al., 2013; Horn et al., 2013; Wakolbinger & Cruz, 2011). Weber, Hiete, Lauer, and Rentz (2010) agreed stating purchase price benefits are lost to hidden costs. Hidden costs include extended supply lines, rising cost of fuel, rising cost of labor, currency volatility, theft of intellectual property, logistics issues, and longer lead times. These costs incur on an irregular basis making them difficult to predict (Handley, 2012; Handley & Benton, 2013; Holweg et al., 2011). Documented as general overhead, hidden costs are lost to the actual price paid for a particular buy when tracked with traditional accounting practices. As a result, they are lost to specific suppliers as well.

These oversights result from the difficulty of calculating the total costs associated with offshore outsourcing; leading to detrimental underestimation of TCO (Holweg et al., 2011; Horn et al., 2013; Johnson et al., 2013). The implication of reshoring is ineffective decisions made to offshore (Ellram, 2013; Gray et al., 2013; Horn et al., 2013). More than two decades ago, Ellram and Siferd (1993) emphasized the need for a model with available cost information to make decisions quickly and intelligently. The use of the TCO cost model results in better supplier choices and improved productivity as all cost is

identified prior to the purchasing and supplier selection decision (Caniato et al., 2014; Ellram & Siferd, 1998; Gass et al., 2014).

Further Studies on Costing Models

Literature contains results of many studies contributing to the development of costing models. Zachariassen and Arlbjørn (2011) reported 23 papers dealing with costing models, identified through a literature review. Of the 23 papers, seven had a theoretical focus (McConnell et al., 2012). Using a case study design, these papers all explored differing facets of TCO (Crowe et al., 2011). Over the last 25 years, the TCO model has dominated the literature on costing models. Differing definitions of TCO appear in existing literature. Ellram (1993) defined TCO as a philosophy for developing an understanding of the true cost of doing business with a supplier. Degraeve and Roodhooft (1999) described TCO as the quantification of all costs related to a particular purchase, of a given quantity, from a specific supplier. In TCO related articles, TCO often focuses on the indirect procurement costs and the life-cycle costs incurred by transactions with various suppliers (Zachariassen & Arlbjørn, 2011). The focus on indirect procurement costs links the TCO model to the ABC accounting system. Inherent to ABC accounting is the premise that all costs are direct in relation to processes and activities, when calculating the cost of a good or service (Chiarini, 2012).

A substantial number of studies focused on the technical application of TCO. Studies benchmarked TCO both as a standard and as the foundation for further development of cost gathering methods (Caniato et al., 2014). The intent was twofold, to create an approach that both measured costs and evaluated suppliers. Ellram (1995)

developed taxonomy for classifying TCO models as standard or unique. Ellram and Maltz (1995) debated the difference between dollar-based and value-based TCO models. Similarly, Degraeve and Roodhooft (1999) developed a TCO model for evaluating suppliers. In a follow-up study, Degraeve et al. (2000) reported testing their model against other supplier selection models during a case study conducted at a Belgian steel producer.

Degraeve et al. (2000) reviewed the use of TCO by conducting a comparison of relative efficiency among various supplier selection decision models. The objective was to improve the firm's purchasing and supplier selection strategy throughout its life cycle (Caniato et al., 2014). In a case study design using real life data, these researchers compared mathematical programming models, linear weighting (rating) models, multiple item models, and single item models (Amerson, 2011). Mathematical programming models consider quantifiable criteria. Linear weighting models rate suppliers on several criteria combining the results into a single score. The two other models consider the issue on an item-by-item approach and a multiple item design (Degraeve et al., 2000). In this multiple path to supplier selection, Degraeve et al. analyzed which model led to the best decision regarding "what to buy from whom and when" (p. 35). Analysis methodology utilized an ABC accounting system to gather data and a mathematical programming model to simultaneously select suppliers and define order quantities (Anderson & Shattuck, 2012). With the help of a decision support system (DSS), the researchers determined from a TCO perspective mathematical programming outperformed linear weighting models. In addition, multiple item models produced better results than single

item models. Using ABC and a mathematical program to analyze the value chain, Degraeve et al. (2005) determined the activities and cost drivers in the value chain, thereby identifying the optimum sourcing and supplier selection strategy.

In an earlier study, Degraeve and Roodhooft (1999) identified a hierarchical structure in activities categorizing purchasing issues. These levels described costs incurring at the supplier level, the order level, and the unit level. In this study, the researchers exposed costs such as quality audit costs, expediting costs, inventory costs, invoicing costs, receiving costs; costs previously hidden and not considered in the TCO. The researchers attributed this discovery to information retrieved from an ABC accounting system that captured relevant costs of activities by specific supplier and the item purchased rather than tracking transaction costs, which is the basis for traditional accounting methods (Askarany & Yazdifar, 2012; Degraeve & Roodhooft, 1999; Schulze et al., 2012).

Some researchers proposed different approaches to gathering costs such as the zero base-pricing model developed at Polaroid (Ellram & Siferd, 1993). Zero base pricing considers the purchase price and the in-house costs. In-house costs include expenses incurred from using the seller's product. Customer returns, lost sales, scrap, rework, transportation, storage, and inspection are examples of in-house costs. Zero base pricing considers the buying firm's product design and manufacturing process as well as that of the supplier's. The goal is to reduce the TCO by scrutinizing all costs over the life of the product. Where TCO focuses on understanding and tracking costs, zero base pricing is

inherently proactive. Buyers work with the suppliers to reduce and manage TCO (Ellram & Siferd, 1993).

Wouters, Anderson, and Wynstra (2005) investigated the adoption of TCO as a means of improving sourcing decisions. These researchers saw TCO as an application of ABC accounting. Like Degraeve et al. (2005), they alleged successful TCO implementation required ABC accounting to gain access to the costing data. Together, TCO and ABC measure costs concerned with the purchase and use of supplies and services (Dogan & Aydin, 2011). The result is a more value-oriented focus within the purchasing function.

Using a structural equation model (SEM) for analysis, Wouters et al. (2005) developed a model to explain the relationships among eight constructs hypothesized to explain TCO adoption (Bagozzi & Yi, 2012; Bollen, 2012; Tabachnick & Fidell, 2013). Designed to consider effectiveness of TCO, these constructs included “competitive pressure in customer markets, strategic purchasing orientation, top management support, functional management commitment, value analysis experience, adequacy of TCO information, success of TCO initiatives, and use of TCO-based review and reward systems” (Wouters, Anderson, & Wynstra, 2005, p.167). Wouters et al. (2005) measured a successful implementation on the perceived financial improvements and tangible results from data collected from the purchasing and maintenance departments. Baiman and Rajan (as cited in Wouters et al., 2005) definitively tied successful TCO to accessing internal as well as inter-organizational accounting information. Achievement of total cost reduction is contingent on supplier selection criteria reaching beyond purchase unit (cost)

price. As supplier selection is one of the most important functions in supply chain management, supply managers must consider the overall value improvement (Dogan & Aydin, 2011). Yet, Horn et al. (2013) demonstrated through case studies conducted in low-wage- countries that practitioners too often rely on unit price information rather than on TCO when making purchasing and supplier selection decisions. Consequently, Wouters et al. (2005) endeavored to investigate the successful implementation of a TCO model by isolating constructs that identified TCO as an extension of ABC accounting for sourcing and supplier selection decisions. Using an SEM analysis, the researchers tested the constructs and relationships amongst them that might explain successful TCO implementation (Bagozzi & Yi, 2012; Bollen, 2012; Tabachnick & Fidell, 2013). This study is one of a few studies using SEM to investigate the success of integrating the business models of TCO and ABC (Wouters et al., 2005).

Weber et al. (2010) conducted a study on the use of TCO when sourcing in low cost countries. Similar to Wouters et al. (2005), these researchers advanced TCO as an application of ABC accounting when measuring and analyzing the costs of international sourcing activities. Drawing on past literature, Weber et al. credited four previous TCO studies with having great influence over their work. Degraeve and Roodhooft's (1999) work proposed use of ABC accounting based TCO models for assessing probable suppliers. Degraeve et al. (2005) analyzed the different product groups for a European steel manufacturer using a TCO model to identify opportunities for improvement. Carbone (2004) described a TCO model applied to a commercial company in gathering costs, selecting suppliers and making purchasing decisions. Finally, Ellram (1995)

descriptively assessed the TCO models applied at 11 companies, comparing the discriminating aspects of each model.

Based on Ellram's (1995) seminal works, Weber et al. (2010) focused on both a monetary and value-based TCO approach. The monetary based TCO model uses actual cost data in figuring the cost elements of the TCO. This method gathers data from systems such as ABC accounting systems. Value-based TCO assigns costs to data gathered from non-monetary methods such as the scorecard technique. Therefore, cost collection was activity-based driven identifying relevant activities along the value chain (Weber et al., 2010).

Weber et al. (2010) declared monetary-based TCO models supported by activity-based data to be more transparent than value-based approaches. Moreover, a monetary-based TCO model eliminates risks of subjectivity that are intrinsic in value-based decisions. The researchers found this observation to be consistent with Ellram's 11 TCO models as well as those developed by Degraeve and Roodhooft (1999), Degraeve et al. (2005), and Carbone (2004).

In order to apply the ABC-based TCO model, Weber et al. (2010) conducted a case analysis at a healthcare equipment manufacturer in North America that sourced offshore in low cost countries. The model proved effective in determining the TCO of the component purchased parts. The analysis revealed the cost elements contributing to the purchase price, account for 57% of the TCO for components outsourced in lower cost countries (LCC); where the balance of the TCO consists of costs classified as "non-purchase price costs" (Weber et al., 2010, p. 11). Non-purchase price costs include risk,

product liability, increased inventory levels, quality issues, and such (Holweg et al., 2011; Horn et al., 2013).

In conducting this literature review, I realized that despite progress in the empirical evidence of implementation and use of TCO as presented in numerous studies, findings on TCO have yet to be organized into a consistent theoretical framework to guide the practitioner when making supplier selection and purchasing decisions. In general, there is a model. However, the ability to mold this theory into a concise application has eluded researchers, making it difficult for practitioners to use effectively a TCO model in practice.

Researchers such as Ellram (1995), Ellram and Siferd (1993), Degraeve et al. (2000), and Caniato et al. (2014) lauded the potential benefits of TCO. In addition, they discussed the technical issues, complexities, limitations, and costs of TCO. Though sporadic case studies focused on the adoption of TCO, empirical research on actual professional applications of TCO is sparse (Degraeve et al., 2005). Consequently, time and resources required to effectively gather all costs of ownership can reach a point of diminishing returns (McConnell et al., 2012).

TCO Limitations

An assumption often made in outsourcing and offshoring decisions is that the decision makers have the precise information required to make the decision (Rezaei & Salimi, 2013). Knowledge of costs throughout the supply chain serve as a key performance indicator yet, Pettersson and Segerstedt (2013) cited a study reporting 59% of companies surveyed were not aware of total supply chain costs (p.358). Conventional

accounting systems do not measure supply chain costs well (Pettersson & Segerstedt, 2013).

Moreover, too many variables exist in the chain of costs leading to TCO for its use as a first time supplier selection tool (L. M. Ellram, personal communication, September 25, 2014; A. Trethewey, personal communication, June 25, 2014). Lack of foresight hampers calculation of the wide-ranging risk or dynamic nature of cost drivers such as energy, transportation, labor inflation, or carbon-offset costs (Holweg et al., 2011). The available supply chain costs contain a mixture of standard costs, budgetary costs, and numbers available from a cost accounting system (Pettersson & Segerstedt, 2013). Often, the final cost of products is calculable only after all costs post to the ledger. This positions TCO as a tool better suited for historic analysis (L. M. Ellram, personal communication, September 25, 2014). The concept suggests a long-term perspective for accurate valuation of procurement.

The main disadvantage of TCO as a sourcing tool is the extensive system required to capture all costs relevant to each supplier (Ekici, 2013; Ellram & Siferd, 1998). Ellram (personal communication, September 25, 2014) and Trethewey (personal communication, June 25, 2014) both agreed the cost of gathering information hits a point of diminishing returns; cost gathering for supplier selection should be taken to a marginal drop off point. Trethewey pointed out the marginal cost exceeds the marginal benefits for practitioners when they reach the point where they feel it is no longer worth pursuing (McConnell et al., 2012).

As recent as April 2014, Caniato et al. (2014) described the use of TCO as a complex and delicate task. Supply chains are often global resulting in longer and more complex inter-firm connections (Caniato et al., 2014; Larsen et al., 2013). Managing extended supply lines requires a strategic management approach (Eckhaus et al., 2013). Consequently TCO is a more formidable tool for evaluating all companies involved in the overall supply chain.

In September 2014, L. M. Ellram (personal communication, September 25, 2014) stated practitioners do not have time to complete all activities required to achieve TCO. However, with high portions of reshoring resulting from inaccurate costing data, evidence abounds supporting the need for a costing tool such as the TCO model when making purchasing and supplier selection decisions (Arlbjørn & Lüthje, 2012; Arlbjørn & Mikkelsen, 2014; Ellram, 2013). Therefore, an exploratory single case study undertaken to understand better how companies use the TCO model will benefit companies such as SMEs who struggle with the process of collecting proper cost data before making purchasing and supplier selection decisions. Improved understanding of the TCO model could effect better buying decisions, reducing purchasing costs, improving productivity, and increasing corporate competitiveness within the supply chain (Pettersson & Segerstedt, 2013). Increased competitiveness could strengthen a company's bottom line allowing for stronger contributions to both local and national economies; including increased employment, local and national tax contributions, and funds for support of socially responsible actions.

Transition

Section 1 was an introduction to the study, overviewing the benefits of using a costing model such as TCO when making procurement and supplier selection decisions. Literature on studies of costing methods presented the benefits of capturing the TCO, forming the foundation for the study. With expenditures exceeding 60% of overall production costs, improved spending can translate into improved profitability and competitiveness. However, much of the literature reported many companies struggle when using a costing model such as TCO. Consequently, empirical evidence shows minimal use of a TCO model when selecting suppliers.

Key elements in this section included the problem statement, purpose statement, nature of the study, research question, conceptual framework, significance of the study, and a detailed review of the literature relating to the TCO costing model and its use in purchasing decisions. Section 2 presents the research and method design, including the population and sampling, data collection, data analysis and instrument, and reliability and validity. Section 3 of this study presents the doctoral study findings, including applications to professional practice, implications for social change, and recommendations for future study.

Section 2: The Project

In this portion of the study, I focused on a large manufacturing company in northeast Ohio that uses TCO when selecting suppliers and making purchasing decisions. This section clarifies the role of the researcher, participants, research method and design, population and sampling, ethical research, and data collection instruments and techniques. In addition, Section 2 contains a description of the data analysis techniques and information supporting the reliability and validity of this process.

Purpose Statement

The purpose of this qualitative, explorative single case study was to identify TCO strategies that senior level supply managers use to make purchasing decisions. The targeted participants were the senior level and mid-level supply chain managers from a large firm in northeast Ohio who uses costing model methods such as TCO in the supply management department. The process included a semistructured face-to-face interview with the senior level supply manager and a focus group session with four mid-level supply chain managers. The opportunity for constructive social change was in sharing the strategies for using costing models with other companies, such as SMEs, who struggle with TCO implementation and use. Sharing the results of this study with SMEs might increase profitability, resulting in successful businesses contributing to society through increased employment, tax contributions, and socially responsible actions. In addition, reassessment of true total costs could result in reshoring procurement decisions, bringing manufacturing of products back to domestic localities.

Role of the Researcher

The main role of a researcher is instituting methodological rigor (Gray, 2013; Hasson & Keeney, 2011; Klassen et al., 2012). In qualitative research, the researcher's role focuses on data collection, data organization, and analysis of the data (Collins & Cooper, 2014). I built rapport with and gained information regarding the use of TCO from participants through a semistructured face-to-face interview with a senior level manager and a round table focus group session with mid-level employees.

Personal experience, knowledge, and values can form bias in analyzing research data. As a past practitioner and current educator in the field of supply chain management, I am experienced with the topic of TCO. Marshall and Rossman (2016) suggested previous knowledge could be beneficial in understanding the viewpoint of the interviewee; though they cautioned awareness of personal views to avoid potential bias in interpreting data gathered. Harper and Cole (2012) suggested the use of member checking as a way to lessen this issue. Member checking is a quality control procedure for strengthening accuracy, credibility, and validity of the interview data (Harper & Cole, 2012). As such, I used member checking in my study.

For this single case study exploratory design, I served as the main instrument for data collection. My role was to certify the data collection process met the level of ethics and protocols put forth in the *Belmont Report*. In addition, it was necessary to ensure bias mitigation ensued throughout the data collection activities. Jacob and Furgerson (2012) indicated that use of an interview protocol provides a guide for an ethical and unbiased interview process. Based on the recommendation of Jacob and Furgerson, I used an

interview protocol. In addition, open-ended questions allowed for follow-up and explanation of responses for clarification when needed.

Participants

My overarching research question asked what strategies senior level supply managers used to gather TCO when making purchasing decisions. Participants in this study worked in supply management at a company that uses TCO in the purchasing decision making process and were willing to share their personal experience of the TCO process in their firm. Identifying parameters helped ensure the selection of participant alignment with the research question (Gerring, 2011; Gray, 2013; Yin, 2014). The senior level supply manager at a manufacturer in northeast Ohio offered to participate in this study. Jacob and Furgerson (2012) suggested skilled interviewing as one method of collecting rich and relevant data. Pezalla, Pettigrew, and Miller-Day (2012) reinforced the aspect of interviewer skills in an exploratory study of three different interviewers who were part of a qualitative research team. The research studied the effect the varying characteristics and styles of these three participants had on the breadth and depth of data collected. Frels and Onwuegbuzie (2013) identified interviewing as a primary method for data collection in qualitative studies and emphasized the importance of incorporating additional sources such as focus groups to support validity of data collected. Following the findings of these studies, I included a semistructured face-to-face interview with this senior level supply chain manager and a focus group session with four mid-level supply managers at the company. The executive consented to the allotted time required for the semistructured interview questions, as well as offering access to the appropriate mid-level

supply chain managers over the age of 18 currently working in the supply management department at the firm. The participants were not part of any protected groups.

To gain access to potential participants, I worked through the local affiliate Purchasing Management Association of Cleveland of the Institute for Supply Management (ISM). Being a large trade organization, many northeast Ohio businesses have membership with the ISM and PMAC. My contacts resulted from membership in these organizations, allowing me to attain the participation of the supply management employees of a large manufacturer for this study. As a frequent presenter of workshops and seminars for the local PMAC, many member of the association are familiar with me. I built on this familiarity to create a comfortable, safe environment in which the participants felt confident in sharing data. When sensing a comfortable and safe environment, participants are more likely to share their stories (Harper & Cole, 2012; Jacob & Furgerson, 2012; Yin, 2014).

Research Method and Design

Researchers use three distinct methods for conducting research: qualitative, quantitative, and mixed methods (Anderson & Shattuck, 2012). Case and Light (2011) made an argument for the value of all three, identifying the strengths and weaknesses of each method. After considering the focus of the study and the research question postulated, I chose a qualitative method with an explorative single case study design. An explorative case study method is a design that addresses the characteristics of a *how* or *what* research question, focusing on a contemporary event, with the lack of a behavioral characteristic (Case & Light, 2011; Gray, 2013; Klassen et al., 2012).

Method

This study used a qualitative method, which best supported the research question exploring what strategies senior level supply chain managers use to gather TCO when making purchasing decisions. Qualitative research allows the researcher to study implementation and execution of a complicated process (Crowe et al., 2011; Klassen et al., 2012; Yin, 2014). Application of TCO can be considerably complex. Furthermore, smaller sample sizes and personal participative interaction, indicative of qualitative studies, derive detailed information not gained from quantitative approaches (Borrego & Bernhard, 2011). Quantitative methodology effects rigor, while a qualitative approach results in greater richness and depth achieved through use of open-ended questions (Östlund, Kidd, Wengström, & Rowa-Dewar, 2011; Yilmaz, 2013). To achieve full understanding of the strategies used to apply TCO, breadth and depth of data collection was required in this study. Many quantitative research approaches test hypotheses and identify the statistical significance of the findings (Tacq, 2011). Tacq described quantitative research as a statistical method resulting in a numerical collection of data, limited in the ability to describe a phenomenon. Mixed method research combines the strengths of both the qualitative and quantitative methods (Klassen et al., 2012). However, as mixed methodology includes a quantitative aspect, the testing of preconceived hypotheses, the mixed methodology approach infringes on the researcher's ability to explore the topic with an open mind. Therefore, a qualitative approach best addressed the research question posed by me in this study.

Research Design

The research design best suited to address research questions of *how* and *why* is an exploratory single case study (Amerson, 2011; Cronin, 2014; Yin, 2014). Yin (2014) and Amerson (2011) endorsed the use of a case study research strategy for answering *how* and *why* questions regarding phenomena occurring in a real-life context. The researcher could use multiple data sources to investigate *everything* in the situation, identify causal links, and uncover a personal richness of individuals' experiences within a specific context (Amerson, 2011; Cronin, 2014; Yin, 2014). A case study research method allowed me the best way to answer the question of what strategies supply chain managers use to successfully apply cost models such as TCO when making sourcing decisions.

My initial considerations study design included ethnography and phenomenology; both having characteristics useful to this study. Ethnographic research focuses on patterns of action that are socio-cultural as opposed to cognitive (Wägar, 2012). Mini- and extended ethnographic studies offer insight into the cultural interactions between people in the workplace (Wägar, 2012). The focus of this study was on understanding the facts rather than the meaning behind the action. As the focus of this study was to determine the strategy rather than the application of the strategy, an ethnographic approach was not germane to this study. Phenomenological researchers identify the personal experiences of the participants (Gray, 2013). However, though personal application of TCO surfaced in the focus group session, the intent was to uncover the process, not the personal variances in its application. Use of methodological triangulation resulted in the opportunity to

identify common dynamics within the data, allowing for separation of facts from feelings. Heale and Forbes (2013) reported use of two or more rigorous methods in data collection results in a more complete representation of the results. A case study design uses triangulation in data collection focused on the process, not the participants, throughout the various data collection methods.

Case study research methodology provides for triangulation of the data, strengthening the validity of the results (Heale & Forbes, 2013; Marshall & Rossman, 2016; Yin, 2014). However, researchers differ on the benefits and implications of voluminous data collection. Recognizing the varying perspectives, O'Reilly and Parker (2013) conducted a study consisting of an in-depth review of 28 peer-reviewed articles published on saturation. Perceiving data saturation from the perspective of sampling size and transferability of results, O'Reilly and Parker looked to see how other researchers used data saturation as a method to indicate rigor and validity for varying qualitative approaches. Declaring saturation as marker for grounded theory, O'Reilly and Parker felt the adoption of saturation as a generic quality marker for *all* qualitative approaches inappropriate. In reporting results of their study, O'Reilly and Parker attempted to clarify thematic/data saturation (no new themes observed) versus theoretical saturation (used to develop an explanatory theory of a social phenomenon). Overall, the results of this research were inconclusive.

Walker (2012) posited the use of saturation as specific to methodology and context. Walker conducted a review encompassing 29 articles. Contrary to O'Reilly and Parker (2013), Walker declared saturation an effective tool for ensuring adequate and

quality data collected to support qualitative studies. Walker reported saturation in research exploring pure description of phenomena as reaching a level of repetitive information and a point of obtaining no new information. I achieved data saturation in this study at the point of finding repetition in the data as captured through NVivo. The main themes were clearly identified through the inputting data gained from an in-depth semistructured interview with a senior supply management employee, a focus group session with appropriate mid-level supply chain managers, and data gained from company documentation on the use of TCO. I further discuss the point of data saturation in Section 3.

Population and Sampling

This study specifically targeted a company using TCO. The study participants consisted of supply managers from a company employing TCO in their procurement decisions. Using purposive sampling, the researcher can identify and select participants knowledgeable about or experienced with the phenomenon (Durham, Tan & White, 2011; Gray, 2013; Palinkas et al., 2013). Therefore, through purposive sampling I located a company in northeast Ohio using TCO and willing to participate in this study. Purposive sampling is nonrandom in nature and results in willing and available participants who are able to communicate experiences and opinions (Palinkas et al., 2013).

Yin (2014) endorsed the sample size of a single-case study when the single case is representative of the phenomenon studied. Researchers select samples for qualitative inquiry to yield information rich data and achieve depth of understanding (Palinkas et al.,

2013). Consequently, sample sizes for qualitative research are smaller than those needed for quantitative inquiries, which seek breadth of understanding (Palinkas et al., 2013; Walker, 2012; Yin, 2014). O'Reilly and Parker (2013) defined the required sample size as that which is sufficient to answer the research question, measuring the depth rather than occurrences of the data. I used a single case study for this exploratory research.

Moreover, Walker (2012) advocated saturation drives the sample size and defined saturation as met at the point where data becomes redundant. Qualitative researchers mine various sources for data including participants, documents, observations, and secondary records (Walker, 2012; Yin, 2014). I used a methodological triangulation to converge the data. Through the process of triangulation and data convergence, saturation emerged. The researcher reaches data saturation when continued efforts generate nothing new or have no additional interpretive worth (Frels & Onwuegbuzie, 2013; O'Reilly & Parker, 2013). For reader satisfaction, the researcher must transparently report how and when the saturation point was reached (Denzin, 2012; Heale & Forbes, 2013; Yin, 2014). I address this in Section 3.

Ohio is home to a high number of large manufacturers like Ford Motor Co., Kraftmaid Cabinetry, Inc., Sherwin-Williams Co., Goodyear Tire & Rubber Co., Swagelok Co., General Motors Corp., Lubrizol Corp., Rockwell Automation, and UTC Aerospace Systems (Jobs Ohio, 2015) offering a diverse population for this study. Specifically targeting northeast Ohio companies using TCO, I located through the PMAC (Cleveland) affiliate of the ISM a company for this single case study. The first interview was with one senior management of the supply chain management at this large

manufacturing company. A round-table focus group with four mid-level supply managers followed, allowing for collaboration of information gathered from the first interview. A review of the documented TCO process verified evidence of the interview and focus group.

Critical to effective data collection is the setting. Researchers need to offer a comfortable, nonthreatening, and private environment when conducting interviews; participants are more likely to share personal experiences when they feel at ease (Frels & Onwuegbuzie, 2013; Jacob & Furgerson, 2012; Yin, 2014). I held interviews at the research site as it was most convenient to the participants and allowed for consideration of privacy (free from interruptions). The sessions required no more than a 60-minute period for the interviews and 2 hours for the focus group session. It was decided accessing a more relaxed setting such as a public library or restaurant would extend the time needed to collect data and would add no value to either the interview or the focus group session. I achieved information rich sessions providing a solid understanding of the company's use of TCO in sourcing decisions at the on-site location.

Ethical Research

To protect the participants in this study, I followed the guidelines of the Walden University Institutional Review Board (IRB approval # 10-14-15-0327439) in conducting the research for this study. To gain IRB approval to conduct this work, I sought permission from the business to conduct this study, expressed in a signed Letter of Cooperation. With permission of the company as well as the IRB, potential participants received a low-pressure email containing the consent form requesting their participation

in this study. Before the data collection session, participants renewed their consent to participate. Researchers' collections of documentations such as signed consent forms ensure a study meets published ethical guidelines (Festinger, Dugosh, Marlowe, & Clements, 2014; Lad & Dahl, 2014; U.S. Department of Health & Human Services, 1979). The consent form specifically asks participants to acknowledge the voluntary aspect of agreement to participate. In addition, the structure of the semistructured interview allowed for terminating participation any time during the process, reverberating the voluntary aspect of participation. Pollock (2012) advised participants be reminded of the ability to withdraw any time throughout the interviewing sessions.

The participants for this research study were purchasing agents and supply management personnel; all considered salaried employees at their organizations. I did not compensate participants for participation in the study other than providing food and beverages at the interview sessions. Sánchez-Fernández, Muñoz-Leiva, and Montoro-Ríos (2012) studied the impact of incentives on retention and response rates in Web-based surveys. Using an experimental design, the researchers evaluated the direct effects of personalizing invitations to studies, frequently reminding participants to complete surveys, and offering post incentives. Results showed none of these factors improved response rate or quality when used alone and personalization had a greater impact than the other two factors. Following the findings of Sánchez-Fernández, Muñoz-Leiva, and Montoro-Ríos, I did not compensate participants in this study.

Any information provided by participants was kept confidential. Unless necessary, researchers refrain from asking participants for personal or corporate

information not beneficial to the study (Steurer, 2011). De Vries et al. (2011) agreed, referencing ethical reasons for protecting information and documents gathered in the study, ensuring use of data does not extend beyond purposes of the research project (de Vries et al., 2011). Information collected for this study contained no information to identify participants or their companies. Hard data resides in a locked, fire-resistant safe in my home and will remain there for 5 years. All electronic data was stored on a password protected USB flash drive kept in a fire-resistant safe in my home where it will remain for 5 years. I will destroy all materials after the 5-year period. Peters and Dryden (2011), supporting the 5 year guideline, observed a move to digitally stored data citing the *Cyberinfrastructure Vision for the 21st Century* report published by the National Science Foundation in 2007. Upon completion of this research study, I presented a synopsis of the study results to the senior level supply manager and focus group participants. In addition, Walden University received a copy of the study results.

Data Collection

The data collection component is critical to a quality research study. This section includes a discussion of the researcher as the primary collection instrument. In addition, I discuss the techniques for collecting, organizing, and analyzing the data key to this study.

Instruments

Qualitative research comprises the collection and study of empirical materials that disclose the routine and problematic aspects of life (Denzin & Lincoln, 2011; Frels & Onwuegbuzie, 2013). When the researcher is the instrument for data collection, it is important to recognize the interview process as a social interaction (Frels &

Onwuegbuzie, 2013; Pezalla, Pettigrew, & Miller-Day, 2012). As such, Pezalla, Pettigrew, and Miller-Day (2012) recommended facilitating interaction in a manner that makes the responder feel safe in sharing stories and experiences pertinent to the study.

Throughout this process, I was the instrument for data collection. When the researcher serves as the main research instrument, the skills, sensitivity, and knowledge of the researcher are crucial to producing quality outcomes (Frels & Onwuegbuzie, 2013; Pezalla, Pettigrew, & Miller-Day, 2012; Rowley, 2012). The senior level supply manager of a large manufacturing company that used a costing method such as TCO for supplier decisions participated in a face-to-face interview. The semistructured format included nine open-ended questions allowing for probing questions and in depth responses. Pezalla et al. (2012) emphasized understanding the social interaction characteristic of a successful interview technique. Secondary data came from a focus group discussion with mid-level supply managers addressing the same nine questions. Questions for both levels of data collection pertained to the use of a costing model; both levels of questioning followed the interview protocol (see Appendix A). Use of an interview protocol keeps even the most seasoned interviewer on track, establishing reliability and validity of the research instrument (Harper & Cole, 2012; Jacob & Furgerson, 2012; Pezalla et al., 2012). The tertiary level of data collection was my review of company documents pertaining to use of TCO in procurement processes. This step solidified triangulation of sources, enhancing validity and reliability through confirmation of data gathered in the interview portion of the data collection.

Methodological triangulation combines various sources to collect, compare, contrast, and analyze data. Serving as confirmation when analyzing data, methodological triangulation can enhance validity and internal consistency of the data (Denzin, 2012; Denzin & Lincoln, 2011; Heale & Forbes, 2013). In addition, member checking can strengthen validity and help reach data saturation by obtaining in-depth verification. Harper and Cole (2012) declared benefits of member checking therapeutic, after reviewing available literature on member checking and enveloping personal experience of this occurrence in their discussion. Beyond allowing participants to review the transcripts from the standpoint of verifying factual and perspective accuracy, member checking results in personal validation as participants critically analyze the researcher's interpretation of their statements (Harper & Cole, 2012; Marshall & Rossman, 2016; Yin, 2014). I used member checking to support and further validate my interpretation of data collected in the interview process of this study.

Data Collection Technique

The primary and secondary data collection techniques included a semistructured interview and a focus group session. In addition, I collected data in the form of supply management departmental policy documentation detailing the use of a cost model such as TCO. I removed all nomenclature or information that could result in research site identification. Collection of data continued to the point of data saturation. At this point, the need for additional data no longer existed. Denzin and Lincoln (2011) defined data saturation as the point when no new themes emerge and data coming forward is repetitive; a definition Walden supports.

An interview, defined as a face-to-face verbal exchange for gaining information and understanding, is a precise and reliable process for finding answers to specific questions (Frels & Onwuegbuzie, 2013; Marshall & Rossman, 2016; Rowley, 2012). Semistructured interviews are open to allow for new ideas during the session. While a framework of themes guides the researcher, a less rigorous set of questions allows all involved to access a greater depth of understanding of the individual's experience (Frels & Onwuegbuzie, 2013; Marshall & Rossman, 2016; Rowley, 2012). Marshall and Rossman (2016) affirmed this as an effective strategy when using exploratory questions to ascertain relevant, in-depth information on specific topics. In addition, semistructured interviews set the stage for greater interaction, allowing the interviewee freedom to share at a more personal level (Frels & Onwuegbuzie, 2013; Marshall & Rossman, 2016). However, possible disadvantages exist with semistructured interviews. The researcher must abstain from interjecting their opinions and perspectives into the interview process, either verbally or implied in the slant of the questions (Cronin, 2014; Jacob & Furgerson, 2012; Rowley, 2012). Furthermore, the researcher must create an atmosphere fostering unrestricted participation, using heightened listening and observation skills throughout the process or risk missing information vital to a quality study.

To mitigate possible bias, I followed an interview protocol, using a semistructured interview to uncover how the participant applies TCO at the company. The first step in the interview process was to schedule a 60-minute face-to-face session with the upper executive of the supply management department. I scheduled the session at a time and place convenient to the participant and ensuring privacy. Consideration of participants'

time and comfort zones can improve numbers of participants as well as quality level of data collected (Javalgi, Granot, & Alejandro, 2011; Rowley, 2012; Yin, 2014). Use of a recording device helped ensure accuracy when transcribing and loading data on NVivo 10 software. Researchers recognize NVivo 10 software for its ability to derive meaning from a transcribed interview session (Bergin, 2011; Leech & Onwuegbuzie, 2011; Thomas & Magilvy, 2011).

A second 30-minute meeting with the senior manager interviewed allowed for member checking. Harper and Cole (2012) recommended the use of member checking to confirm the accuracy of the researcher's interpretation of the participant's responses. Member checking, a quality process for bolstering accuracy, credibility, and validity of the interview data, allows participants to authenticate the representation of the findings (Goldblatt, Karnieli-Miller, & Neumann, 2011; Harper & Cole, 2012; Marshall & Rossman, 2016). Harper and Cole described member checking as having therapeutic benefits for the participants as it allows for a solid understanding of what transpired in the session.

The second step entailed organizing a focus group consisting of mid-level supply managers. A qualitative research method structured in an interactive setting, a focus group design allows for open discussion of participants' perceptions, opinions, and attitudes on a predefined area of interest (Goldman & Waymer, 2014; Hancock & Algozzine, 2011; Marshall & Rossman, 2016). I set up a focus group session that accommodated time and location for the highest number of participants, achieving four participants in attendance. The members of this focus group addressed the same nine

questions posed to the supervisor. The intent was to validate data gathered from the first interview through methodological triangulation. The process of recording, translating, and analyzing this session involved a flip chart to capture data and notes, with the help of an individual to record the discussion (see Appendix B). The group participants reviewed the information documented on the flip chart to synthesize any common themes that emerged from the responses to the interview questions. The synthesizing in the focus group process allowed for consensus.

I used a third method, document review, to verify validity of data collected through the interview and focus group processes. Heale and Forbes (2013) traced the introduction of triangulation in qualitative research to the 1950s as a means to avoiding biases from use of a single method. The purpose of this single case study was to explore strategies the senior level supply chain managers use when gathering total costs for sourcing products and services. A document, such as a department policy or worksheet, recording the strategy for gathering total costs can validate data resulting from the semistructured interview and focus group session (Bekhet & Zauszniewski, 2012; Denzin, 2012; Heale & Forbes, 2013). The research site shared documents containing the department policy and an Excel worksheet that recorded the strategy for gathering total costs. These documents validated data resulting from the semistructured interview and focus group session

Documentary data can be advantageous in authenticating data from other sources providing detailed content for complicated processes (Heale & Forbes, 2013). Data reliability comes from verifying the data with other sources through methodological

triangulation (Bekhet & Zauszniewski, 2012). A disadvantage to document review is the potential for misinterpretation of the documents, which can result in inability to triangulate the data (Bekhet & Zauszniewski, 2012). My field and theoretical knowledge of costing methods such as TCO helped mitigate this potential problem, as my skills were beneficial in interpreting documents outlining an application process for cost analysis.

Data Organization Techniques

Constant organization of data is critical for effectively tracking, analyzing, and protecting information. Hancock and Algozzine (2011) stressed the importance of concurrently organizing, examining, and interpreting data throughout the qualitative case study process. Yin (2014) emphasized the need for a case study database containing raw data for increased *reliability*. Basurto and Speer (2012) agreed, reporting on the ability of a well-developed database allowing for the evaluation of data on a micro level. For this purpose, I used an Excel spreadsheet and an electronic filing system to track, sort, and retrieve data. The spreadsheet organized consent forms, permission letters, transcript review information, and interview logistics. An electronic filing system helped arrange interview transcripts, focus group data, emerging understandings, and any interpretation notations resulting from member checking. All files were password protected and saved on portable USB devices, rather than hard drives. A locked, fire-resistant safe will protect the devices for a period of 5 years after study completion. After the 5-year period, I will destroy all materials. With the completion of the study, participants can access the Walden IRB approval number upon request.

Data Analysis Technique

Methodological triangulation provided the framework for data assessment, interpretation, and conclusions. Methodological triangulation uses more than one method for gathering and crosschecking data, such as interviews, focus groups, questionnaires, and documents (Bekhet & Zauszniewski, 2012; Denzin & Lincoln, 2011; Yin, 2014). I used methodological triangulation to identify themes and assess and interpret data across three sources. The first semistructured interview and following focus group interview provided the primary and secondary data. The tertiary source consisted of the supply management documents.

The first steps in analyzing data included entering the ideas and concepts from the interviews, member checking follow-up interviews with the senior supply manager, focus group data, and information from the supply management documents into NVivo 10 software. Bergin (2011) recommended NVivo for its dynamic ability to evaluate a myriad of data sources and identify themes through its creation of coding nodes. I assigned a random participant code such as p1, p2 to all participants as well as a code such as C1 to the organization to preserve and protect identities. Coding is useful in organizing and classifying the data (Ivey, 2012; Marshall & Rossman, 2016; Yin, 2014). In addition, the published study excludes participant or company identification to safeguard confidentiality.

The next step involved scanning the data for themes. Use of NVivo, computer-aided qualitative data analysis software, can improve coding of the data and identifying themes, as it runs a constant comparison analysis, supporting the methodological

triangulation of the data (Leech & Onwuegbuzie, 2011). From the perspective of converging evidence through triangulation, data gathered from three sources should align (Bekhet & Zauszniewski, 2012; Heale & Forbes, 2013; Yin, 2014). Consequently, I looked for data alignment from the three sources, specifically, the interview, focus group, and company documentation. Key themes correlating with the conceptual framework of TCO surfaced, including detailed total costing, supplier quoting, supplier performance, overall supply chain, and overall value, demonstrating strategies of how large organizations use costing methods such as TCO.

Reliability and Validity

The greatest challenge for the qualitative researcher is evidencing quality of the data (Thomas & Magilvy, 2011). Without statistics and numbers to support results, qualitative researchers must prove reliability and validity of their conclusions (Frels & Onwuegbuzie, 2013; Marshall & Rossman, 2016; Thomas & Magilvy, 2011). Guba and Lincoln (1994) proposed a unique criterion for judging qualitative research, distinctive from that evaluating quantitative work.

Reliability

Guba & Lincoln (1994) distinguished *dependable* from *reliable* when judging the trustworthiness of qualitative work, recognizing the ever-changing environment within which research occurs. The researcher ensures dependability through qualitative measures such as copious documentation of processes, procedures, and protocol and by use of member checking of data interpretation and transcript reviews (Frels & Onwuegbuzie, 2013; Marshall & Rossman, 2016; Thomas & Magilvy, 2011). Member

checking (or informant feedback) is the opportunity for select participants to view the researcher's documented interpretation of what participants shared during the interview process. The concept allows for participant validation of the completeness and accurate interpretation (reported as categories and themes) of their experiences as captured by the researcher (Harper & Cole, 2012; Marshall & Rossman, 2016; Thomas & Magilvy, 2011). I used member checking to assure data as recorded was complete and reflected the perspective of the interviewee. An interview protocol (see Appendix A) governed the interview process, helping to establish consistency among the semistructured interviews, thereby minimizing the influx of bias. Documentation of procedures used throughout the data collection process enhances *confirmability* of findings (Drost, 2011; Khorsan & Crawford, 2014; Thomas & Magilvy, 2011). As defined by Thomas and Magilvy (2011) the researcher achieves *dependability* when another researcher can follow the decision trail used in the research process.

Validity

Qualitative researchers strive to verify or establish *credibility* of the study rather than establishing *internal validity* (Drost, 2011; Khorsan & Crawford, 2014; Thomas & Magilvy, 2011). Judged by the participants, credibility implies the researcher's presentation of the experience contained in the study accurately reflects the interpretation of the participants (Thomas & Magilvy, 2011). Credibility of qualitative research is a reflection of the ability and effort of the researcher to uncover, interpret, and accurately convey the story (Thomas & Magilvy, 2011). Frels & Onwuegbuzie (2013) stated

attention to detail is critical in forming correct conclusions; including selection of method, design, instrument, and accuracy in the collection of data.

The researcher achieves credibility by considering the data collected as a whole (Thomas & Magilvy, 2011). A strategy used to establish credibility is triangulation. I used methodological triangulation, collecting data from more than one source, to achieve credibility in this study. Methodological triangulation combines various sources from which to collect data and can enhance validity (credibility) and internal consistency of the data (Bekhet & Zauszniewski, 2012; Denzin & Lincoln, 2011; Heale & Forbes, 2013). However, regardless of the level of achieved credibility, *transferability* to other contexts or settings is for the reader and future researchers, rather than the researcher to establish. Unlike *generalization* or *external validity* sought by quantitative researchers, transferability refers to the extent to which the reader accepts findings of an inquiry apply to other contexts (Thomas & Magilvy, 2011). A researcher can provide rich depth in describing the population, situation, demographics, and geographic boundaries of a study, yet in the end; the decision of transferability is outside of the scope of the researcher's control (Thomas & Magilvy, 2011; Tsang, 2014; Tsang & Williams, 2012). To generate support for transferring my findings to other businesses, I sought to present a detailed, encompassing view of how the leaders in one larger company use TCO. By using three sources to collect data, the depth of detail in how other companies use TCO allowed readers to see the potential of using TCO for procurement decisions.

Confirmability occurs once a researcher establishes credibility, transferability, and dependability (Drost, 2011; Frels & Onwuegbuzie, 2013; Thomas & Magilvy, 2011).

Steps taken in the data analysis process can help establish confirmability. My use of an interview protocol, electronic devices to capture data, member checking, and methodological triangulation contributed to dependability, credibility, and transferability. Moreover, use of NVivo, computer-aided qualitative data analysis software runs a constant comparison analysis, improving coding of the data and identification of themes (Leech & Onwuegbuzie, 2011). Throughout the process, I took time for reflective practice, clarifying responses, definitions, terminology, metaphors, and such as needed, allowing for emergence of the big picture as viewed by the participants.

Case study research methodology provides for triangulation of data collection, strengthening the validity of the results (Heale & Forbes, 2013; Marshall & Rossman, 2016; Yin, 2014). I reached data saturation in this study through an in depth semi-structured interview with a senior manager of supply management and a focus group session with mid-level employees in the supply management department, with the potential of finding repetition in data through company documentation. Walker (2012) defined saturation the point where data becomes redundant. Through a process of triangulation and data convergence, saturation should emerge (Denzin, 2012; Heale & Forbes, 2013; Yin, 2014). Evidence of saturation came from the repetition of data and the failure to identify new themes in the data coming forth.

Transition and Summary

This study focused on identifying how practitioners use costing models for supplier selection. I used a purposive sampling approach to identify a company using a costing model such as TCO for the focus of this qualitative exploratory case study. Data

collection techniques serving to enhance reliability and validity of the study through triangulation were semistructured interviews, a focus group, and collection of documentation.

Key elements in this section included discussion on the research method and design chosen for the study. Other topics included selection of the population and sampling method. I examined steps for conducting ethical research, as well as methods for maintaining reliability and validity throughout the process. Section 3 of this study presents the doctoral study findings, including applications to professional practice, implications for social change, and recommendations for future study.

Section 3: Application to Professional Practice and Implications for Change

Introduction

Businesses often make purchasing decisions based on quoted price alone as senior level supply chain managers often lack knowledge of TCO strategies (Holweg, Reichhart, & Hong, 2011, p. 338). As purchase items can account for more than 60% of companies' expenditures, a company's financial viability is contingent on optimum purchasing decision making (Vanteddu, Chinnam, & Gushikin, 2011). The purpose of this study was to identify TCO strategies that senior level supply managers used to make purchasing decisions. To ascertain these strategies, I conducted a qualitative, exploratory single case study at a large manufacturing company that uses TCO strategies in procurement practices.

From an interview with a senior level supply chain manager, a focus group session with mid-level supply chain managers, and an analysis of company documents, themes of TCO application emerged, illustrating strategies used in applying TCO to purchasing decision making. The themes encompassed detecting the best costing approach for identifying and defining all costs relevant to the life cycle of the product, which included identifying hidden costs, indirect costs, and risk factors. Supplier rating and management surfaced as an important facet of accessing and controlling costs. Data for the supplier rating resulted from consistently measuring the performance of suppliers in areas such as on-time delivery and acceptable quality. The ability to access costing information emerged as a vital factor in the firm's ability to use TCO in procurement and supplier selection decisions. A close internal relation with engineering and accounting

personnel was key to successful application of TCO. In addition, an internal infrastructure supported by a materials requirements planning system provided a tool for tracking costs. Reliable record keeping provided historical cost and quality performance data used in supplier rating and procurement decisions.

Presentation of the Findings

The overarching research question for my study was as follows: What strategies do senior level supply managers use to gather total cost of ownership when making purchasing decisions? To answer this question, data were validated through cross corroboration using multiple data sources: (a) an in-depth interview with follow-up member checking, (b) a focus group session, and (c) company documents consisting of a supplier manual and an Excel spreadsheet used to compare supplier quotes. Walker (2012) posited the use of multiple sources as specific to data saturation. By conducting an interview with a senior level supply manager, a focus group session with mid-level supply chain managers, and a company document analysis, I had the opportunity to gather enough information for the repetition and relevance of findings necessary for data saturation. The senior level manager agreed to a member checking interview follow-up session to clarify TCO strategies. Convergence of evidence through methodological triangulation provided construct validity.

After data transcription, I loaded information from the interview, focus group session, and the documents collected from the senior supply manager into NVivo 10 software, which helped capture themes from the data. These themes included: (a) identifying total costs, (b) identifying tools for implementing TCO, (c) supplier rating and

management, and (d) maintaining detailed record keeping. The categorical themes that emerged from the multiple data sources provided a structure for pinpointing strategies for applying TCO when making purchasing decisions. The knowledge on TCO application could benefit other companies when making purchasing and supplier selection decisions, positively impacting firms' competitiveness, productivity, and profitability.

Theme 1: Identify Total Costing

In analyzing data through NVivo 10, two co-occurring codes surfaced within the first theme of cost identification, the strategies of identifying hidden costs and the need to clarify all costs. Table 2 shows the frequency of references made to this and four themes that surfaced throughout the data collection process.

Table 2

References Related to Theme 1: Identify Total Costing (and all Themes in Study)

Sources of data	Frequency in Theme 1	Frequency in all themes
Semistructured interview	11	31
Focus group	12	36
Supplier manual policy	10	26
Landed cost spreadsheet	7	7

Using methodological triangulation, I was able to corroborate the data I collected on TCO implementation strategies at the site company to the point of saturation.

Identification of all costs emerged from the interview, focus group session, and documentation as a critical theme to attaining the TCO. The strategy of identifying all

costs is inherent to the TCO model. Seminal works by Cavinato (1992), Ellram (1995), and Degraeve and Roodhooft (1999) conveyed the importance of ascertaining all costs associated with the purchasing transaction. The key construct underlying TCO was the identification of all costs: preownership, ownership, and post ownership (Gass et al., 2014; Ellram, 1995). The concept of accounting for all costs prior to purchasing decision making is critical to corporate sustainability when purchasing expenditures account for more than 60% of the average total costs for manufacturing firms (Vanteddu et al., 2011, p. 204).

Central to this research, recent literature validated the benefits of TCO in appreciably reducing purchasing costs and increasing productivity (Caniato, Ronchi, Luzzini, & Brivio, 2014). Fisher and Krumwiede (2015) reported Nestlé SA discovered that selection of the appropriate cost system led them to consolidate product lines for improved profitability. The senior level supply manager at my research site noted that identifying both direct and indirect costs was fundamental to tracking down *all* costs. During member checking this manager stated that indirect (hidden) costs overlooked in the buying decision could negate expected gains. These costs included consumables, scrap/yield losses, discount rates, inflation rates, research and development costs, product warranty costs, and tool lifetime costs. Compiled in the focus group session, this list of costs corroborated with information shared by the focus group member responsible for indirect costs, and information found in the corporate document, a multi-tabbed, detailed Excel spreadsheet used for calculating landed costs. For instance, clearly detailed in the document are instructions for tracking charges and ownership of tooling. If not

effectively tracked, tooling, which can often be very expensive, is a cost that can be lost in the process (Senior manager, personal communication, October 29, 2015). Because tooling is a significant cost driver for this company, upfront purchases of tooling keeps supply management focused on this cost. In my interview, the senior manager stated “Ownership costs are taken out up front through contracting and breaking out our largest cost drivers”. In allocating indirect costs to products, the goal is to find the biggest cost driver that represents the cause-and-effect linkage between the costs and the product (Fisher and Krumwiede, 2015). Supply managers must establish criteria definitions as a ratio of weighted inputs and outputs (Visani et al., 2015). For the research site company, criteria definitions cited in the supplier policy manual include identifying supplier risk factors, identifying sources of data, and establishing a weight for each factor. Imbedded within the landed cost spreadsheets are formulas to compute mathematical equations determining a ratio of inputs to outputs. Similar to this company’s approach, Visani et al. (2015) recently developed a tool measuring the efficiency of the supply relationship using TCO cost drivers as inputs and the purchased amounts as outputs; also derived from a mathematical program approach. Visani et al. corroborated the basic costing approach of this company when formulating a data envelopment analysis (DEA) application that acts as a proxy for TCO and relies on a mathematical programming approach.

Clarifying and defining all costs is a vital step to identifying costs. Evans, Baskerville, and Nara (2015) identified translation of accounting and costing terms as an obstacle, in particular to equivalent implementation of International Financial Reporting Standards. Translation of accounting terminology becomes progressively important with

the increasing interaction in international capital markets (Evans, Baskerville, & Nara, 2015). Built into the supplier manual and the landed cost spreadsheet of this company is a tab that delineates what this company means by terms such as capital expenditures, tooling, nonrecurring engineering costs, and more. The consensus from the focus group described the clarity of the terminology as defined in the company document, as very valuable when identifying TCO.

Theme 2: Tools for Implementing TCO

Implementation of TCO requires tools for identifying and collecting cost data. Various levels of technology used for accomplishing this task include Ellram's (1993) development of an activity flow chart for grouping costs and Ellram and Siferd's (1998) suggestion of spreadsheets. Holweg et al. (2011) empirically tested a framework for capturing costs through an MRP system and Degraeve et al. (2005) paired ABC accounting, an ERP system, and a mathematical program calculating product life costs.

Theme 2 aligned with the historical and recent supportive body of literature as well as with the TCO theory. In fact, the need for a somewhat extensive system required to capture all costs relevant to each supplier is a deterrent to implementation of TCO as a sourcing tool (Ekici, 2013; Ellram & Siferd, 1998). Recent studies, such as a TCO study comparing electric vehicles to conventional vehicle completed by Wu, Inderbitzin, and Bening (2015), demonstrated the benefits of sophisticated tools when gathering total costs. Wu et al. built a Monte Carlo simulation model broad enough to capture costs across the national market. Visani et al. (2015), in a study conducted to further develop

the TCO theory, developed and empirically tested a tool they designated “TCO-based DEA;” DEA being a data envelopment analysis application.

In this case study, though not as sophisticated, the use of tools surfaced as a major theme in three of the four sources of data collection. The senior supply manager reported, “Supply management works in conjunction with operations management, engineering, quality, and the cost accounting group to capture all costs related to a product or service.” As a member of the focus group reported, “We work in a team environment.”

Working as a team, this cross-functional group developed an Excel spreadsheet used to capture total landed costs. The designers imbedded the Excel document with macros that captured costs as succinctly as possible. In the member checking session, the senior manager noted that “even rebates were captured” and “the present value of all payments for products/services were captured over the life of the contract.”

Access to proper tools gives access to cost drivers identifying the cost of activities as they progress through the life cycle of the product. An ABC accounting system is one such tool. ABC accounting systems allow managers to determine which product or service initiated the activity associated with the cost. As a result, companies can understand which product and service adds to profitability and contributes to loss (Chiarini, 2012). The senior manager, corroborated by the focus group, reported the use of ABC accounting to track costs through the system. ABC cost accounting is one of the most accurate systems for assigning overhead costs to products (Fisher & Krumwiede, 2015).

In addition to ABC accounting, this company used web-based tools to manage its costs and suppliers. The web-based “Supplier Collaborative Portal” is homegrown and proprietary to this research site. This tool allows for real time notification of activities and issues, allowing suppliers to better manage their transactions with the case study site. This portal is the medium for releasing purchase orders and real-time releases against existing orders for direct material suppliers. As the company processes supplier invoices through this electronic document management system, supply management retrieves direct costs from this system as well.

The senior manager described a second web-based tool used to manage the supply chain. Supply managers use the Ariba Commerce Network for procurement of items sourced through the reverse auction process. Ariba provides a marketing platform for the auctions, as well as tracks cost results from the activities of the auction. In short, tools used to gather TCO include an ABC accounting system, a homegrown supplier portal, the Ariba Commerce Network, and an Excel spreadsheet serving as a land cost calculator for tracking costs of inventory throughout the supply chain. This approach to use of TCO emulates Degraeve et al.’s (2005) approach when these researchers applied TCO at a Belgian ball bearing plant and reported a 10% cost reduction.

The senior manager reported great success with this approach to capturing TCO and managing suppliers. The focus group suggested that companies of all sizes might apply similar strategies successfully. Fisher and Krumwiede (2015) suggested that with the existence of many costing methods and systems available, companies must find the right balance of ease, fit, and implementation costs for their individual needs. A critical

review of historical and current literature revealed strategic tools of various levels of technological advancement used to gather costs of ownership. As evident in Visani et al.'s (2015) work on TCO-based DEA, TCO is a dynamic concept that continues to evolve. As technology improves the tools available for tracking costs, organizations will move closer to gaining accurate TCO before making supplier decisions. In the focus group discussion, conversation abounded with discussion on the new ERP system, Oracle, the site is currently implementing. When overlain on the existing ABC accounting system, Oracle will significantly improve this company's capability to achieve TCO before making procurement decisions.

The contribution of proper tools to implementing TCO was evident in the majority of data collected from varying sources. Table 3 displays the frequency of references made to this and all four themes that surfaced throughout the data collection process. As the table shows, the supplier policy manual supported collaboration for this theme, frequently mentioned among the supply management team in both the semi-structured interview and the focus group session. The landed cost spreadsheet is actually one of the tools mentioned in the above discussion, which accounts for zero references reported.

Table 3

References Related to Theme 2: Tools for Implementing TCO (and all Themes in Study)

Sources of data	Frequency in Theme 2	Frequency in all themes
Semistructured interview	11	31
Focus group	12	36
Supplier manual policy	3	26
Landed cost spreadsheet	0	7

Theme 3: Supplier Rating and Management

A third theme emerging from the data was that of *supplier rating and management*. The concept of rating and managing suppliers is to drive the focus of supplier relationships to that of a cost contractual rather than price contractual agreement. According to the senior manager, “When the focus is on cost, it is conducive to tracking and reducing costs”. TCO is a tool for evaluating the cost of doing business with a supplier, used to move the decision closer to an optimum decision. This theme directly relates to the concept of TCO that was the conceptual framework for this study.

The historical body of literature supported this theme. Kähkönen and Lintukangas (2012) found in a study a strong correlation between strategic supplier management, and competitive advantage and healthier business performance. In addition to cost efficiencies, firms seek an acceptable quality work level, an educated labor pool, and opportunities for leveraging innovation and reaching new markets (Holweg et al., 2011; Lewin & Volberda, 2011). A tool such as TCO, used for evaluating the cost of doing

business with a supplier can result in optimal procurement decisions (Ellram & Siferd, 1998; Vitasek & Manrodt, 2012).

There was repetition of this theme evident in all sources of data; semi-structured interview, focus group, and documentation. The supplier policy manual, supported by data collected from both the senior manager and the focus group, showed an aggressive system for development of supplier relationships using Ultriva, a collaborative electronic kanban system. This Internet based software offers interactive means to stay connected with suppliers while offering easy to follow pictorial of the entire supply chain. Electronic kanban cards trace the movement of product through the in-process queue. In addition, the supply management group provides supplier quality and delivery performance data via an Internet supported *collaboration portal*. This feedback mechanism allows for supplier continuous improvement, which is useful in keeping product costs lower. Moreover, the supply management group uses cost driven contracts to manage transactions; suppliers are encouraged to share cost breakdowns for better identifications of product costs. The senior manager stated, “We actually suggest suppliers use ABC costing”.

Table 4 shows the frequency of references made to this and four themes that surfaced throughout the data collection process. This organization expects its suppliers to achieve a target level of quality and delivery performance. The commodities’ managers review supplier performance each month to maintain control of TCO over the life of the products. As the overall purpose of the TCO theory is identifying costs for the purpose of

cost reduction, supplier management as demonstrated by this organization implements the TCO concept integral to this study.

Table 4

References Related to Theme 3: Supplier Rating and Management (all Themes in Study)

Sources of data	Frequency in Theme 3	Frequency in all themes
Semistructured interview	5	31
Focus group	7	36
Supplier manual policy	6	26
Landed cost spreadsheet	0	7

Nita (2014) suggested monitoring and assessing costs incurred throughout the supply chain was essential to meeting increased global competition. Use of TCO allows for accurate assessment of the costs of relations with suppliers making decisions more cost effective. Visani et al. (2015) stated TCO takes into account all activities across the supply chain, allowing for better supplier selection and negotiations, technical analysis and evaluation, quality management, and inbound logistics. TCO can effectively support sourcing at various levels of the process from raw materials, through conversion, to consumption (Visani et al., 2015). In a study on supply disruption, Hu and Kostamis (2015) supported the need for managing supplier performance and risk. Hu and Kostamis indicated closer supplier-buyer relationships could result in benefits such as guaranteed-delivery contracts. Managed relationships are essential to managing supply risk (Hu & Kostamis, 2015).

Theme 4: Detailed Recordkeeping

The theme of *detailed recordkeeping* was somewhat of a surprise; not because of its lack of value but more because I did not uncover this specific strategy in my historical review of the published body of literature. I revisited historical articles and checked for newly published literature for information specific to recordkeeping as a strategy for applying TCO. Though the task of copious recordkeeping was implied, I did not find it identified specifically as a strategy for TCO implementation.

Yet, this theme emerged to a point of saturation in my collection of data. Throughout the semi-structured interview, the senior level supply manager referenced historical data, including costing information, pricing information, supplier ratings, quality and delivery levels, inventory turnovers, and more. The focus group reiterated much of the same expounding on the benefits of the MIN system. “That’s the materials information network,” explained the senior level manager. The focus group corroborated that the system goes back 15 years with information on raw material markets for steel, electronics, precious metals, market trends, political issues, supplier data, and availability of products, in addition to items mentioned previously. From this plethora of data, the company is able to make future projections.

Moreover, data is shared with suppliers as appropriate; “records are archived and made available for supplier retrieval should a question arise” (Supplier Policy Manual). With web-based networks, these tools are assessable through portals or emails giving suppliers relevant information in a timely fashion. Table 5 shows the frequency of

references made to this and all four themes that surfaced throughout the data collection process.

Table 5

References Related to Theme 4: Detailed Record Keeping (and all Themes in Study)

Sources of data	Frequency in Theme 4	Frequency in all themes
Semistructured interview	4	31
Focus group	5	36
Supplier manual policy	7	26
Landed cost spreadsheet	0	7

This company recognizes the value of maintaining records with great integrity as evident in the frequency of references to accurate record keeping during the data collection process. The landed cost spreadsheet is one of these record-keeping tools. In addition, to calculate landed cost as done with this tool, careful records are essential for accuracy.

In a final analysis for saturation of data, I considered a matrix of collected data as it related to the established themes. I conducted a query in NVivo to identify themes emerging from more than one data source. Table 6 displays the results, which I feel demonstrate a satisfactory level of data saturation. As the spreadsheet for calculating landed cost is a tool, it is not surprising it did not contribute to the collection of data for all themes.

Table 6

Matrix Coding Search for Data Saturation – Frequency Representing Repetition

Sources of Data	Theme 1	Theme 2	Theme 3	Theme 4
Semi-structured Interview	11	11	5	4
Focus Group	13	12	7	5
Document 1 (Manual)	10	3	6	7
Document 2 (Spreadsheet)	7	0	0	0

Square Peg in Round Hole

The following did not surface as themes, but rather provided me with some *aha* moments. The first revelation was how much of what this company achieved using spreadsheets and database applications inexpensively available through software providers such as Microsoft Corporation. This is similar to the seminal work on TCO by Ellram and Cavinato in the 1990s. Ellram (1995) developed an activity flow chart grouping costs into three categories. TCO denotes all costs associated with the acquisition, use, and disposal of an item be considered, not just the unit purchase price. Cavinato (1992) identified 18 factors inspiring the customers' *perceived value*, expanding the TCO concept to the end customer. Though Ellram and Cavinato envisioned an empirical approach to TCO, both recognized the philosophical *soft dollar* benefits of bringing the concept of capturing all costs to the forefront of the buyers' minds.

However, as the TCO concept evolved in the 20th century, historical and newly published bodies of literature transcended the concept of cost collection to a scientific approach supported by technological developments. Degraeve et al. (2005) recommended

an ABC accounting approach, an enterprise resource planning system such as SAP or Oracle, and mathematical programming interlinked to capture total costs effectively. In another approach, Nita (2014) reported that cost management required ABC cost accounting, a balanced scorecard approach, and other such instruments to achieve TCO. However, Fisher and Krumwiede (2015) felt no single best product cost system existed; rather one should be selected after careful consideration of costs and benefits.

Nonetheless, it was this expectation of costly computerized systems that misled me. I anticipated a system running systems applications and products (SAP) or some other ERP with cost information supplied by an ABC accounting system, and complicated mathematical programming running underneath it all. Much to my surprise and delight, this company has a myriad of systems that they manually merge. Some are homegrown spreadsheets and databases like MIN. Others are web-based applications such as SAP's the Ariba commerce network. Though they are now on an ABC accounting system, they started this approach to accounting for TCO using a traditional standard cost accounting system. Thus, systems such as these are more affordable for SMEs who feel they cannot afford to implement TCO.

The second revelation resulting from this study was the admission that they still are "not there yet". As data showed, with spreadsheets and systems manually manipulated, I had biased expectations of seamless systematic access to TCO. Newer literature expounding on ABC accounting systems feeding ERP systems, and the fact that this was a division of a very large organization deluded my expectancies. The data revealed a different scenario. During member checking the senior manager stated, "we

don't have it all figured out" and "so much is manual." The focus group comments such as "still very manual" and "it's getting better" substantiated the manager's statements. In addition, it is getting better. This company is in the process of installing an Oracle ERP system. Though the process of implementation is trying, the team looks forward to easier and more complete access to TCO for use in their supplier selection decision-making.

Application to Professional Practice

This study's findings were significant with respect to the professional practice of supply management in business. The literature review revealed limited application of costing models such as TCO, regardless of the benefits proposed by scholarly studies. Degraeve et al. (2005) reported savings of 10% for two of the three product groups at the Belgian ball bearing plant by utilizing TCO in purchasing decision-making. However, the review of the research revealed a gap on *what strategies* organizations effectively used to apply TCO and other costing models. This posed a significant risk to a firm's competitiveness, productivity, and profitability (Degraeve et al., 2005; Ellram & Siferd, 1998; Horn, Schiele, & Werner, 2013), particularly for SMEs.

The findings of this study detail specific strategies supply chain managers can use to apply a TCO model when making purchasing decisions. Included within this study are the tools a large manufacturer used to optimize purchasing expenditures. When making purchasing and supplier selection decisions, supply chain managers might improve business performance by following the TCO strategies outlined in the findings of this study.

The findings are relevant and support scholars' assertions advocating the use of costing models. Holweg et al. (2011) reported unexpected costs as high as 72% of total costs undermine expected cost savings when managers base purchasing decisions on comparison of unit price alone. Longer supply pipelines, lower quality, on time delivery, decreased reliability, and ineffective service can offset low unit purchase prices (Degraeve et al., 2005; Denning, 2013; Horn et al., 2013). Decisions made with unreliable cost information can cause irreparable harm to the company (Ellram & Siferd, 1998). Managers who implement the TCO strategies reported in this study may benefit in supplier selection, strategic decisions, and outsourcing and offshoring decisions. Supply managers may be forfeiting reduced costs and improved profitability by detrimentally underestimating TCO. The use of the TCO cost model could improve supplier choices and improve productivity as managers identify all costs before making supplier selection decisions.

Additionally, the research findings included four major themes, one of which I recognized as a new finding, not specifically identified in past literature. Resulting from this study are recommendations to supply managers for implementing TCO, as well as ideas for further work in this area. Supply managers seeking to reduce costs and improve productivity may find the strategies in this study useful.

Implications for Social Change

The greatest opportunity for constructive social change is in sharing the strategies for using costing models as defined in this study with other companies such as SMEs who struggle with TCO implementation and use. Sharing the results of this study with

SMEs might result in reassessment of true total costs of offshore buys. Reassessment of total costs of these buys could result in reshoring procurement decisions, bringing manufacturing of products back to domestic localities.

The fervor to outsource offshore, driven by psychological expectations of savings, often failed to deliver positive results (Holweg et al., 2011; Horn et al., 2013). Horn et al. (2013) implied that perceived advantages and pressure drove many offshoring choices, citing instances evidenced in case studies of purchases outsourced to lower wage countries in Asia that were unsuccessful. Recent trends in moving manufacturing back to America (Arlbjørn & Mikkelsen, 2014; Ellram, 2013; Kazmer, 2014) provide a strong argument for the use of a cost model such as TCO in procurement, manufacturing, and supplier selection decisions. The findings of this study might provide the strategies and tools to SME's and other businesses struggling with the application of costing models such as TCO. Tangible changes in how purchasing and sourcing decisions are made could result in consideration of all costs, including the hidden costs such as transportation, inventory levels, and quality issues; effecting purchasing managers to select the domestic market.

Recommendations for Action

As a past practitioner and the researcher, I am resolved to share with supply managers the findings of this study as they transmit to supply management procurement practices. With control over a large portion of the expenditures of the organization, supply managers play an important role in the success and sustainability of the organization. Effective spending practices can strengthen the financial standing of a

corporation and TCO is a well-known approach for evaluating supplier performance (Visani et al., 2015). Supply managers should pay attention to the recommendations of this study, as they relate to strategies for implementing TCO procurement practices.

The strategies emerged include (a) identifying total costs, (b) developing tools for capturing costs, (c) managing suppliers and risk, and (d) following good recordkeeping practices. Identifying costs means reaching beyond the traditional unit price, which often consists of direct costs, a portion of overhead, and a profit percentage. Holweg et al. (2011) stated unit price alone could account for as little as 28% of the total cost of product. Supply managers should operate as a team with other functions such as cost accounting to determine the main cost drivers of the product or service. Tools used to capture costs do not have to be sophisticated or costly. A simple spreadsheet could help identify the main cost drivers for the more costly items in inventory. The use macros could help to develop a calculator for determining landed costs. Supply managers could download information from spreadsheets into a database to serve as a base on which to build historical costs.

The business community in general can benefit from the findings of this study. Application of TCO is advantageous in reducing organizational costs and improving profitability regardless of the size of the expenditure or capital commitment. For that reason, I will use my association with the Institute of Supply Management and its local affiliates to access a platform to publicly share my findings through workshops and seminars. Working with academic and professional connections, I will work to publish these findings in an effort to reach a wider audience. As revealed in the literature review,

decisions based on unit price alone are generally ineffective, inefficient decisions often resulting in negative benefits for the business. The findings of this research indicate a need for supply managers to actively seek strategies such as those outlined in this study for implementing TCO protocol when outsourcing procurement decisions.

Recommendation for Future Research

In this study I investigated the implementation strategies companies use to apply TCO in supply management decisions. This study focused on implementation of an internal process within a company, and internal processes and operations differ from company to company. A limitation of this study was the single case study design as it presented a risk of the subject company being atypical of the larger population. As such, results would not be transferable to the broader population (Yin, 2014). A recommendation for the future would suggest a design change to allow investigation of a broader base.

A second consideration is the many variables that exist in the chain of costs leading to TCO for its use as a first-time supplier selection tool. This positions TCO as a tool better suited for historic analysis (L. M. Ellram, personal communication, September 25, 2014). The concept suggests a long-term perspective for accurate valuation of procurement. Literature supports this premise. The main disadvantage of TCO as a sourcing tool is the extensive system required to capture all costs relevant to each supplier (Ekici, 2013; Ellram & Siferd, 1998). The cost of gathering information hits a point of diminishing returns; buyers should take cost gathering for supplier selection to a marginal drop off point. The marginal cost exceeds the marginal benefits for practitioners

when they reach the point where they feel it is no longer worth pursuing (McConnell et al., 2012). As such, buyers too often settle for the unit price. I recommend future research on a critical cost of ownership (CCO) model where the Pareto principle is applied to TCO to develop a practical model where practitioners can find the marginal point of cost collection that will result in optimum value in the purchasing decision process.

Reflections

In May of 2000, the United States voted on a bill that opened the doors to trade with China (Saaty & Cho, 2010). What was supposed to be a plethora of trade opportunities for United States exports turned into a negative balance of trade. Manufacturers in high labor cost countries gravitated to lower labor markets, frequently overseas and in particular, China (Kitcher, McCarthy, Turner, & Ridgway, 2013). For labor intense products, China represented an opportunity to reduce costs and increase competitiveness in the global marketplace. However, because of automation and progressive management the reduction of unit labor costs outflanked material costs so that by 2000 the percentage of labor accounted for less than 35% of the manufacturers' total cost to produce many items (Burt et al., 2012). In addition, China's main resource was its people. China was importing *raw material* from America. As a result, I struggled with understanding the flood of offshoring that followed the trade agreement when less than 35% of the TCO was labor and offshoring meant an increase in transportation, inventory, risk, quality issues, and other hidden costs.

Working through this study I came to understand much of what was behind the frenzy to offshore. Maltz, Carter, and Maltz (2011) identified the fervor to outsource

offshore as a *pervasive influence* on purchasing (p. 797). Horn et al. (2013) agreed with the insinuation that psychological expectation and pressure drove many offshoring decisions, citing case studies of purchases outsourced to lower wage countries in Asia that were ineffective. Lewin and Volberda (2011) referred to this as the *bandwagon effect*. Wang, Singh, Samson, and Power (2011) suggested offshore advantages as *perceived* (p.419).

As I suspected, buying decisions often failed to consider longer supply chains and other hidden costs thus, failing to achieve perceived benefits. Companies neglected to use a costing model such as TCO when making these offshore decisions. Yet, it was through the literature review undertaken for this study I learned of the difficulty of implementing a cost model such as TCO. Through the research and findings consequential to the study, I uncovered large companies using unsophisticated tools such as spreadsheets and the World Wide Web to gather costing data resulting in greatly improved buying decisions. Understanding of how large companies implement cost models such as TCO when making purchasing decisions can benefit SMEs in supplier selection to improve productivity and profitability within their organizations' supply chains. This insight into unpretentious approaches to cost gathering offers a tremendous opportunity for companies of all sizes to improve profitability and competitive advantage.

Conclusion

Companies struggle to compete in this global economy. Decreasing costs can result in greater productivity and profitability. Costing models can help reduce overall costs when making supply management decisions. Models such as TCO focus on

gathering costs incurred while making and maintaining business relationships within the supply chain. Yet, identifying all cost activities performed in the supply chain can be difficult. Cost management in the supply chain requires multiple tools, though the nature of these tools is debatable.

I conducted a qualitative exploratory case study to determine the tools used by a firm in northeast Ohio successfully using TCO in procurement decisions. TCO served as the lens through which I focused on collection of costing data. Data collection included a semistructured interview, a focus group session, and the evaluation of company documents. I used methodological triangulation to help ensure reaching data saturation.

Data analysis revealed major strategies supply managers could use in implementing cost models such as TCO in supply management decisions. The research findings emphasized the importance of identifying costs of ownership yet revealed some rather unsophisticated tools with which to do so. Standard spreadsheets, database software, and web-based systems provided solid infrastructure on which to build cost and supplier analysis platforms. Though ABC accounting systems, ERP systems such as SAP and Oracle, and complex mathematical programming were preferred tools for cost consolidation, research clearly demonstrated the effectiveness of the unsophisticated approach to gathering costs. Both literature and research confirmed the indisputable benefits of using a costing model such as TCO as opposed to making supply management decisions based on a roll of the dice.

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Appendix A: Interview Protocol

Interview Protocol	
What I will do	What I will say—script
<p>Introduce the interview and set the stage—often over a meal or coffee</p>	<p>I would like to thank you for participating in this case study exploring the strategies your organization uses to gather total cost of ownership when making purchasing decisions. I have a copy of the consent form you received before this session that indicated your consent by your email response. I would like to remind you that you have the opportunity to withdraw at anytime during the interview process.</p> <p>[FG Only: To assure I capture all data, I have enlisted the help of an individual to capture all responses offered by participants. This individual has signed a Confidentiality Agreement to protect you and your company.]</p> <p>Before we begin, do you have any questions I can address for you? If you have no questions, let us proceed with the interview.</p>
<ul style="list-style-type: none"> • Watch for non-verbal queues • Paraphrase as needed • Ask follow-up probing questions to get more indepth 	<ol style="list-style-type: none"> 1. How do you access total costing information on purchasing decisions? 2. What resources do you use to gather and track total costs? 3. Can you walk me through the process for gathering total costs for a purchase? 4. What types of purchase items require this process before making a purchasing decision? 5. How much of this process uses automation? 6. What systems or tools offer automated availability to this costing information? 7. What costs have you identified as most critical for effective supplier selection? 8. What process is in place to follow-up on total costs incurred after the product or service is complete? 9. What method of cost collection did you use before this TCO approach to cost collection? 10. What additional experiences have you had where use of TCO resulted in a supplier selection contrary to your initial expectation?

Wrap up interview thanking participant	That completes the questions I have for you regarding use of TCO. Can I answer any questions you have before we wrap up this session? Once again, I extend my appreciation for your time and the information you have shared with me here today.
Schedule follow-up member checking interview	I would like to schedule a short follow-up session so that you can review the transcript of this session to ensure it is an accurate, credible, and valid record of our interview.
Follow-up Member Checking Interview	
Introduce follow-up interview and set the stage	Thank you for taking the time to meet with me to review the transcripts of our initial interview. As we go through each question, please verify the synthesis represents your response to the question.
Share a copy of the succinct synthesis for each individual question	I will read each question asked in the initial interview, followed by a succinct synthesis of your response. Please feel free to offer additional information that may further clarify your intent.
Bring in probing questions related to other information that you may have found—note the information must be related so that you are probing and adhering to the IRB approval. Walk through each question, read the interpretation and ask: Did I miss anything? Or, What would you like to add?	1. Question and succinct synthesis of the interpretation—
	2. Question and succinct synthesis of the interpretation—
	3. Question and succinct synthesis of the interpretation—
	4. Question and succinct synthesis of the interpretation—
	5. Question and succinct synthesis of the interpretation—
	6. Question and succinct synthesis of the interpretation—
	7. Question and succinct synthesis of the interpretation—
	8. Question and succinct synthesis of the interpretation—
	9. Question and succinct synthesis of the interpretation—
	10. Question and succinct synthesis of the interpretation—

Appendix B: Confidentiality Agreement

CONFIDENTIALITY AGREEMENT

Name of Signer: [REDACTED]
Focus Group Recorder

During the course of my activity in collecting data for this research: "Applying Costing Models for Competitive Advantage" I will have access to information, which is confidential and should not be disclosed. I acknowledge that the information must remain confidential, and that improper disclosure of confidential information can be damaging to the participants.

By signing this Confidentiality Agreement I acknowledge and agree that:

1. I will not disclose or discuss any confidential information with others, including friends or family.
2. I will not in any way divulge, copy, release, sell, loan, alter or destroy any confidential information except as properly authorized.
3. I will not discuss confidential information where others can overhear the conversation. I understand that it is not acceptable to discuss confidential information even if the participant's name is not used.
4. I will not make any unauthorized transmissions, inquiries, modifications, or purging of confidential information.
5. I agree that my obligations under this agreement will continue after termination of the job that I will perform.
6. I understand that violation of this agreement will have legal implications.
7. I will only access or use systems or devices I am officially authorized to access and I will not demonstrate the operation or function of systems or devices to unauthorized individuals.

Signing this document, I acknowledge that I have read the agreement and I agree to comply with all the terms and conditions stated above.

Walden University policy on electronic signatures: An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically. Electronic signatures are regulated by the Uniform Electronic Transactions Act. Electronic signatures are only valid when the signer is either (a) the sender of the email, or (b) copied on the email containing the signed document. Legally an "electronic signature" can be the person's typed name, their email address, or any other identifying marker. Walden University staff verifies any electronic signatures that do not originate from a password-protected source (i.e., an email address officially on file with Walden).



Appendix C: Letter of Cooperation

Letter of Cooperation from [REDACTED]

[REDACTED]
Sr. Commodity Manager

September 25, 2015

Dear Ms. Petcavage,

Based on my review of your research proposal, I give permission for you to conduct the study entitled Applying Costing Models for Competitive Advantage within the [REDACTED]. As part of this study, I authorize you to conduct an interview followed by a member checking session with an executive level supply manager regarding TCO strategies used at the [REDACTED]. I understand you will invite mid-level supply managers to participate in a focus group session to share TCO strategies used in [REDACTED] procurement decisions. Individuals' participation will be voluntary and at their own discretion. In addition, I will share documentation of the supply management TCO policies, used in making supply decisions at this location.

We understand that our organization's responsibilities include access to supply management personnel and room availability if required for the focus session. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting and that this plan complies with the organization's policies.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the student's supervising faculty/staff without permission from the Walden University IRB.

Sincerely,

[REDACTED]

Appendix D: Invitation to Participate in Research

Semi-structured interview invitation:

Greetings Participant!

I invite you to take part in a research study exploring strategies used to gather total cost of ownership when making purchasing decisions. Your participation in this study is of great value, as you are a member of the senior management team, employed at a large company that uses a total cost of ownership (TCO) costing model in making procurement decisions. As a participant, you will answer interview questions at a time and place convenient to you. The interview will take about an hour. I will also ask you to meet a second time for 30 minutes for member checking and to confirm my interpretation of your responses.

If you are willing to participate in this study, please read the attached consent form and respond as directed in the consent form.

I am happy to answer any questions you may have and look forward to hearing from you.

Best regards,

Sheila Petcavage

Focus Group invitation:

Greetings Participant!

I invite you to take part in a research study exploring strategies used to gather total cost of ownership when making purchasing decisions. Your participation in this study is of great value, as you are a member of the supply management team, employed at a large company that uses a TCO costing model in making procurement decisions. As a participant you will partake in a face-to-face-group session, lasting about two hours in duration, answering questions in relation to the study. As these sessions are informal and a flip chart will be used to capture responses, an outside individual will help to record your responses. This individual has signed a Confidentiality Agreement for your protection and the protection of your company.

If you are willing to participate in this study, please read the attached consent form and respond as directed in the consent form.

I am happy to answer any questions you may have and look forward to hearing from you.

Best regards,

Sheila Petcavage