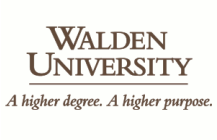

2015

Perceptions of Value-Stream Costing and the Effect on Lean-Accounting Implementation

Patricia Hart Timm
Walden University

Walden University

College of Management and Technology

This is to certify that the doctoral dissertation by

Patricia Timm

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Jeffrey Prinster, Committee Chairperson, Management Faculty
Dr. Godwin Igein, Committee Member, Management Faculty
Dr. Robert Aubey, University Reviewer, Management Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2015

Abstract

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on Lean-Accounting Implementation

by

Patricia Hart Timm

MS, Ferris State University, 1996

BA, Michigan State University, 1982

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Management

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August 2015

Abstract

In response to the competitive global economy, lean manufacturing has become more prevalent in the United States. Manufacturing has changed, but cost accounting has not. Lean manufacturing has the potential to change the U.S. manufacturing economy, resulting in positive economic social change, yet it requires lean accounting to increase successful implementations. This study addressed the problem of lack of adoption of lean-accounting techniques like value-stream costing in lean-manufacturing enterprises. The purpose of this nonexperimental explanatory study was to investigate factors that influence the adoption of lean accounting. Using the technology acceptance model (TAM), based on the theory of reasoned action and the theory of planned behavior, this study examined whether management accountants' perceptions of the ease of use (PEOU), or perceived usefulness (PU) of value-stream costing may influence their intention (BI) to implement value-stream costing. The 2,307 attendees of the Lean Accounting Summit from 2005–2013 were invited to participate in an online survey; 70 attendees agreed to participate. Descriptive statistics, Pearson correlation coefficient, and multiple regressions were calculated. Statistically significant positive relationships emerged between PEOU, PU, and the intention to implement value-stream costing. Also, PEOU and PU for the individual accounted for 51% of the variance of BI, and PEOU and PU for the organization accounted for 49% of the variance of BI. This study added to the understanding how management accountants' perceptions positively influence their intention to implement value-stream costing. The relationships found by this study will create positive social change when used to influence the adoption of value-stream costing in order to increase the successful implementation of lean manufacturing in the U.S.

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Dedication

To my daughters, Katelyn and Diana, who have persevered through my adventures in higher education for approximately half their lives. Their unconditional love and support humbles me. Their dedication to their education, careers, and families is inspiring. I am blessed to be their mom. To my husband, Larry, who entered this odyssey late in the process, and became my number one cheerleader, coach, and counselor. He allowed me the freedom to pursue this dream with confidence in his love and support. To my parents and stepparents who always had encouraging words and never doubted I could accomplish whatever I dreamed. They each found special ways to let me know they loved and supported me. I am so very blessed to be loved by such wonderful people. I fully understand these blessings come from God and without His love and grace; I would not be where I am today.

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Chapter 1: Introduction to the Study

Management accounting is the internal accounting system that generates information needed by internal users to make decisions about business operations. Management accounting and the associated inventory costing for manufacturing has not changed since the early 20th century, yet manufacturing processes have changed. *Lean manufacturing* created a radical change in manufacturing from large-batch processing to one-piece processing, yet little changed in most accounting departments.

Accountants developed *lean accounting* to provide accounting information that is relevant and useful to lean manufacturers (Maskell, Baggaley, & Grasso, 2011). The standard cost-accounting procedures of traditional management accounting do not provide the information needed and can provide misleading information (Fullerton, Kennedy, & Widener, 2014; Maskell et al., 2011). Although some lean manufacturers are using lean accounting, the majority of lean manufacturers are not (Fullerton & Kennedy, 2010; Rao & Bargerstock, 2011). This dissertation addresses why management accountants in lean manufacturing environments are not embracing lean accounting. Researchers noted the paucity of research into this problem (Fullerton & Kennedy, 2010; Fullerton et al., 2014; Rao & Bargerstock, 2011), providing support for this study, which used the technology acceptance model (TAM) to examine whether the *perceived usefulness* (PU) and *perceived ease of use* (PEOU) of value-stream costing influence the intention to implement value-stream costing, a lean-accounting technique.

Companies seeking to be more competitive have implemented lean manufacturing which, if successful, improves the economy, maintains or creates new jobs, leads to increasing profits, and supports positive social change. Successful lean implementations

require all departments to participate, including accounting (Fullerton et al., 2014), yet accounting departments have been barriers to lean implementations (Li, Sawhney, Arendt, & Ramasamy, 2012), which led to the development of lean accounting. This study may help determine factors that influence management accountants' decisions to implement lean accounting. Strategies developed by determining what influences management accountants to accept lean accounting may increase successful lean implementations (Darabi, Moradi, & Toomari, 2012) and consequently, positive social change.

This chapter includes a discussion of the background of the problem, the problem statement, the purpose of the study, and the research questions and hypotheses. I examine the theoretical framework for the study next, discussing the nature of the study, definitions, assumptions, scope, delimitations, and limitations. Finally, the chapter provides the significance of the study.

Background of the Problem

Modern cost accounting developed in the early 20th century when labor was the largest cost component of a manufactured product (Giroux, 1996; Johnson & Kaplan, 1987), and although technology and process improvements have changed manufacturing, cost accounting continues to value inventory and assign costs based on outdated assumptions (Chiarini, 2012; Maskell & Katko, 2007; Solomon & Fullerton, 2007). The adoption of lean-manufacturing processes challenges the basic assumptions of standard cost-accounting methodology (Chiarini, 2012; Fullerton et al., 2014; Maskell et al., 2011). Timely, accurate, and understandable financial information that measures performance would meet the needs of all users, including internal users (Cunningham &

Fiume, 2003; Fullerton et al., 2014; Rao & Bargerstock, 2011; Solomon & Fullerton, 2007). Accounting departments have blocked successful lean implementations when they have not changed and become a lean-support system (Cunningham & Fiume, 2003; Fullerton et al., 2014; Grasso, 2007). Accounting must provide measurements that support management decision making and determination of the financial impact of lean implementations (Fullerton et al., 2014; Maskell et al., 2011).

To understand the need for management accountants to implement lean accounting, one must understand the differences between traditional mass production and lean manufacturing, first identified by Womack, Jones, and Roos (1991), and named by Krafcik. Womack, Jones, and Roos (2007) approached definitions of lean by contrasting it with traditional craft and mass production; for this study, I use the term *lean* interchangeably with lean manufacturing, lean-production systems, and the *Toyota Production System* (TPS). Many definitions and understandings exist for lean (Hart, 2012). Although Womack et al. (2007) and others provided many examples of the differences between lean manufacturing and traditional manufacturing, many researchers consider the main objective of lean to be waste reduction (Schonberger, 2008; Smart et al., 2003).

Schonberger (2008) argued that organizations have focused on the waste-reduction component of lean because it achieves quick, measurable results, but ignores other principles of lean and TPS. Many types of organizations have implemented techniques developed by Toyota, but have not taken a holistic approach (Liker & Hoseus, 2010). The *just-in-time* concept developed by Toyota is an example of waste reduction, yet it is only one segment of the Toyota model (Liker & Hoseus, 2010). The TPS is a

broader philosophy that includes building quality into each step of the process and not allowing defects to continue through the system (Liker & Hoseus, 2010). The foundation of TPS is stable, repeatable processes with employees motivated to identify and solve problems at the center (Liker & Hoseus, 2010).

Lean thinking is easy to explain but not to implement. The overall goal of lean is to produce the highest quality with the shortest lead-time and lowest cost (Van Goubergen & Van Dijk, 2011). The TPS uses five steps (Womack, Jones, & Roos, 2003):

1. Correctly identifies *value* for the customer.
2. Identifies the *value stream* and removes waste.
3. Makes the product flow.
4. Responds to customer orders (pull).
5. Manages toward perfection.

Many companies mistakenly focus only on waste reduction (Hart, 2012).

The value of lean is that by reducing steps in a process, inefficiencies will be more readily identified, which allows for problems that create waste to be addressed and the system strengthened (Bhasin & Burcher, 2006; Hart, 2012; Liker & Hoseus, 2010). Another benefit of lean was increased competitiveness because of the reduction in lead-time, increased labor productivity, higher profitability, and intangible benefits that are difficult to quantify (Bhasin & Burcher, 2006). Likewise, Czabke, Hansen, and Doolen (2008) viewed the Womack et al. (2007) definition as a multidimensional approach to doing business with the primary focus on waste reduction. Waste could result from mistakes, correction of mistakes, production of unwanted items, unnecessary production steps, unnecessary movement or transport of employees, unnecessary movement or

transport of goods, downstream waiting, goods or services that do not meet customer needs, unused employee creativity, and repeated mistakes (Czabke et al., 2008).

By using the term lean manufacturing interchangeably with the creation of a lean-manufacturing organization, a misunderstanding can arise that lean only applies to the manufacturing process. That misperception can impede the progress of implementing lean principles across the organization (Hart 2012; Solomon & Fullerton, 2007). Companies implementing lean have begun to understand that lean is an enterprise-wide initiative and requires support of the whole organization (Cunningham & Fiume, 2003; Fullerton et al., 2014; Solomon & Fullerton, 2007).

The first principle of lean is to identify what creates value for the customer (Maskell et al., 2011; Womack et al., 2003). The concept of value streams ensures that every business activity adds value for the customer. A value stream can produce a product or provide a service that includes all steps, even those that do not add value to the customer (Cunningham & Jones, 2007; Maskell et al., 2011). In manufacturing, a value stream involves more than just the manufacturing process and includes all processes that support manufacturing (Maskell et al., 2011). Lean principles dictate that continuous improvement efforts must identify and remove waste in processes that do not add value for the customer; therefore, companies must identify and eliminate non-value-added steps (Maskell et al., 2011).

The primary purpose of a manager in a lean enterprise is to focus on how to improve the flow of work, strive for perfection, and satisfy customers by focusing on each value stream (Baggaley & Maskell, 2003a). The more mature a lean manufacturer becomes, the greater the need to manage each value stream. Each value stream must have

a manager assigned with the responsibility of managing the profit and loss of that value stream (Baggaley & Maskell, 2003a). Effective value-stream managers assign revenues and expenses to each value stream (Cunningham & Jones, 2007).

In response to the needs of lean manufacturing, accountants developed lean accounting to provide relevant, useful, and timely financial and performance information to better manage a business, using financial and performance measures designed to capture data at a more granular level of operation when compared to traditional costing techniques (Rao & Bargerstock, 2011). Lean accounting and *accounting for lean* have been used interchangeably in practice (Solomon & Fullerton, 2007); however, the two concepts differ significantly (Timm, 2013). Lean accounting uses lean tools to eliminate waste in the accounting function (Cunningham & Fiume, 2003; Solomon & Fullerton, 2007) whereas accounting for lean is the process that captures the financial benefits of a lean implementation (Solomon & Fullerton, 2007).

Solomon and Fullerton (2007, p. 37) provided a definition for lean accounting:

- An accounting process that uses the lean tool kit to minimize the consumption of resources that add no value to a product or service in the eyes of the customer. A discipline focused on providing actionable information to users and eliminating transactions, reports, and historical data collection.
- A department of financial advisors to a series of focused factories, along with associates who are involved in the day-to-day activities of all areas of the company who are willing to work in the plant and participate in lean activities.

- An accounting department whose lean efforts are fully compliant with generally accepted accounting principles (GAAP) and all internal and external reporting requirements.

Similarly, Solomon and Fullerton (2007, p. 39) offered a definition of accounting for lean:

- An accounting process that provides accurate, timely, and understandable information to motivate a lean transformation throughout the organization and improve decision making, which leads to increased customer value, growth, profitability, and cash flow.
- An accounting process that supports the lean transformation by providing relevant leading as well as lagging metrics and actionable information that enables continuous improvement at every level of the organization.
- An accounting process that uses value-stream costing, plain-English profit-and-loss statements, box scores, and other straightforward means to convey performance activity.
- An accounting process that meets the needs of all of its customers, including tax authorities, the board of directors, creditors, internal and external auditors, and internal customers such as manufacturing.

Although lean accounting includes two strands of definitions, this paper uses lean accounting as a global term encompassing lean accounting and accounting for lean.

Lean accounting promotes use of a *plain-English financial statement* that is GAAP compliant, yet easier for nonaccountants to read and interpret (Kennedy &

Brewer, 2006; Maskell, 2006). Lean accounting includes all costs with no distinction between product and period costs. Although traditional full absorption-costing financial statements hide the change in inventory, lean statements clearly report the change in inventory and the associated impact on income (Kennedy & Brewer, 2006). A traditional financial statement, shown in Figure 1, and the plain-English financial statement shown in Figure 2 were adapted from Maskell and Kennedy (2007).

	Period 1		**Period 2**	
Customer Sales	$ 998,977		$ 1,039,440	
Systems Sales	1,002,466		1,009,246	
Total Revenue	2,001,443		2,048,686	
Cost of Goods Sold	1,621,169	81%	1,687,800	82%
Gross Margin	380,274	19%	360,886	18%
Adjustments				
Purchase Price Variance	(60,466)		(59,467)	
Materials Usage Variance	94,533		96,733	
Labor Variance	(19,718)		(93,895)	
Overhead Absorption Variance	38,341		182,577	
SG&A	129,889	6%	135,215	7%
Net Profit	$ 197,695	10%	$ 99,723	5%

Figure 1. Traditional financial statement.
Source: "Why do we need lean accounting and how does it work?" by B. Maskell & F. Kennedy, 2007, *Journal of Corporate Accounting & Finance, 18*(3), 59–73, doi:10.1002/jcaf.20293

	Period 1		Period 2	
Customer Sales	$ 998,977		$ 1,039,440	
Systems Sales	1,002,466		1,009,246	
Total Revenue	2,001,443		2,048,686	
Materials	829,936	41%	609,526	30%
Direct Labor	305,767	15%	312,964	16%
Support Labor	340,245	17%	342,421	17%
Machines	113,862	6%	116,550	6%
Outside processing	60,043	3%	53,731	3%
Facilities	40,250	2%	41,200	2%
Other Costs	12,009	1%	9,664	1%
Total cost of goods sold	1,702,112		1,486,056	
Gross Margin	299,331	15%	562,630	27%
Inventory Adjustments	(41,593)		(401,426)	
Corporate Allocations	60,043		61,461	
Net Profit	$ 197,695	10%	$ 99,723	5%

Figure 2. Plain English statement.
Source: "Why do we need lean accounting and how does it work?" by B. Maskell & F. Kennedy, 2007, *Journal of Corporate Accounting & Finance, 18*(3), 59–73, doi:10.1002/jcaf.20293

The traditional financial statement is difficult for nonaccountants to understand, as are the root causes of the variances (Solomon & Fullerton, 2007). It is impossible to determine if the results included increasing or decreasing inventory, or to know what was spent on material, labor, or overhead in the period. The plain-English financial statement is a simple presentation that allows readers to monitor expenses. Material is usually the largest expense and is easily identified. Managers are also able to monitor if overproduction affected the period results by tracking inventory adjustments. Negative inventory adjustments result from selling items out of inventory. As shown in Figures 1 and 2, the current period costs in Period 2 were lower than in Period 1, but the cost of

inventory manufactured in earlier periods that was sold in this period increased the costs by $401,426. If there had been overproduction and product was retained as inventory instead of being sold, the reduction in cost for the period would have shown as a positive figure in the inventory adjustment. This would directly show the impact of the overproduction on the income for the period.

A significant difference between lean accounting and traditional accounting is that a lean organization's costing is based on value streams compared to costing based on departmental or functional divisions in traditional accounting (Haskin, 2010; Kroll 2004; Maskell, 2006). Value-stream costing and the associated plain-English financial statements may assist managers by clearly highlighting improvements that are hidden in traditional financial statements (Cooper & Maskell, 2008; Maskell, 2006). Traditional cost accounting requires detailed and complex cost allocations (Maskell, 2006). In general, value-stream costing avoids arbitrary allocations whenever possible (Kennedy & Brewer, 2006).

Lean accounting using value streams treats most costs as direct and requires very few allocations (Haskin, 2010; Maskell, 2006). Occupancy costs are an exception, allocated based on square footage used to motivate value streams to minimize their space usage (Kennedy & Brewer, 2006; Maskell, 2006). Management accountants assign resources to value streams with as little sharing of resources as possible (Kennedy & Brewer, 2006; Maskell, 2006). Kennedy and Brewer (2006) found no distinction between product costs and period costs in a lean financial statement because cost is defined as the total cost of moving the product through the value stream.

Chapter 2 will include a thorough discussion of current literature on management accounting, standard costing, full-absorption costing, lean manufacturing, value streams, and lean accounting. The literature highlights the benefits of lean accounting for lean manufacturers, and the apparent slow response of management accountants to implement the new costing system. A lack of research exists to explain why management accountants in lean-manufacturing organizations do not change their accounting practices to align with lean-manufacturing principles.

Problem Statement

Companies have implemented lean-manufacturing processes, but continue to use traditional standard costing, even when using value streams for manufacturing (Cunningham & Jones, 2007; Fullerton et al., 2014). Although accountants experienced in lean implementations clearly understand the value of lean accounting to organizations (Fullerton, Kennedy, & Widener, 2013), companies have been slow to implement lean accounting practices (Fullerton & Kennedy, 2010; Rao & Bargerstock, 2011). Researchers have difficulty gathering information about organizations using lean accounting because very few have implemented lean accounting (Fullerton & Kennedy, 2010) and accounting initiatives for lean implementations can be inadequate (Rao & Bargerstock, 2011). In addition, empirical studies to determine whether lean companies are changing management accounting systems (MAS) for product valuation and performance measures remain limited (Rosa & Machado, 2013). A review of the literature indicated few empirical studies that explain why lean accounting has not replaced standard costing in lean-manufacturing enterprises (Fullerton & Kennedy, 2010; Fullerton et al., 2014; Rao & Bargerstock, 2011). Companies know the potential value of

lean accounting; however, the reasons lean-manufacturing enterprises have not adopted lean accounting are not well understood (Rao, 2013; Rao & Bargerstock, 2011, 2013).

This study aimed to determine factors that influence the adoption of lean accounting by U.S. manufacturers that use lean-manufacturing techniques. To add to understanding of why lean accounting is or is not implemented by lean manufacturers in the United States, I selected the TAM (Davis, 1989) as the methodology to study the impact of PEOU and PU of value-stream costing on management accountants' *behavioral intention* (BI) to implement lean accounting using value-stream costing. An understanding of factors influencing the adoption of value-stream costing may increase future lean-accounting implementations and lead to positive social change.

Purpose of the Study

The purpose of this quantitative explanatory study was to investigate factors that influence the adoption of lean accounting in organizations that use lean manufacturing. The lack of research identifying why manufacturers using lean manufacturing do not use lean accounting indicates a gap in the literature, reported by many researchers (Fullerton & Kennedy, 2010; Fullerton et al., 2014; Rao & Bargerstock, 2011). Numerous reasons may explain why management accountants do not abandon the traditional standard costing model in favor of lean accounting. In this quantitative study, I examined whether concern about the complexity of value-stream costing, or accountants' perceptions that value-stream costing may not be useful to their organization or to their required job responsibilities, influenced their adoption of value-stream costing.

I used the TAM, developed by Davis (1989), to determine if the PEOU and PU influence the BI of accountants to implement value-stream costing. Value-stream costing

is a fundamental lean-accounting indicator and is the specific lean-accounting technique studied here; no extant research described the use of the TAM to study value-stream costing or any other indicators of lean-accounting adoption or implementation. Although many researchers have conducted TAM studies in other disciplines and for the adoption of diverse technologies (Benamati & Rajkumar, 2008; Hess, McNab, & Basoglu, 2014; Moqbel, Charoensukmongkol, & Bakay, 2013; Slatten, 2012), this study is a foundational TAM study for lean-accounting adoption and implementation.

Research Questions and Hypotheses

Q1. Do management accountants' perceptions of the usefulness of value-stream costing to the individual and to the organization relate to their intentions to implement value-stream costing?

$H_{1 0}$. There is no significant relationship between management accountant PU for the individual and value-stream costing adoption, as measured by BI.

$H_{1 a}$. There is a significant relationship between management accountant PU for the individual and value-stream costing adoption, as measured by BI.

$H_{2 0}$. There is no significant relationship between management accountant PU for the organization and value-stream costing adoption, as measured by BI.

$H_{2 a}$. There is a significant relationship between management accountant PU for the organization and value-stream costing adoption, as measured by BI.

Q2. Do management accountants' perceptions of ease of use of value-stream costing for the individual and for the organization relate to their intentions to implement value-stream costing?

$H_{3 0.}$ There is no significant relationship between management accountant PEOU for the individual and value-stream costing adoption, as measured by BI.

H_{3a}. There is a significant relationship between management accountant PEOU for the individual and value-stream costing adoption, as measured by BI

$H_{4 0.}$ There is no significant relationship between management accountant PEOU for the organization and value-stream costing adoption, as measured by BI.

$H_{4a.}$ There is a significant relationship between management accountant PEOU for the organization and value-stream costing adoption, as measured by BI.

Q3. How do management accountants' perceptions regarding usefulness to the individual and ease of use for the individual affect their intentions to implement value-stream costing?

$H_{50.}$ PU to the individual and PEOU for the individual are not significant predictors of value-stream costing adoption, as measured by BI.

$H_{5a.}$ PU to the individual and PEOU for the individual are significant predictors of value-stream costing adoption, as measured by BI.

Q4. How do management accountants' perceptions regarding usefulness to the organization and ease of use for the organization affect their intentions to implement value-stream costing?

$H_{6 0.}$ PU to the organization and PEOU for the organization are not significant predictors of value-stream costing adoption, as measured by BI.

$H_{6a.}$ PU to the organization and PEOU for the organization are significant predictors of value-stream costing adoption, as measured by BI.

Theoretical Framework

In this study, I used the TAM, developed by Davis (1989), which is based on the theory of reasoned action (TRA) and the theory of planned behavior (TPB) developed by Ajzen and Fishbein (1980). The TRA purports that intention to perform a specific behavior determines behavior, with the intention influenced by the individual's attitude toward the behavior and the subjective norm (Ajzen & Fishbein, 1980). Theorists argued the best predictor of behavior is intention (see Figure 3); thus, TRA extended to TPB by adding perceived behavioral control (Ajzen, 1991). The more favorable the attitude and subjective norm toward the behavior, and the greater the perceived behavioral control and the stronger the individual's intention to perform the behavior (Ajzen, 1991). Perceived behavioral control describes the perceived ease or difficulty of performing a behavior (Moqbel et al., 2013; see Figure 4). Davis developed the TAM using the TRA and TPB to explain how usefulness and the ease of use of a new technology influence the planned use of the technology, and developed the TAM instrument to measure these influences. As this is a first study of TAM to address the problem of the paucity of lean-accounting adoption, the study stands on this theoretical framework of TRA and TPB.

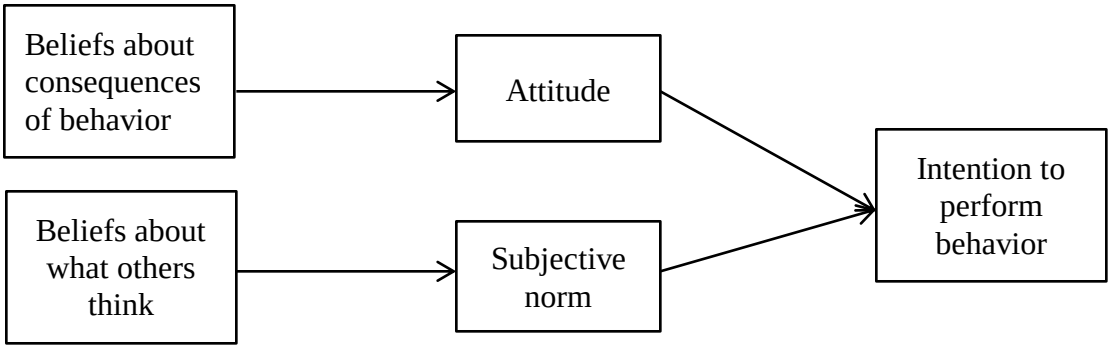

Figure 3. Theory of reasoned action.

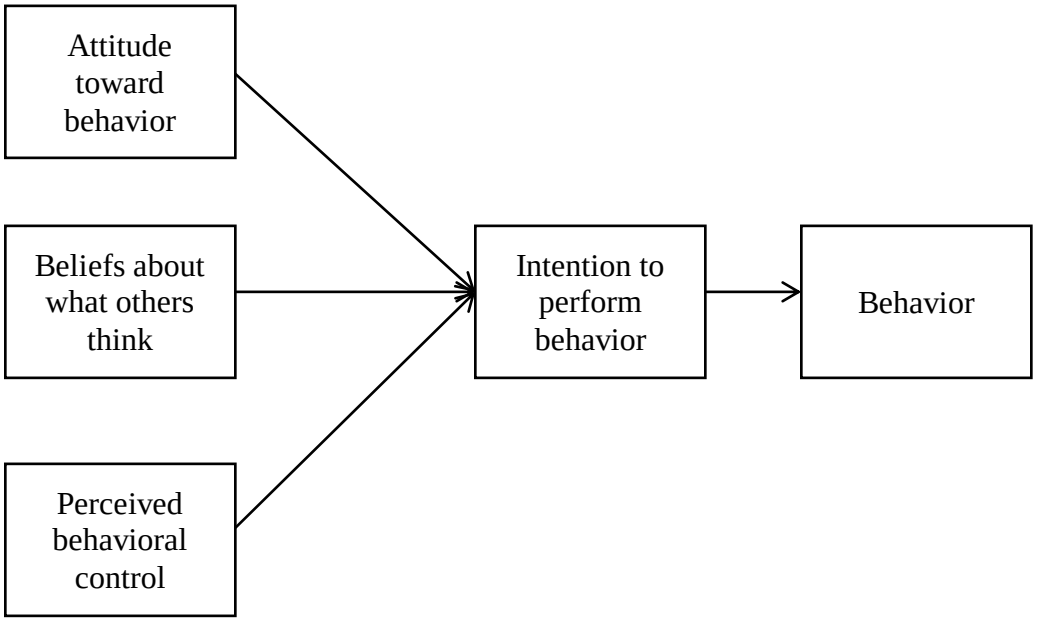

Figure 4. Theory of planned behavior.

Currently in the United States, accountants must follow GAAP. GAAP is the overarching theoretical framework for U.S. accounting. Although management-accounting reports do not have to be GAAP compliant, they must align with tax and financial-reporting standards for consistency. The lean-accounting principles included in this study, specifically value-stream costing, are acceptable under GAAP. The purpose of financial accounting is to generate financial statements and annual reports for use by

informed external and internal users. GAAP governs financial reporting. The purpose of management accounting is to provide financial and nonfinancial information used internally to make decisions and measure operational performance (Garrison, Noreen, & Brewer, 2006) and does not require GAAP compliance.

GAAP incorporates cost-accounting principles from the early 1900s into financial accounting (Giroux, 1996). Alignment with GAAP requires full absorption costing to separate total production costs into cost of goods sold and ending inventory (Horngren, Datar, & Rajan, 2012). Tax and financial-reporting cost-accounting requirements became the standard for management reporting, which ensures fair presentation of financial statements, but may not be useful for making management decisions (Garrison et al., 2006; Horngren et al., 2012). Accountants developed lean accounting to be GAAP compliant and provide useful management reports (Cunningham & Fiume, 2003; Fullerton et al., 2014; Solomon & Fullerton, 2007).

Financial Accounting Standards Board Concept Statement No. 6 defines cost as an economic sacrifice. Cost accounting provides methods to determine manufacturing costs to match costs to the associated revenues generated in the accounting period. Although lean accounting does not violate GAAP (Cunningham & Fiume, 2003), some resistance to change comes from a misconception that any costing method, other than a detailed standard costing system by unit, is not GAAP compliant. The use of plain-English financial statements and value-stream costing is GAAP compliant as GAAP is based on the principles of materiality, conservatism, consistency, and matching, which will be observed when developing new cost-accounting methods for lean. These principles will be discussed in more detail in Chapter 2.

When discussing accounting issues in the United States, researchers must address the impact of convergence with International Financial Reporting Standards (IFRS). The global economy has made it necessary to find mutually acceptable accounting standards to ensure comparability of financial statements with a common financial language. The Securities and Exchange Commission set 2015 as the earliest possible date for IFRS adoption (Moqbel et al., 2013), which requires U.S. accountants to consider the impact. Although lean accounting is a management-accounting issue, and, therefore, not required to be GAAP or IFRS compliant, the aspects of the costing methodology that impact inventory valuation and cost of goods sold on the financial statement must be GAAP and IFRS compliant.

As explained earlier in the discussion of GAAP, it is possible to use lean accounting and have GAAP-compliant financial statements. This topic will also be discussed in Chapter 2, based on a review of the literature. According to Moqbel et al. (2013), GAAP and IFRS are different in that GAAP are rules-based, whereas IFRS is based on principles and relies heavily on accountants' judgment. The principles-based philosophy of IFRS should be even more accepting of the procedures used to value inventory and measure cost of goods sold by lean accounting because lean accounting relies more heavily on the accountant's value judgments.

The TRA purports that intention to perform a specific behavior determines behavior, with the individual's attitude influencing intention toward the behavior and the subjective norm (Ajzen & Fishbein, 1980). Further, Ajzen and Fishbein (1980) argued the best predictor of behavior is intention (see Figure 3). The TPB extends the TRA, adding perceived behavioral control (Ajzen, 1991). The more favorable the attitude and

subjective norm toward the behavior, and the greater the perceived behavioral control, the stronger the individual's intention to perform the behavior (Ajzen, 1991). Perceived behavioral control describes the perceived ease or difficulty of performing the behavior (Moqbel et al., 2013; see Figure 4).

The TAM developed from the TRA and TPB, with additional support from expectancy theory, self-efficacy theory, the cost–benefit paradigm, and the channel-disposition model. Davis (1989) suggested that those creating new technology would benefit from the ability to assess users' acceptance of new products, and managers in organizations contemplating purchases would be able to assess the value provided by the technology. Davis developed the TAM to predict users' acceptance of technology, based on two specific variables: PU and PEOU. Bagozzi (2007) stated, "TAM is a remarkable model and has had an incredible effect on empirical research for a long time" (p. 252). Researchers have extended and revised the TAM, which may influence the reliability of the model (Hess et al., 2014; Ma & Liu, 2004; Schepers & Wetzels, 2007). It is important to understand the original work of Davis before applying the model.

Davis (1989) studied multiple theoretical perspectives to conclude that PU and PEOU were key determinants of behavior. Davis defined PU as "the degree to which a person believes that using a particular system would enhance his or her job performance" (1989, p. 320). Davis defined PEOU as "the degree to which a person believes that using a particular system would be free of effort" (1989, p. 320). The multidisciplinary research Davis reviewed indicated that PU and PEOU were distinct constructs that influenced decisions to use information technology (IT). Figure 5 diagrams the TAM.

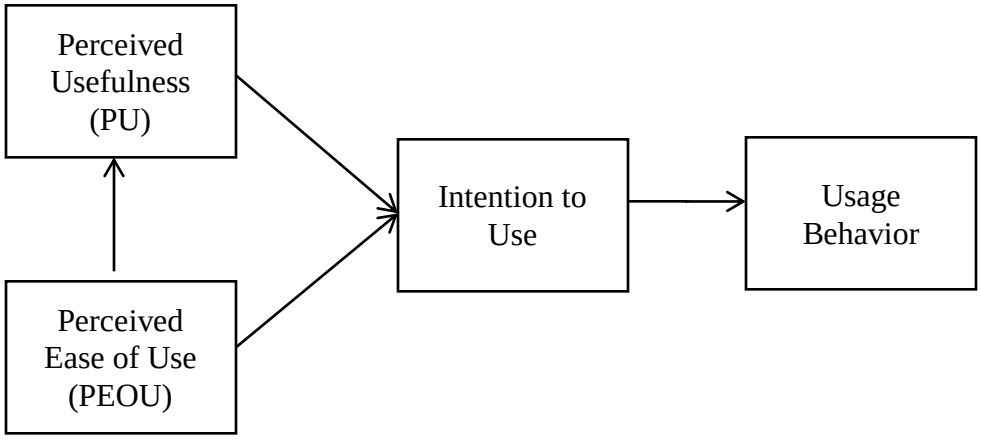

Figure 5. Technology acceptance model.

Schwarze, Wullenweber, and Hackethal (2007) used the TRA and TPB to analyze the drivers of and barriers to change in management accounting in the banking industry. Moqbel et al. (2013) argued implementation of IFRS would require significant IT application changes; therefore, the TAM is an appropriate theoretical model for this study. Snead, Johnson, & Ndede-Amadi (2005) found implementing new inventory-costing systems had similar issues to information-system (IS) implementations. New costing methods constitute a new IS and are subject to the same user-acceptance concerns as those influencing new IS implementations (Snead et al., 2005). Based on a search of literature related to TRA, TPB, and TAM, I used the TAM to measure management accountants' perception of the usefulness and the ease of using value-stream costing.

Nature of the Study

In response to the change in manufacturing processes caused by lean implementation, industry stakeholders expected management accountants to change management-accounting practices (Baines & Langfield-Smith, 2003; Fullerton et al.,

2014). Davis (1989) created the TAM as a survey. It has become one of the most popular models used to predict use and acceptance of technology by individual users (Chuttur, 2009; King & He, 2006; Surendran, 2012).

A quantitative, explanatory design aided in determining inferential relationships (Babbie, 2013) and offered explanations for predictors of lean-accounting adoption based on TAM principles. In this study, I examined four independent variables: PEOU for the individual (PEOU-I) and the organization (PEOU-O), PU for individuals (PU-I) and organizations (PU-O), and the dependent variable of BI of management accountants to adopt lean accounting using value-stream costing. I obtained permission to use Davis' (1989) TAM instrument, a 7-point Likert-type survey, as the study instrument, due to its usefulness in collecting study variables and describing the study sample for explanatory purposes (Babbie, 2013; see Appendix A). Researchers have justified the use of the 7-point Likert scale to collect interval-level data in previous TAM studies across disciplines (Benamati & Rajkumar, 2008; Davis, 1989; Yoon, Duff, & Ryu, 2013), as it measures perceptions on a continuous interval scale (Field, 2013). The TAM employs a quantitative methodology, and this study examined the variables in the context of lean accounting, based on the three constructs operationalized as five variables (PEOU-I, PEOU-O, PU-I, PU-O, and BI), measured on a 7-point Likert-type scale (1 = strongly disagree; 7 = strongly agree), in response to questions adapted from the original TAM survey.

The TAM instrument is appropriate for use in this study because the literature supported analyzing costing activities using IS methodologies: specifically, activity-based costing (ABC),which was developed to gather more detailed cost information in an

effort to control costs (Garrison et al., 2006; Horngren et al., 2012; Hutchinson & Liao, 2009; Johnson, 2002). Snead et al. (2005) found some organizations were unsuccessful in implementing ABC, and argued their concerns were the same as those found by researchers who studied IS implementation. Activity-based costingwas subject to the same user-acceptance concerns that have hindered new IS implementations.

Snead et al. (2005) also found that ABC implementation was similar to IS implementations because the gap between management IT development and its effective implementation was based on behavior-related factors. Value-stream costing, like ABC, is a new costing system accountants use to overcome the limitations of traditional standard cost systems. Snead et al. found the use of expectancy theory as a framework to study the implementation of new costing systems to be a reasonable model. Because researchers developed the TAM based on expectancy theory, and Snead et al. found support for the use of expectancy theory, using the TAM from IS-implementation research is therefore a reasonable model to study value-stream costing implementations.

Lee, Yen, Peng, and Wu (2010) also argued ABC was an IS to be studied using IT-acceptance research models. Using the unified theory of acceptance and use of technology (UTAUT), Lee et al. found performance expectancy and social influence had a significant positive impact on change agents' intention to implement ABC. Change agents' intention to promote ABC usage and facilitating conditions were significant determinants of the extent of usage of ABC (Lee et al., 2010). Marchand and Raymond (2008) also used IS frameworks to study performance-measurement systems that are a function of management-accounting systems. The use of IT-acceptance frameworks by

Snead et al. (2005), Marchand and Raymond, and Lee et al. were important extensions of IT-acceptance models to management-accounting-related research.

According to Brown, Dennis, and Venkatesh (2010), technology adoption was one of the most mature areas of IT research. The TAM, cited more than 2,400 times, has been used across a wide range of technology tools (Hess et al., 2014). Venkatesh, Morris, Davis, and Davis (2003) stated, "One of the most important directions for future research is to tie this mature stream of research into other established streams of work" (p. 470). By understanding the TAM, as applied to the acceptance of new technologies, researchers justified the use of TAM in other complex processes, such as lean-accounting adoption.

Osgood, Suci, and Tannenbaum (1957, as cited in Ajzen & Fishbein, 1980), developed semantic differential techniques to measure the meaning of an object; researchers use these techniques widely to measure attitude (Young, 2010), adapted for use in the TAM (Davis, 1989). This study extended the usage of the TAM to lean accounting to determine possible explanations and impediments for adoption or implementation of value-stream costing. Additionally, descriptive data aided in assessing the level of lean implementation in participants' organizations.

The TAM's validity and reliability to predict technology acceptance provides researchers and practitioners the opportunity to extend the model to multiple variables and varied technologies. Researchers studied multiple technologies and tasks using the TAM (Davis, 1989), including usefulness of documentation, decision making, and implementation of new accounting standards. The use of new technology requires users to perform tasks in new ways. Accounting processes are complex and changes to those processes require accountants to perform tasks differently. The technology acceptance

model offers a model to study management accountants' intention to change to a new inventory-costing method. The TPB, TRA, and TAM will be discussed in detail in Chapter 2.

Although Davis (1989) developed the TAM to study the impact of PEOU and PU on the intention to use technology, others have applied the TAM to intention to use software documentation (Scott, 2008) and outsourcing decisions (Benamati & Rajkumar, 2008). Management accounting is a technical field. Although it uses technology, the concepts and processes are complex; to implement and maintain them accountants must understand them.

Davis (1989) conceptualized PU as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320), applicable to the management-accounting process of value-stream costing. Would using value-stream costing make a management accountant more successful in providing accurate and timely data to managers? The concept of PEOU, "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320) may also apply to the implementation of value-stream costing. Because accountants have not been educated about lean accounting and associated value-stream costing, many questions and concerns arise during implementation. Accountant's perceptions about ease of use and usefulness may influence their intention to implement change.

I used an online survey on the SurveyMonkey engine. The TAM was the basis for the survey questions measuring PEOU, PU, and BI (see Appendix B). The descriptive and demographic questions in Part 2 of the survey are from a survey by Fullerton, representing a small portion of the survey Fullerton administered to Lean Accounting

Summit attendees from 2005 to 2008. Permission to use this survey appears in Appendix C. These questions were not of primary interest in this study, but may offer insights and areas for future research.

Using the TAM, the dependent variables were PEOU and PU of value-stream costing for the individual and PEOU and PU of value-stream costing to internal organizational users. The independent variable was the intention of management accountants to implement value-stream costing, measured without asserting control over their behavior. The independent and dependent variables were measured at a point in time and not longitudinally. This design answered the research questions related to the measurement of perceptions of management accountants as to the usefulness and ease of use of value-stream costing. The design also determined the relationship of the perceptions of management accountants to the intention to implement value-stream costing.

The findings from this study may be generalizable to accountants in all firms that use lean manufacturing. However, because the size of that population is not currently well understood, I chose participants in the annual Lean Accounting Summit as the population of interest. The Lean Accounting Summit promotes lean accounting for lean manufacturers by educating management accountants in lean and lean-accounting principles. I assumed attendees of the Lean Accounting Summit attend to gain insights into how lean accounting is beneficial to their lean organizations. The Lean Accounting Summit would only be of interest to those familiar with lean principles. Previous researchers surveyed 2005–2008 attendees (Fullerton & Kennedy, 2010; Fullerton et al., 2013, 2014). This study examined attendees from 2005 through 2013.

The size of this population was 2,307. Lean Frontiers, the organization that developed and maintains the Lean Accounting Summit, provided 2,307 e-mail addresses. For the study, I invited the entire population of Lean Accounting Summit attendees for the years 2005 through 2013 to participate. To ensure an adequate sample size and minimize nonresponse error, I distributed surveys to the entire population. Using an *a priori* sample-size calculator for multiple regression with two predictors and assumptions of a medium effect size of .15 and an alpha of .05, the minimum required sample size was 67 (Statistics Calculator, n.d.). Although I identified four independent variables, I calculated two multiple linear regressions, each with only two predictors. I assumed a very conservative 5% response rate would yield a sample of 117, which was greater than the minimum required sample size of 67.

I exported data from the survey results from SurveyMonkey.com into SPSS for analysis. Descriptive statistics measured PEOU and PU to the individual and organization, with mean and standard deviation of the related Likert-type survey questions. The results of the Likert-type questions for each independent variable were averaged to create a composite Likert scale item for each independent variable. I completed a multiple linear regression using the Likert scales for PU and PEOU to the individual as independent variables and the BI of management accountants as the dependent variable, along with a multiple linear regression using PU and PEOU to the organization as independent variables and the BI of management accountants as the dependent variable.

Definitions

Behavioral intention (BI): The cognitive representation of a person's readiness to perform a given behavior (Schwarze et al., 2007).

Lean. The business theory that considers expenditure of resources for any purpose, other than creating value for the customer, as waste and to be eliminated. Lean tools and techniques evolved from the TPS (Womack et al., 1991). When an organization implements lean, they are using lean principles to create a lean organization.

Lean accounting: The process that captures the financial benefits of a lean implementation and the use of lean tools to simplify the accounting process (Solomon & Fullerton, 2007).

Lean production. A manufacturing approach that strives to create value for the customer and eliminate any waste or inefficiencies in the production process (Womack et al., 1991).

Perceived ease of use (PEOU): The degree to which a person believes that using a particular system would be free of effort (Davis, 1989).

Perceived usefulness (PU): The degree to which a person believes that using a particular system would enhance his or her job performance (Davis, 1989).

Plain-English financial statements: A financial statement configured to meet the needs of the company, clearly identifying actual costs for a period without the use of variances, and isolating the impact of inventory fluctuations (Solomon & Fullerton, 2007).

Value: Constitutes worth from the customers' viewpoint in features or characteristics of the product or service (Womack et al., 1991).

Value stream: The sequence of processes through which a product is transformed from raw material to delivery to the customer. A value stream usually processes groups of related products that require the same production steps (Womack et al., 1991).

Value-stream costing: Recording revenues and expenses by value stream (Cunningham & Fiume, 2003)

Assumptions

In survey research, researchers assume respondents must have sufficient knowledge to answer the questions and they answer truthfully and conscientiously (Fullerton & Kennedy, 2010). This study used information from attendees of the Lean Accounting Summit because their exposure to lean-accounting topics gave them sufficient knowledge to answer the questions. I assumed participants would be truthful and conscientious. By keeping the anonymity of the participants, their responses were made without fear of reprisal. I also assumed participants were not influenced by the results of other surveys. Johns (2006) cautioned that context might affect functional relationships between variables and influence personal variables.

Scope and Delimitations

Why more lean manufacturers do not use lean accounting could be studied using different methodologies, populations, and variables. Little empirical evidence exists on the number of lean manufacturers using lean accounting (Fullerton & Kennedy, 2010; Rao & Bargerstock, 2011). Lean accounting has many components. For this study, I used the population of attendees of the Lean Accounting Summit over the years 2005–2013. Other researchers surveyed Lean Accounting Summit attendees from 2005–2008 and had a 54% response rate. When Rao (2013) surveyed members of the IMA, the response rate

was less than 5%. Although the issue is a management-accounting issue, I assumed Lean Accounting Summit attendees would have the knowledge required and the motivation to respond to the survey. Although the results may be generalizable to accountants in all firms that use lean manufacturing, results cannot be generalizable to the population of all management accountants.

Because little empirical data exists on lean accounting implementations, I chose a quantitative approach (Rao, 2013). Researchers have conducted case studies (Kennedy & Widener, 2008; Ruiz-de-Arbulo-Lopez, Fortuny-Santos, & Cuatrecasas-Arbós, 2013; Van Goubergen & Van Dijk, 2011) and used structural equations to examine lean-accounting implementations (Baines & Langfield-Smith, 2003; Fullerton et al., 2013; Fullerton & Wempe, 2005). Rao (2013) surveyed IMA members, but the low response rate and limited number of respondents familiar with lean accounting did not provide generalizable empirical data.

The TAM model was the theoretical framework. I used the associated survey instrument because management-accounting costing processes have the same concerns as IT systems (Snead et al., 2005) and can be studied using the same research models used to study IT (Lee et al., 2010). Researchers have used the TAM model extensively (Hess et al., 2014) and the instrument is considered robust (Chuttur, 2009; Schepers & Wetzels, 2007). The original TAM variables of PEOU, PU, and BI were used and no additional antecedents were studied. Researchers found the original variables to have reliability and validity over decades of use (Hess et al., 2014).

Lean accounting is a broad term that encompasses many concepts. Value-stream costing is significantly different from traditional standard costing (Cunningham & Fiume,

2003). The use of value-stream costing was an indicator of lean-accounting implementation. This study was limited to examining the implementation of value-stream costing as an indicator of lean-accounting implementation.

Limitations

In survey research, response rate can be a limitation. Researchers use the same techniques to increase response rate for mailed surveys as for Internet surveys (Babbie, 2013; Fowler, 2014). Explaining to respondents that they have been specifically selected and setting a deadline increases response rate (Babbie, 2013). As with any survey research, a nonresponse bias may exist (Frankfort-Nachmias & Nachmias, 2008). Many companies have a fiscal year that is a calendar year. Surveying management accountants at the end of December through the middle of January may have reduced the response rate because participants were busy with year-end closing processes; avoiding this time may have increased the response rate. To test for nonresponse bias, late responses were compared with early responses to determine if significant differences existed. Surveys are susceptible to reactivity, which causes systematic measurement error and relies on self-reporting of intention that cannot be observed (Singleton & Straits, 2010). I assumed respondents were honest in their responses, spent adequate time reading and responding, and did not suffer from survey fatigue. The methodology may have garnered limited results. Errors may have been made in the data analysis, calculating the sample, and generalizability.

Significance of the Study

Lean manufacturing has the potential to change the U.S. manufacturing economy, resulting in positive social change. When successfully implemented, lean offers positive

benefits to organizations. Czabke et al. (2008) found profitability increased, along with significant improvements in safety, improved cooperation between managers and employees, and the creation of a culture better able to solve problems. Although not a planned benefit, successful lean implementations created more positive views of managers by employees (Worley & Doolen, 2006). Many lean-implementation failures may have been caused by the failure of managers to change organizational culture and focus only on implementing specific lean tools.

Significance to Theory

This study was also significant for extending the use of the TAM to MAS procedural changes rather than the original purpose of study in IT implementations. Researchers proposed using the TAM to examine ABC (Kellermanns & Islam, 2004), but collected no empirical data. Although researchers used the TAM to examine the adoption of IFRS, they did not use the original TAM question format (Moqbel et al., 2013). This was the first empirical study using the TAM questionnaire applied to an accounting-system change that is procedural rather than a technology-tool implementation.

Significance to Practice

To become a successful lean organization, a company must commit to lean as a philosophy and not just specific tools to increase efficiency. The philosophy has to encompass more than just waste reduction. Organization leaders must recognize the need for continuous learning and improvement for the long term. Lean requires managers' support and empowered employees to be creative and innovative. A lean organization must be a learning organization, thereby distinguishing lean from other strategic manufacturing initiatives (Hart, 2012).

Lean accounting is essential to the long-term success of lean-manufacturing implementations. Successful lean implementations require a change in culture across the organization (Solomon & Fullerton, 2007). Management accountants must assist in building a cooperative culture for lean to be successful (Fullerton et al., 2014; Grasso, 2007); lean is not successful in a command-and-control culture (Grasso, 2007). This cultural shift requires management accountants to align with lean objectives and provide support to the organization by furnishing useful, timely, and relevant information.

This project was significant because it addressed an under researched area of managerial accounting. The results of the study provided insights into reasons accountants in lean-manufacturing enterprises do not eliminate standard costing in favor of lean accounting. Because successful lean implementation requires the organization's culture to change (Bhasin & Burcher, 2006), accounting in a lean organization must change to support the lean implementation. This change requires a commensurate change in longstanding assumptions and processes. As U.S. manufacturers implement the lean strategy, lean manufacturing has the potential to change the economy. Without the support of the accounting department, companies may experience difficulty in gaining long-term success with lean (Cunningham & Fiume, 2003; Fullerton et al., 2014; Grasso, 2007).

Significance to Social Change

For an organization to be successful, individuals' behavior must align with organizational objectives (Gong & Tse, 2009). It is essential to the success of lean manufacturers to understand the behaviors of management accountants with respect to lean accounting. This study created positive social change by adding to understanding of

how management accountants view value-stream costing and what barriers they may face in implementing value-stream costing.

Summary

Chapter 1 included the problem statement and described the theoretical framework of the study. The chapter contained the methods, operational definitions, assumptions, limitations, scope, and delimitations. Based on the background of the problem, available research methodologies, and the research questions, I provided a quantitative analysis using the TAM.

Chapter 2 includes a review of literature related to the theoretical foundation of the study and a historical review of the TAM and associated extensions. The chapter also details a review of literature on lean manufacturing, management accounting, and lean accounting, and provides an analysis of the use of the TAM (Davis, 1989). The literature review supports the significance of the study. The chapter concludes with justification for the study and recommended methodology.

A discussion of the methodology in Chapter 3 incorporated the survey instrument and participant-invitation letter. Chapter 3 provides a detailed description of the population, protection of the participants, survey-distribution procedures, and data handling. The chapter specifies the survey instrument and its validity and reliability, along with the data analysis. Chapter 4 incorporates the results of the study and Chapter 5 contains a summary of the results, the conclusions drawn from the data, and recommendations for future research.

Chapter 2: Literature Review

Introduction

This chapter provides a review of the literature related to lean manufacturing, management accounting, lean accounting, management-accounting research methods, and the TAM. The literature indicates the need for MAS to make changes when an organization implements lean-manufacturing principles as one factor associated with successful lean implementations. Although lean accounting principles were developed and are effective for lean-manufacturing organizations, management accountants have not embraced the change. The TAM is a valid research methodology to study management accountants' perceptions of value-stream costing and the associated intention to implement. The chapter includes a review of lean manufacturing, management accounting, and lean accounting, preceding the discussion of management-accounting research methods and concluding with the literature on the TAM.

Literature-Search Strategy

Peer-reviewed articles retrieved from multiple databases contributed to the literature review. I performed searches in Google Scholar, ProQuest, ABI/Inform Complete, Business Source Complete, and Thoreau. If full-text articles were unavailable electronically, library staff assisted in finding full-text articles. Searches were not limited by publication date because of the small number of articles written on lean accounting. To access the full breadth of lean accounting, the search was unlimited by time and included a search for books written on the topic. Literature from 2009 was the focus, but previous dates were included because of the limited scholarly research on lean accounting. Search terms included lean accounting, value-stream costing, lean

manufacturing, technology acceptance model, theory of reasoned actions, theory of planned behavior, management accounting interpretive research methods, and lean accounting survey. When authors had multiple articles on a topic, I performed additional searches to find all works by the author on the topic. Davis published the TAM in 1989, and extended it over time. Searches for Davis and TAM revealed additional articles by Davis and coauthors.

Theoretical Foundation

Currently in the United States, accountants must follow GAAP. Although management-accounting reports do not require GAAP compliance, tax and financial-reporting standards must be used in management-accounting reports for consistency. When IFRS convergence takes place, lean accounting will be compliant.

The Financial Accounting Standards Board defined materiality as the magnitude of an omission or misstatement in the financial statements that makes it probable that a reasonable person, relying on those financial statements, would have been influenced by the omitted information or made a different judgment if the correct information had been known (Epstein, Nach, & Bragg, 2009, p. 12). According to Cunningham and Fiume (2003), confusion exists between precision and accuracy. Precision requires calculations to extend to many decimal places; accuracy is the answer that is correct for the decision to be made (Cunningham & Fiume, 2003). Cunningham and Fiume argued that materiality is the borderline between precision and accuracy, based on the amount that would change a decision made using financial data. When companies implement lean manufacturing, they reduce inventory, which usually becomes immaterial to financial statements (Horngren et al., 2012).

The principle of conservatism is the profession's reaction to uncertainty (Epstein et al., 2009). Conservatism is anticipating losses but not gains (Cunningham & Fiume, 2003). Conservatism evolved from the desire to be cognizant of outside lenders' usage of financial statements and minimize the risk of uncertainty (Epstein et al., 2009). "Conservatism in accounting may mislead users if it results in a deliberate understatement of net assets and net income" (Epstein et al., 2009, p. 35). This approach may lead to future overstatements that may bring into question the reliability and neutrality of the statements (Epstein et al., 2009). Accounting literature indicated conservatism's influence on accounting practice had occurred over hundreds of years and some viewed it as the most influential principle of valuation in accounting (Watts, 2003).

The consistent application of accounting methods is a fundamental quality of accounting principles. GAAP allows costing methodology to change as long as a reasonable explanation exists and the change is properly disclosed. The goal of implementing lean accounting is to provide more useful information for decision making (Cunningham & Fiume, 2003). Consistency is only helpful if the method used provides useful information. If not, a change should be made and the new method used consistently in the future.

The matching principle requires that accountants must expense costs to manufacture goods in the period in which the revenue is recognized (Epstein et al., 2009). This becomes an important factor in accounting for lean manufacturing and offers opportunities to simplify accounting processes (Cunningham & Fiume, 2003). As inventory shrinks, and lead times shorten, goods may be manufactured and shipped in the same month. This eliminates the need to capitalize labor and overhead as inventory.

Accountants may express costs as current-period costs and fulfill the matching principle. Matching eliminates the need for complicated standard costing systems. Measuring cost requires judgment (Horngren et al., 2012). Alternative ways exist for accountants to define and measure costs. Because no requirements exist for a specific costing method, as long as the one used is reasonable and matches expenses to the associated revenue (Horngren et al., 2012), companies can use lean accounting and the associated value-stream costing.

The TRA proposes that intention to perform a specific behavior determines the intention, influenced by the individual's attitude toward the behavior and the subjective norm (Ajzen & Fishbein, 1980). The best predictor of behavior is intention (Ajzen & Fishbein, 1980): "the cognitive representation of a person's readiness to perform a given behavior" (Schwarze et al., 2007, pp. 5–6). Attitude greatly affects the behavior of the individual during the decision-making process (Ajzen, 1991) and is a reliable predictor of intention (Schwarze et al., 2007). Attitude is the degree to which an individual has a favorable or unfavorable evaluation of a particular behavior (Moqbel et al., 2013). The subjective norm is the perceived social pressure to perform or not to perform a behavior (Moqbel et al., 2013).

Researchers extended the TRA to the TPB by adding perceived behavioral control (Ajzen, 1991). The more favorable the attitude and subjective norm toward the behavior, and the greater the perceived behavioral control, the stronger the individual's intention to perform the behavior (Ajzen, 1991). Perceived behavioral control describes the perceived ease or difficulty of performing a behavior (Moqbel et al., 2013).

Davis (1989) developed the TAM using the TRA, additionally supported by self-efficacy theory, the cost–benefit paradigm, and the channel-disposition model, to determine if users' perception of usefulness and ease of use of new technology influenced the likelihood that the user would use the technology. Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). Perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). Perceived usefulness is equivalent to TRA and TPB measurements of attitude and subjective norms, whereas PEOU is the equivalent of behavioral control. Davis found both PU and PEOU significantly correlated with self-reported indicators of system use. Usefulness correlated more significantly to usage than ease of use (Davis, 1989).

Davis, Bagozzi, and Warshaw (1989) argued for the importance of understanding the determinants of PEOU because it influences intention in two ways:

1. PEOU has a direct effect on intention and an indirect effect on intention through PU.
2. PEOU is an initial hurdle that users have to overcome to accept, adopt, and use a new system.

Although PEOU aligns with the intention to use a system, the TAM does not predict usage. Research in behavioral decision making demonstrates individuals attempt to minimize effort in behaviors, which supports a relationship between intention and usage (Venkatesh, 2000). Despite extensive use, little had been done to understand the determinants of PEOU (Venkatesh, 2000).

Managerial Accounting

Management and financial accounting differ in the kinds of behavioral assumptions on which accounting systems build. Caplan (1966) discussed the traditional management-accounting model and the associated fundamental assumptions about human behavior. The management-accounting function is a behavioral function that is materially influenced by the view of human behavior held by the accountants who design and operate the accounting systems (Caplan, 1966). Caplan related behavioral assumptions of organizational theory to the objectives of management accounting (see Figure 6). These assumptions support the validity of lean accounting by identifying the relationship between management-accounting techniques and the motivations of people in the organization; the amount of discretion management accountants have when making choices in processing and reporting information; and the influence organizational goals on management accountants.

Assumptions with Respect to the Role of Managerial Accounting

A. The management-accounting process is an information system whose major purposes are
   1. To provide the various levels of management with data that will facilitate the decision-making functions of planning and control.
   2. To serve as a communications medium in the organization.

B. The effective use of budgets and other accounting-control techniques requires an understanding of the interaction between these techniques and the motivations and aspiration levels of the individuals to be controlled.

C. The objectivity of the management-accounting process is largely a myth. Accountants have wide areas of discretion in the selection, processing, and reporting of data.

D. In performing their function in an organization, accountants can be expected to be influenced by their own personal and departmental goals in the same way as other participants are influenced.

Figure 6. Behavioral assumptions from organizational theory.

Businesses operate in environments that continually change. Caplan (1966) defined good management as the ability to evaluate previous changes, react to current changes, and predict future changes, supporting the view that management is a decision-making process. Management accounting is an IS that provides data for management decision making (Caplan, 1966; Ryan, Scapens, & Theobald, 2002). Accountants must make decisions on which information is critical, how it should be processed, and who should receive it (Caplan, 1966). In manufacturing, when companies implement lean manufacturing, the information needed by decision makers changes, requiring the management-accounting process to change (Cunningham & Fiume, 2003; Solomon & Fullerton, 2007). The lack of changes in management accounting in lean manufacturers is the problem addressed by the study.

Researchers traditionally have divided accounting research between management accounting and financial accounting. Researchers based management-accounting research in the 1960s on neoclassical economics, which assumed the goal was profit maximization (Ryan et al., 2002). They also assumed individual decision makers with access to complete and perfect data made decisions, along with the knowledge to use any mathematical technique required to analyze the data (Ryan et al., 2002). Another necessary assumption was goal congruence between decision makers and the owners of the entity (Ryan et al., 2002).

In the 1970s, researchers added the application of statistical decision theory to management-accounting research, which allowed for uncertainty in decision outcomes (Ryan et al., 2002). The previous neoclassical economic framework assumed no uncertainty in information available to decision makers; therefore, when uncertainty in

information conjoined the analysis, researchers had to evaluate the cost of information production (Ryan et al., 2002). The inclusion of information cost in decision models was an important contribution to management-accounting research. However, although the addition of information economics clarified the role of information, it did not address the management-accounting techniques used to generate information. Ryan et al. (2002) identified this information as the "costly truth approach," which implied truth was available, but an ideal accounting system able to give all relevant information in every circumstance does not exist.

Management-accounting practices aim to meet management needs rather than those of external stakeholders (Gong & Tse, 2009). Economic, organizational, behavioral, and social factors influence the theories applied in management-accounting research. Researchers often apply contingency, agency, sociological, and psychological theories to management-accounting research (Gong & Tse, 2009). Davis (1989) developed the TAM based on the psychological theories of TRA and TPB, to understand individual behavior. The need continues to understand why management accountants in lean manufacturers do not act in a manner consistent with the organizational objectives of applying lean principles, which can be studied using psychological theories.

History of Cost Accounting

During the first half of the 20th century, management accountants focused on determining costs; in particular, product costing (Ryan et al., 2002). This focus led to developing control mechanisms for the associated direct materials, direct labor, and manufacturing overhead. In the second half of the century, the focus changed to address

generating information appropriate for the needs of a variety of internal users and management (Ryan et al., 2002).

A significant aspect of management accounting is accounting for the cost of products and services. Horngren et al. (2012) described three features of cost accounting and cost management included in management accounting:

1. Calculating the cost of products, services, and other cost objects.
2. Obtaining information for planning and control and performance evaluation.
3. Analyzing the relevant information for making decisions. (p. 48)

To understand why traditional management-accounting techniques, and in particular traditional standard costing, are inconsistent with lean-manufacturing practices, researchers must study the history of the development of cost accounting.

In the late 18th century, Wedgwood, a potter, was one of the first to develop a cost system for manufacturing that captured material and labor for each step in the manufacturing process (Giroux, 1996). Wedgwood allocated overhead costs to products to determine the profitability of individual products. Because Wedgwood's products were priced based on the cost to produce, Wedgewood's pottery business was able to survive the British depression of 1772. Other British manufacturers, contemporaries of Wedgwood, also developed similar cost-accounting systems (Giroux, 1996).

Accounting historians documented that companies created full-absorption and standard-costing methods early in the 20th century (Carnes & Hedin, 2005; Maskell, 2006). The manufacturing environment of that time used mass production and large batches; labor comprised more than 50% of the total cost and was considered totally variable; set-up times were long; and production runs long (Carnes & Hedin, 2005).

Organizations created the standard-cost system for a time when allocating a small amount of overhead, based on direct labor (Carnes & Hedin, 2005; Johnson & Kaplan, 1987; Maskell, 2006). At the time, the cost breakdown was 30% material, 60% labor, and 10% overhead, compared to today's averages of 60% percent material, 10% labor, and 30% overhead (Maskell & Katko, 2007). Companies set standards for costing and motivation (Maskell, 2006; Kulesza, Weaver, & Friedman, 2011) and used variances to evaluate and control functional performance (Carnes & Hedin, 2005; Ruiz-de-Arbulo-Lopez et al., 2013). Johnson and Kaplan (1987) argued no progress has ensued in cost accounting since the early 20th century.

Kulesza et al. (2011) described Taylor's theories of management accounting. Although Taylor was an engineer, Taylor developed a cost-accounting system that classified expenses, distributed overhead (of particular interest to Taylor), and improved material handling. Taylor focused on labor and task management without considering other scientific methods.

Johnson and Kaplan (1987) criticized cost accounting as partially responsible for U.S. industry losing its competitive advantage. According to Solomon and Fullerton (2007), the problems with cost accounting include the following:

1. The focus on direct labor to allocate overhead, when direct labor accounts for only 10% of product cost.
2. The focus on financial accounting that puts more emphasis on valuing inventory than accurate cost accounting information.
3. The focus on satisfying stockholders and external financial statement users more than internal management needs.

4. The focus on short-term performance rather than long-term planning.

Johnson (2007) argued

> The prevalence of management accounting control systems in American business probably contributes more than any single thing to the confusion that causes American managers to believe they can run operations mechanically by chasing financial targets, not be nurturing and improving the underlying system of human relationships from which such results emerge. (pp. 7–8)

According to Johnson (2007), Toyota viewed daily plant operations as an area accounting systems did not enter. "Everything one needs to know about the transformation that takes place inside the plant is inherent in the flow of the work itself" (p. 8), which illustrates one of the differences between Toyota and most U.S. manufacturers.

In response to criticisms of managerial accounting, management-accounting initiatives, such as ABC, gather better detailed cost information to control costs (Garrison et al., 2006; Horngren et al., 2012; Hutchinson & Liao, 2009; Johnson, 2002; Ruiz-de-Arbulo-Lopez et al., 2013). However, most companies that have tried ABC have since abandoned it (Hutchinson & Liao, 2009) and the creator of ABC has since abandoned the principles it represents (Johnson, 2002). Activity-based costing added to the complexity of the accounting system rather than simplifying the process (Cunningham & Fiume, 2003; Ruiz-de-Arbulo-Lopez et al., 2013). This is inconsistent with the lean philosophy because it is more concerned with better allocation of cost than with eliminating costs (Rosa & Machado, 2013).

Because reducing steps and waste is the purpose of lean, ABC was inconsistent with the lean philosophy (Cunningham & Fiume, 2003; Rosa & Machado, 2013).

Activity-based costing was not the answer to the inadequacy of management accounting in lean organizations (Cunningham & Fiume, 2003; Hutchinson & Liao, 2009). In response to the lack of a costing system consistent with the lean philosophy, companies developed lean accounting.

Lean Accounting

Companies developed current accounting systems to support batch manufacturing, which sends incorrect signals in a lean-manufacturing environment (Cunningham & Fiume, 2003; Maskell & Katko, 2007). New cost-accounting techniques are a necessary part of the solution for U.S. businesses to increase manufacturing productivity, profitability, and worldwide competitiveness (Cunningham & Fiume, 2003; Giroux, 1996; Maskell & Katko, 2007).

One barrier to successful lean implementation is a MAS incompatible with lean-manufacturing principles (Li et al., 2012). Without a compatible MAS, financial reports do not align with operational improvements (Li et al., 2012). Traditional MAS focused on labor rather than materials and overhead. When companies make operational improvements, they do not reduce labor but increase capacity and reduce other costs. Traditional financial statements do not clearly show the reduction in current costs because they report variances rather than showing total costs along with the change in inventory. Lean-accounting reports, called plain-English financial statements, are easier for nonaccountants to read and interpret (Solomon & Fullerton, 2007).

Accountants must recognize the limitations of standard cost accounting and the related concepts of full-absorption costing and variance analysis (Cunningham & Fiume (2003). Too much emphasis exists on tracking unit costs, which are estimates of cost

using subjective allocations (Cunningham & Fiume, 2003). Existing cost systems are complex and driven by large numbers of transactions in an attempt to capture data in the smallest units possible (Maskell & Katko, 2007). The focus should be on cost management, which requires understanding costs at a higher level than unit cost (Cunningham & Fiume, 2003).

As companies implement *lean production*, they identify and reduce waste, identify value streams, pull product through the plant using one-piece flow, and reduce inventory (Kennedy & Brewer, 2006). Traditional standard costing and full-absorption accounting becomes a barrier to a successful lean conversion (Solomon & Fullerton, 2007). When companies organize manufacturing around value streams, they can assign costs directly, consider more costs to be fixed, and need few allocations (Cunningham & Fiume, 2003).

The differences between standard cost and value streams become even more apparent when discussing lean accounting in comparison to traditional costing. Accounting departments impeded successful lean implementations when they did not change and become a lean support system (Cunningham & Fiume, 2003; Grasso, 2007). The use of traditional standard-costing structure promotes nonlean behavior (Baggaley & Maskell, 2003b; Carnes & Hedin, 2005; Hutchinson & Liao, 2009; Maskell, 2006). Standard costing focuses on labor efficiency and machine use (Timm, 2013), which creates pressure to manufacture large batches regardless of demand, build inventory, hide waste, and focus on financial, rather than operational, performance (Carnes & Hedin, 2005; Haskin, 2010 ; Kroll, 2004; Maskell, 2006). Lean manufacturing promotes

production only to customer pull and does not consider idle machine time to be a negative circumstance (Kennedy & Brewer, 2006).

Manufacturing and accounting myths explain the differences between traditional manufacturing and lean manufacturing (Kennedy & Brewer, 2006; see Tables 1 and 2).

Table 1

Manufacturing Myths

Myth	Rebuttal
Achieve the lowest possible cost per unit by maximizing employee and equipment productivity.	The investment in total fixed assets is constant, so lowering costs by producing more inventories is a fallacy.
Clustering similar machinery and functionally trained employees in departments increases efficiency.	It requires a material handling department which is nonvalue added. The quality department is located separately so scrap and rework is detected later in the process.
Producing large batches reduces overall costs due to fewer changeovers, downtime, and material moves.	This increases storage costs, nonproductive use of space and excess work-in-progress inventory.
If each functional department meets its production forecast, the company as a whole will meet its customer delivery deadlines.	Forecasting errors lead to stock outs and markdowns.
Strong supervision of line workers ensures efficiency and product quality.	Investing in worker training and empowering workers to make decisions utilizes workers as assets and frees up supervisors for broader management responsibilities.
Creating adversarial short-term relationships with suppliers lowers overall costs.	Turning suppliers on and off causes them to incur additional costs and motivates them to cut corners in quality and service to over their losses. This leads to higher scrap rates and downtime.

Note. From "The lean enterprise and traditional accounting: Is the honeymoon over?" by F. Kennedy & P. Brewer, 2006, *Journal of Corporate Accounting & Finance, 17*(6), 63–74, doi:10.1002/jcaf.20234

Table 2

Accounting Myths Identified

Myth	Rebuttal
Inventory is an asset.	Inventory is a sunk cost. It consumes cash that could be invested. It is vulnerable to spoilage and obsolescence, and costs money to store and transport.
Holding managers accountable for optimizing their department's performance will deliver optimal customer value.	Managers focus on the department performance measurement even if the customer gets overlooked.
Accountants drive improvement by seeking explanations for variances.	Variances are difficult for workers to understand and raise a concern too late (usually at the end of the month).
The monthly financial accounting cycle should define the time frame for reporting data to decision makers.	These reports are released well after month-end, and summarize out of date information. Real-time non-financial data is needed.
Idle time is a sign of inefficiency.	If there are no orders to fill, machines should not be running.
Profits are maximized by reducing expenses. The biggest of which are labor costs.	Front-line employees are an asset that should be cross-trained and highly skilled.

Note. From "The lean enterprise and traditional accounting: Is the honeymoon over?" by F. Kennedy & P. Brewer, 2006, *Journal of Corporate Accounting & Finance, 17*(6), 63–74, doi:10.1002/jcaf.20234

Timm (2013) argued the myths identified by Kennedy and Brewer (2006) explained why traditional cost-accounting indicates that increased volume lowers per-unit costs. Companies allocate fixed manufacturing costs over all units produced, which promotes higher production and lowers unit costs using traditional cost accounting (Haskin, 2010; Hutchinson & Liao, 2009; Maskell, 2006). Kennedy and Brewer (2006) argued that investment in fixed assets are sunk costs and remain the same no matter how many units the company produces. This investment makes it impossible to lower fixed costs by attaining higher production.

Using traditional decision making based on standard cost accounting, labor is considered a variable cost (Brosnahan, 2008; Kennedy & Brewer, 2006) whereas in a

lean organization, increased capacity may allow additional products to be produced without increasing total value-stream labor. Using traditional management-accounting techniques, managers may decide to cut employees when sales decrease; a shortsighted view according to Kennedy and Brewer (2006). The authors argued that laying off employees eliminates intellectual capital, increases employee fear, and creates additional costs when employees need to be replaced when demand improves.

Managers consider inventory to be waste in a lean system because it hides production inefficiencies and ties up working capital (Haskin, 2010; Maskell, 2006). One factor creating overproduction and increased inventory is the mass-production mindset that justifies large batches to reduce changeovers, decrease machine downtime, and move fewer materials (Kennedy & Brewer, 2006). Inventory ties up cash, increases storage costs, and wastes space that could be used for production instead of storage. Kennedy and Brewer (2006) questioned the efficacy of classifying inventory as an asset. In addition to tying up cash and increasing expenses, inventory may spoil or become obsolete (Kennedy & Brewer, 2006).

Value-Stream Costing

The purpose of management accounting is to provide financial and nonfinancial information used internally to make decisions and measure operational performance (Garrison et al., 2006). Traditional standard costing does not provide the information needed to manage a lean-manufacturing organization; therefore, managers must develop alternative methods to provide useful and accurate information. According to the literature, value-stream costing is the alternative that best meet the needs of lean-manufacturing organizations (Rosa & Machado, 2013). Accountants use value-stream

costing to record costs incurred in the value stream including production labor, materials, indirect labor, machinery and equipment, facilities, maintenance, and operations support (Li et al., 2012). Value-stream costs are easy to understand because the cost assignment is simple, with no complex allocations; the information is collected and reported in a timelier manner than traditional costing information (Baggaley & Maskell, 2003b). Value-stream costing highlights waste areas and opportunities to manage capacity more efficiently (Rosa & Machado, 2013).

Lean principles emphasize creating value for the customer and eliminating waste. Lean accounting strives to create value by costing products by value stream, instead of by individual products or departments (Baggaley & Maskell, 2003b; Maskell & Katko, 2007). This format reduces wasted effort to estimate and allocate costs using complex costing methods (Cunningham & Fiume, 2003). Accountants trace actual costs to value streams and do not calculate standard costs and variances. Lean accounting is simpler than traditional product costing because it requires little overhead allocation to calculate product cost. Critics argued that lean accounting does not accurately value inventory under GAAP (Horngren et al., 2012). Supporters offered solutions for valuing inventory, while also arguing that lean companies reduce inventory to immaterial amounts (Cunningham & Fiume, 2003; Horngren et al., 2012; Solomon & Fullerton, 2007).

Accountants easily can trace direct costs to each value stream because lean companies allocate direct resources to value streams. Companies consider all costs of a value stream to be direct costs and allocate no costs outside a value stream (Baggaley & Maskell, 2003b; Maskell & Katko, 2007). During implementation, organizations require some allocation until managers can assign all employees to a value stream and can

purchase machines for use in each value stream. In the beginning, some employees or machines may provide services to multiple value streams. Accountants consider machines or departments shared by more than one value stream to be "monuments." Until the number of monuments are reduced or eliminated, Maskell and Katko (2007) recommended accountants allocate monument costs using simple rates calculated at the beginning of the year.

Maskell and Katko (2007) explained that when assigning costs to value streams, accountants do not distinguish between direct and indirect labor. They assign employees providing indirect labor to specific value streams, which eliminates the need to allocate indirect labor as an overhead product cost (Baggaley & Maskell, 2003b). Companies sometimes expense direct material as a current-period cost to encourage a reduction in work in process and finished goods inventory (Cunningham & Fiume, 2003; Maskell & Katko, 2007). At a minimum, organizations charge actual material used as direct material, allocating facility costs by square footage used by each value stream (Baggaley & Maskell, 2003b; Cunningham & Fiume, 2003; Maskell & Katko, 2007). This format encourages managers to reduce the square footage required for production and inventory storage (Horngren et al., 2012; Maskell & Katko, 2007).

Accountants do not allocate unused manufacturing square footage, instead treating it as a business-unit expense. This allocation highlights the issue of unused capacity and creates incentives to find other uses for the space (Grasso, 2007; Horngren et al., 2012). Companies also exclude from the value stream corporate or support-department costs that they cannot be reasonably assign to value streams, considering business-sustaining costs that should be budgeted and controlled (Cunningham & Fiume,

2003; Maskell & Katko, 2007). Maskell and Katko (2007) suggested that because the value streams do not control these costs, they should not be allocated to them. Value streams should focus on reducing direct costs by improving processes (Cunningham & Fiume, 2003; Maskell & Katko, 2007). To cover business-sustaining costs in value stream costing, companies should encourage higher returns on sales (Maskell & Katko, 2007).

Ruiz-de-Arbulo-Lopez et al. (2013) compared traditional standard costing with value stream costing and ABC. The findings included the following:

- Value-stream costing can model processes on the shop floor while simplifying the accounting process, compared to traditional costing and ABC;
- Value-stream costing gives more relevant cost information than that given by ABC; and
- Whereas ABC fails to identify unused capacity, a key element in lean manufacturing, value-stream costing techniques encourage continuous improvement because they reflect operational improvements (Ruiz-de-Arbulo-Lopez et al., 2013, p. 664).

The drawbacks of value-stream costing include the requirement that a lean company must be organized around value streams and offers a rough estimation of the cost of the product (Ruiz-de-Arbulo-Lopez et al., 2013). Avoiding allocations can be less precise than complex costing systems such as ABC.

Several important differences exist between standard and value-stream costing. Value-stream costing simplifies accounting for costs by not using standards. Accountants

record costs at actual cost, which they can monitor clearly and simply over time (Cunningham & Fiume, 2003; Solomon & Fullerton, 2007). Table 3 provides a comparison of standard costing and value-stream costing.

Table 3

Standard Costing Comparison to Value-Stream Costing

Standard costing	Value-stream costing
Many transactions and allocations	Simplified costing methods
Standards set and rarely changed	Standards not needed
Actual costs compared to standards	Actual costs monitored over time with the expectations that cost performance will improve
Direct labor recorded based on time spent on each job	Labor reporting simplified
Indirect labor allocated as overhead	
Labor costs recorded based on standard	
Direct material recorded at standard	Direct material charged at actual (either actual used or purchased)
Overhead applied based on standard applied to labor hours	

Value-stream costing eliminates the need to set standards, and allows costs to be recorded using actuals. Fewer, simplified transactions eliminate the need to post costs by job, which simplifies labor reporting. Rosa and Machado (2013) concluded value-stream costing was the only MAS to respect all the goals of lean.

When standard cost information is no longer available, employees responsible for pricing become anxious (Brosnahan, 2008). Brosnahan (2008) argued that decisions on whether to accept an order must be made at the value-stream level with participation from the value-stream leader with information on the impact of the order on machine and labor capacity. Maskell (2006) agreed the decisions must be made at the value-stream level.

The amount of time needed from whichever machine is considered the bottleneck impacts the cost of a product, best determined by the value-stream leader (Kennedy & Brewer, 2006; Maskell & Kennedy, 2007). Profitability should be determined at the value-stream level, not the individual product level (Maskell, 2006).

Kennedy and Brewer (2006, p.71) listed the limitations of traditional product costing as follows:

1. The arbitrary allocation of overhead costs.
2. Relevant nonmanufacturing costs are ignored.
3. Reliance on standards that may be inaccurate.

Maskell (2006) argued that there is no correct product cost because it varies each time it is manufactured. “The idea that a standard product cost can be established may be a useful accounting artifice, but it leads to very poor decisions within companies transitioning to lean” (Maskell, 2006, p. 34).

Maskell and Kennedy (2007) claimed traditional management accounting methods were actively harmful to lean implementations. The authors listed the following reasons accounting methods need to change:

1. Wrong measurements
2. Wrong costs
3. Better decision making
4. Understandable information
5. Complex systems
6. Focus on customer value

Management accounting needs to change for a lean-manufacturing organization for many reasons. When determining product price, instead of traditional cost-plus costing, accountants must use target costing, using market pricing rather than cost-plus (Brosnahan, 2008; Maskell, 2000, 2006). Finance and marketing departments must determine what the customer is willing to pay (Maskell, 2000). The market must determine price (Maskell, 2000). After determining the price, the value-stream leader calculates the target cost needed to achieve the desired gross profit (Maskell, 2000), deciding price not on cost, but rather on the value created for the customer (Maskell, 2006).

Traditional standard costing uses productivity, efficiency, product costs, and gross margins to evaluate manufacturing performance (Carnes & Hedin, 2005). The concern that traditional full-absorption cost accounting negatively affects operational decisions is not new; more than 50 years ago, Drucker expressed the same concern (as cited in Carnes & Hedin, 2005). Traditional management accounting measures undermine a company's lean transformation (Maskell & Kennedy, 2007). Kroll (2004) was alone in expressing concern that companies would emphasize speed and efficiency without concern for cost.

Lean accounting promotes integrating performance measures and cost information with continuous improvement processes (Maskell, 2000). Successful management accountants must see themselves as business partners rather than mere calculators (Carnes & Hein, 2005; Kennedy & Brewer, 2006). Collaborating with manufacturing requires that companies develop performance measures that promote lean behaviors (Carnes & Hein, 2005; Rosa & Machado, 2013). When following lean thinking,

companies cannot base performance measures solely on financial information (Rosa & Machado, 2013).

Johnson (2002) originally created ABC, yet later abandoned it. Johnson explained the change in philosophy as moving from managing from results to managing by means. Johnson stated better management cannot be achieved by better cost data; rather, costs are the results of the system of work relationships designed into the organization. To reduce costs, leaders must examine the relationships, not the quantitative cost (Johnson, 2002). This is consistent with the lean philosophy.

Lean-Accounting Implementation

Multiple reasons may exist as to why management accountants may not change accounting methods when companies implement lean manufacturing. When accounting systems do not change, traditional financial statements will indicate that the company is in a worse financial position than before lean. This misrepresentation has caused companies to abandon their lean transitions (Hart, 2012). If companies use lean accounting, along with plain-English financial statements, managers would be able to identify production-efficiency gains. The lack of lean-accounting implementations hinders successful lean implementations and may cause companies to miss opportunities to become more efficient and profitable.

Companies implementing lean manufacturing experience decreased net income during the lean implementation when using traditional financial-accounting principles (Brosnahan, 2008; Maskell & Kennedy, 2007). A predictable obstacle to acceptance of lean is that financial statements will not indicate improved financial performance quickly enough (Cooper & Maskell, 2008). Failure of traditional accounting to provide financial

information supporting the change to lean manufacturing has been a major factor in managers halting lean initiatives (Carnes & Hedin, 2005). Managers must anticipate the financial impact of lean implementation and manage expectations (Cooper & Maskell, 2008).

Cooper and Maskell (2008) identified factors that negatively impact financial performance during a lean implementation. First, increased efficiency shortens the lead time for products to be delivered to customers. Although these changes benefit the customer, in the short-term, they decrease revenues. Customers can wait to place their orders and also may be using up safety-stock inventory because of previous long lead times. Second, the improved cycle time reduces the need for work-in-process and finished-goods inventory. The decrease in inventory increases operating cash flow, but also increases expenses. Full-absorption costing allocates fixed costs to items produced in the period. These costs end up on the balance sheet when inventory increases. As companies reduce inventory, accountants expense these fixed costs in the period of the sale, along with current-period fixed costs (Haskin, 2010). Inventory reduction because of cycle-time decreases and reduced need for safety stock can decrease profits by 50 to 100% (Cooper & Maskell, 2008).

Productivity increases when companies implement lean. This increase creates excess production capacity (Cooper & Maskell, 2008). Although this operational improvement is good for long-term financial results, companies may have difficulty taking advantage in the short-term. Most companies do not lay off workers during an implementation in order to increase worker acceptance of lean (Cooper & Maskell, 2008). Fear of job loss is a major factor in worker resistance to lean. The commitment to

a lean implementation also requires companies to involve workers in lean-process improvement, which is nonproduction time. Companies also may have difficulty quickly taking advantage of the new increased capacity (Cooper & Maskell, 2008). Over time, companies may use the new capacity to produce new products or fill increased demand from customers.

Accounting researchers documented the lack of progress in adopting new techniques in management accounting (Carnes & Hein, 2005). Implementing lean accounting causes challenges. Kennedy and Brewer (2006) identified the following keys to successful implementation of lean accounting:

1. Recognize that lean accounting works along with lean manufacturing
2. Focus metrics on a few key areas
3. Keep everyone informed using visual systems
4. Eliminate transactions only as their need is removed
5. Develop a transition plan with accountability
6. Include all process stakeholders in the transition planning

Authors offered many opinions on lean-accounting implementations and the changes required (Timm, 2013). Kennedy and Brewer (2006) recommended that lean-accounting implementations proceed simultaneously with lean-manufacturing implementation. Companies should eliminate accounting controls as production-floor controls increase (Kennedy & Brewer, 2006). Companies will no longer be using standard-cost inventory valuation because they no longer exist (Brosnahan, 2008; Maskell, 2006). One organization studied used detailed bills of materials and average cost per day of conversion costs times the estimated days of inventory on hand at period end

to value inventory (Brosnahan, 2008). Maskell (2000) argued traditional manufacturing transactions should be targeted for elimination. These changes may create obstacles to the change, which needs identification and resolution (Kennedy & Brewer, 2006).

Existing accounting and IT structures may hinder the change of production systems (Carnes & Hein, 2005; Hutchinson & Liao, 2009; Li et al., 2012). Researchers showed production managers experienced frustration over the lack of support and deficiencies in reporting by management accountants (Carnes & Hein, 2005). The accounting systems include many transactions that managers consider waste (Maskell, 2000, 2006). Companies should not report any information not required by operations personnel or needed for the physical control of processes (Maskell, 2000).

Brosnahan (2008) offered insights from a successful implementation that could be used by other companies attempting to implement lean accounting. Watlow Electric Manufacturing Company organized costs by value streams, changed inventory-valuation techniques, and modified financial reports to include nonfinancial information. Watlow no longer uses standard costs, variances, or allocations. The success at Watlow can serve as guidance for other lean manufacturers. Management accountants must be able to quantify and explain the financial changes caused by lean-manufacturing implementations and also quantify nonfinancial improvements. Improvements in efficiency, increased capacity, and reduction in inventories will cause short-term net income losses because of the requirements of financial reporting (GAAP) but management accountants using lean-accounting techniques can quantify current and projected savings.

Readiness for Change

The lack of lean-accounting implementations (Rao, 2013) is a problem and the focus of this study. Lean-manufacturing implementations have been more successful, but not all manufacturing firms that may benefit from lean manufacturing have implemented it. The literature indicated numerous barriers to successful lean-manufacturing and lean-accounting implementations. Researchers must understand the barriers to change to increase the readiness to change.

Some manufacturers have attempted to implement lean and been unsuccessful (Hart, 2012). The same cultural issues that hinder lean initiatives across organizations are barriers to accountants' willingness to change. Hart (2012) found literature supported the concept that successful implementation of lean required employees to align with the lean strategy. A common difficulty for companies implementing lean was the Western culture attitude to get results and move on (Hart, 2012). Toyota, which originated lean principles, did not have a short-term focus (Womack et al., 2007). Instead, the assumption was that over the long-term (with continuous improvements) business performance and competitive advantage would improve (Womack et al., 2007). Western companies' tendency to focus on short-term results often results in a focus on *doing* rather than *planning* (Liker & Hoseus, 2008).

Successful lean implementations involve a complete cultural commitment across all departments (Solomon & Fullerton, 2007). Lean thinking requires a change in mental models, which includes striving for continuous improvement (Hart, 2012). An organization's culture must change from that of command and control, to a cooperative environment.

> Lean transformation champions want management accountants to be change agents, helping to build and reinforce the cooperative culture necessary for lean to thrive. The change to a cooperative culture can be subverted, dooming the lean transformation to failure if the accounting system continues to support a command and control culture. (Grasso, 2007, p. 185)

Grasso (2007) argued that accountants have difficulty with lean transformation because of their interdependent relationships with managers who do not comprehend the cultural change that must accompany a lean transformation.

Accounting education has historically focused on preparing graduates for careers in public accounting (Grasso, 2007). Very few baccalaureate accounting programs in the United States cover lean principles or lean accounting (Grasso, 2007). Educators must teach management accountants lean principles and accountants' role in successful implementation. Stenzel (2007) offered little hope that academia would assist in the lean transformation of accounting. Financial accounting and auditing dominate the curriculum of business schools, and promote a command-and-control business philosophy (Stenzel, 2007). Without a change in curriculum, accounting PhDs will perpetuate the same biases as they graduate and become professors.

Short-term financial barriers affect lean implementations (Timm, 2013). A lean-manufacturing initiative will focus on reducing inventory. As inventory diminishes, deferred labor and overhead will reduce income (Cunningham & Fiume, 2003). The pressure to make monthly income projections is a problem for all companies; not just publicly traded companies (Cunningham & Fiume, 2003). Programs, incentives, or loans

tied to financial results or inventory balances need to be addressed so companies do not view the improved efficiencies as short-term financial failures.

Another financial barrier during the lean transformation is that financial leaders need to justify a specific strategy or expenditure. With an incompatible MAS, managers receive mixed messages from financial reports and may withhold continued support (Li et al., 2012). Many lean benefits accrue managers cannot easily measure or observe (Solomon & Fullerton, 2007).

No clear consensus exists among accountants on the appropriate accounting methods for lean manufacturers (Li et al., 2012). Through the literature review, I found a majority of authors recommended lean accounting and the associated value-stream costing. The literature clearly documents the inadequacies of traditional standard costing for lean manufacturers, but little research describes implementing lean principles under different MAS environments (Li et al., 2012).

Researchers have conducted little quantitative research related to lean accounting (Fullerton & Kennedy, 2010; Fullerton et al., 2013; Rao, 2013). Fullerton and Kennedy (2010) experienced difficulty gathering information about organizations using lean accounting because very few have implemented lean accounting. A limitation in the Rosa and Machado (2013) study was an inadequate number of empirical studies to determine whether lean companies are or are not changing their MAS in product valuation and performance measures. Ruiz-de-Arbulo-Lopez et al. (2013) found little discussion of the adaptation of MAS for lean manufacturing. Baines and Langfield-Smith (2003) reviewed empirical research examining the nature of changes in MAS in response to external environmental changes. Successful organizations emphasized customer service and

product innovation, which encouraged the increased use of advanced manufacturing technologies like lean, just-in-time manufacturing, and computer-aided design and manufacturing (Baines & Langfield-Smith, 2003). Using structural-equation modeling, Baines and Langfield-Smith found differentiation strategies led to increased use of advanced management-accounting techniques. Any change in management-accounting techniques was in response to the strategic emphasis.

The trend to increase use of lean-manufacturing techniques implies an increase in MAS changes to support the new strategy. However, this increased change is not the case. Although researchers have shown the potential value of lean-accounting, researchers must determine why management accountants have not adopted lean-accounting methods, such as value-stream costing, when a company has implemented lean-manufacturing processes.

Technology Acceptance Model

Davis (1989) developed the TAM using the TRA and the TPB to explain how usefulness and the ease of use of a new technology influence the planned use of the technology. Davis developed the TAM instrument to measure the influences. Venkatesh and Davis (1996) experimented with hands-on system use to determine if object usability impacted PEOU after direct experience with a system. Venkatesh and Davis found computer self-efficacy was a determinant of PEOU, before and after hands-on experience, whereas objective usability was a determinant of PEOU only after a hands-on experience. Understanding the determinants of PEOU may help guide system development and training to increase user PEOU.

Venkatesh (2000) found initial drivers of system-specific PEOU—computer self-efficacy, facilitating conditions, computer playfulness, and computer anxiety—served as anchors to form PEOU about a new system. With experience, objective usability, perceptions of external control, and perceived enjoyment from system use played a role as adjustments to PEOU, with general beliefs regarding computers as the strongest determinant (Venkatesh, 2000). Venkatesh measured objective usability by comparing the time spent by the participant to the time spent by an expert on the same set of tasks (Venkatesh, 2000).

Venkatesh and Davis (2000) extended the original TAM by testing a theoretical framework that explained PU and BI in social influence and cognitive instrumental processes. The extended model, TAM 2, accounted for 40% to 60% of variance in PU and 34% to 52% of BI. Subjective norms, voluntariness, image, job relevance, output quality, result demonstrability, and PEOU significantly influenced user acceptance (Venkatesh & Davis, 2000). The subjective norm definition comes from TRA and TPB: "a person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302). Technology acceptance model 2 is represented in Figure 6.

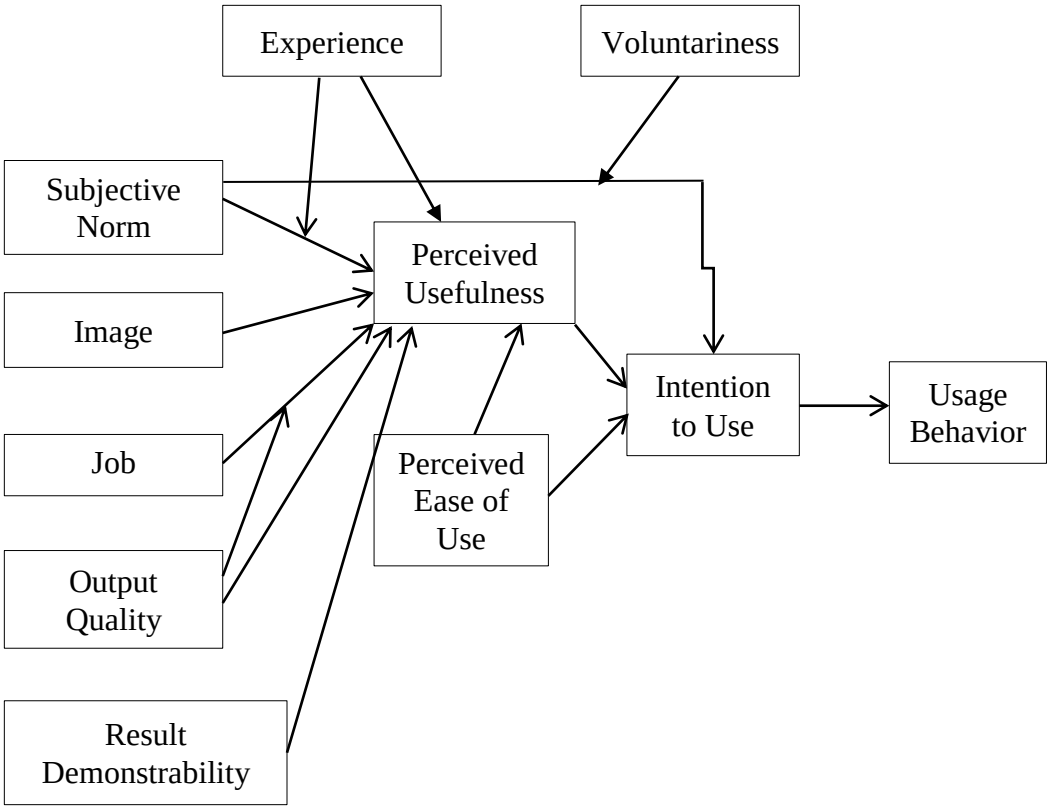

Figure 7. TAM 2 research model.

Venkatesh et al. (2003) compared the TRA, TAM, a motivational model, TPB, a model combining TAM and TPB, a model of personal computer use, innovation-diffusion theory, and social-cognitive theory, to create UTAUT. They argued that user acceptance of new technology is a mature research field that resulted in several theoretical models and constructs, from which researchers must chose (Venkatesh et al., 2003). By reviewing and synthesizing existing models, they proposed the UTAUT illustrated in Figure 8.

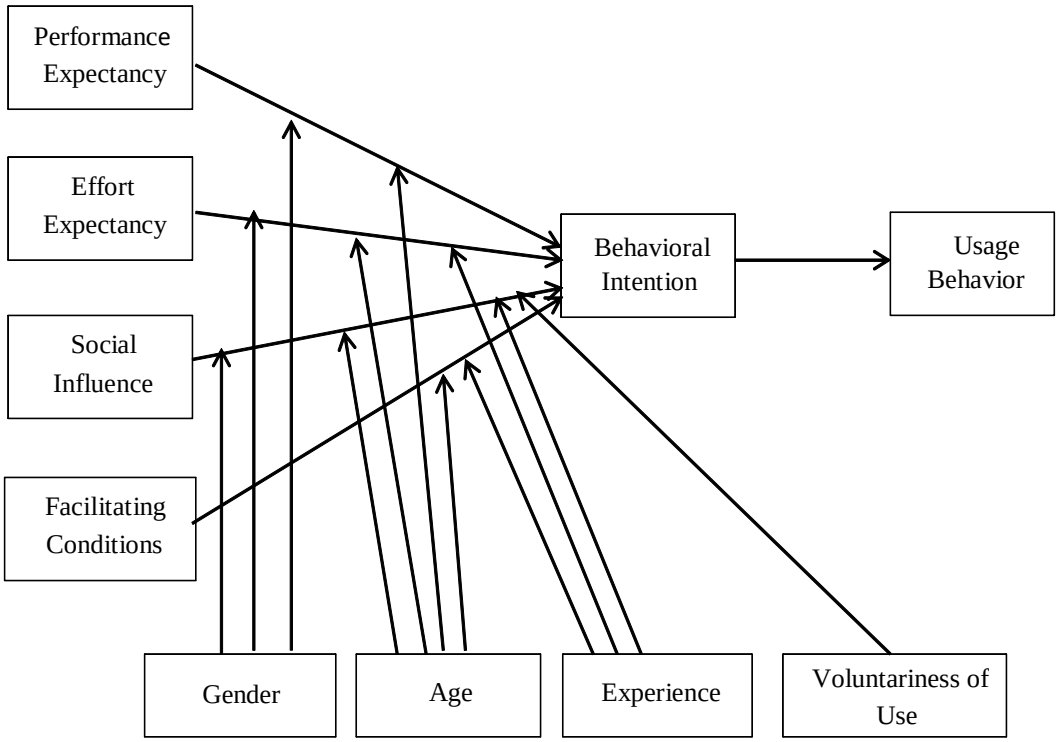

Figure 8. UTAUT research model.

Venkatesh et al. (2003) found performance expectancy, effort expectancy, and social influence to directly determine intention to use, and intention and facilitating conditions to directly determine usage behavior. The researchers confirmed experience, gender, age, and voluntariness have significant moderating influences. Venkatesh et al. (2003) reported UTAUT accounted for 70% of the variance in usage intention, which was significantly more than any of the original models and extensions. The independent variables of computer self-efficacy, computer anxiety, and attitude toward using technology were nonsignificant (Venkatesh et al., 2003). The effects were captured by effort expectancy and process expectancy, which indicated the model is not dependent on technology-specific variables. Because the model is an extension of TAM, the

researchers assumed technology-specific variables are nonsignificant with TAM, which supports the use of TAM for nontechnology-related topics.

Theorists have extended and integrated UTAUT since it was developed (Venkatesh, Thong, & Xu, 2012). Researchers have made three types of changes (Venkatesh et al., 2012):

- Use of UTAUT in new contexts, such as new technologies, new user populations, and new cultural settings.
- Additions of constructs to UTAUT to expand the scope.
- Inclusion of exogenous predictors of the UTAUT variables.

Although these changes have extended the use of UTAUT, Venkatesh et al. (2012) found most studies used only a subset of the original constructs.

The TAM, although extensively tested and confirmed as robust, is not without criticism (Chuttur, 2009; Schepers & Wetzels, 2007). Chuttur (2009) found some researchers arguing self-reported usage is not as reliable as measured actual usage. Studies using students as participants cannot be generalizable to other populations. Schepers and Wetzels (2007) found relationships were stronger for students than nonstudents because students are a more homogeneous group and more likely to comply with authority. Chuttur also argued that a large number of studies predicted voluntary use, whereas in work situations, system use is usually mandatory. Hess et al. (2014) also noted Davis (1989) developed the TAM for utilitarian contexts whereas the TAM has been applied to hedonic contexts. The application to hedonic-system usage has shown to significantly change the predictive power of TAM (Hess et al., 2014).

Schepers and Wetzels (2007) found the type of technology had a moderating effect on pairwise relationships. The correlations were lower in a microcomputer setting than in a nonmicrocomputer setting. The subjective norm of TAM 2 had a larger impact on BI in Western culture than in studies conducted in non-Western cultures (Schepers & Wetzels, 2007). This was not an expected outcome. Other cultural differences were that PU was more important in Western cultures and PEOU more important in non-Western studies (Schepers & Wetzels, 2007).

Chuttur also suggested researchers have questioned the elimination of attitude from the TAM. In previous research, PEOU and PU had a direct influence on BI; therefore, attitude was not needed as a construct (Venkatesh & Davis, 1996). Chuttur found research indicating adding two additional attitude variables found the effect of cognitive attitude was statistically significant in predicting system use. Other researchers found PEOU might have more of an impact on BI in mandatory settings that were different from voluntary settings, where PU had more influence than PEOU (Chuttur, 2009). Bagozzi (2007) questioned whether BI leads to actual usage and argued the TAM was not suitable to explain and predict use.

Hess et al. (2014) conducted a meta-analysis of 380 research articles that used the TAM. The researchers found differences in reliability when controlling for number of items, sample size, and sampling error. Researchers have applied and adapted the TAM over a range of technology contexts, but have conducted little psychometric work on the original scale (Hess et al., 2014). The meta-analysis results found TAM results were more reliable in a utilitarian context and the use of original scales resulted in better reliability for PEOU and PU (Hess et al., 2014). Hess et al. found studies reporting a composite

reliability type had higher reliability coefficients for PEOU and BI compared to studies using Cronbach's alpha.

Researchers used the TAM to measure the usability of enterprise-resource-planning (ERP) systems documentation, which extended the research model's usage beyond measuring the usability of technology. Although the documentation was related to technology implementation, the documentation was not a type of technology. Scott (2008) used a unified model based on the TAM to determine the relationship between the PU and perceived usability of ERP documentation, which could be printed or accessed online. Scott included computer self-efficacy in the measures because computer self-efficacy aligns with higher PEOU of technology. The model used by Scott assumed users who perceive technology as easier to use would find documentation easier to follow and understand, making it more useable. The PU of ERP documentation strongly affects its perceived usability (Scott, 2008). When users perceived the documentation as useful, they were more likely to use it efficiently, effectively, and with satisfaction (Scott, 2008).

Riemenschneider, Hardgrave, and Davis (2002) used five models—including the TAM—that researchers used to examine technology-tool acceptance to study methodology acceptance. Riemenschneider et al. argued, because each of the tool-acceptance models derived from more general theories of human behavior, they would generalize beyond tool acceptance to methodology-use intentions. The group conducted the study to determine if the acceptance models applied to methodologies. Riemenschneider et al. defended the similarity of technology-tool usage and methodology usage because both are workplace behaviors with job-performance consequences and both require effort and skill to learn and use. In all five models,

usefulness was significant, which was consistent with findings when applied to tool acceptance (Riemenschneider et al., 2002).

Benamati and Rajkumar (2008) extended the use of the TAM to analyze decision making by investigating the effect of PU and PEOU on the decision to outsource IT application development. Researchers hypothesized decision makers' perceptions of how application-development outsourcing would enhance performance of the IT department, and the degree to which the decision maker believed the application-development outsourcing would be free of effort, would influence the attitude about outsourcing, and would impact the intent to outsource. Benamati and Rajkumar used a survey to empirically test a model that included the TAM constructs, along with antecedent variables previous researchers found to influence decision making.

The Benamati and Rajkumar (2008) study validated that the TAM has application to organizational decision makers and may be useful in the study of other organizational-level decisions. Perceptions of usefulness and ease of use of outsourcing strongly influenced decision makers' intention to outsource application development. The decision makers had a higher mean score of PU than for PEOU. Benamati and Rajkumar stated, "The applicability of TAM as a basis for explaining the mediating effects of decision-maker attitude on organizational decision making is a major contribution of this study" (2008, p. 94).

Summary and Conclusions

The adoption of lean-manufacturing processes challenges the basic assumptions of standard cost-accounting methodology. Management accountants need to provide timely, accurate, and understandable financial information that measures performance

and meets the needs of all users, including internal users (Cunningham & Fiume, 2003; Solomon & Fullerton, 2007). Accountants must provide measurements that support management decision making and determination of the financial impact of lean implementations to become a lean support system (Cunningham & Fiume, 2003; Grasso, 2007). In response to the needs of lean manufacturing, management accountants developed lean accounting, which uses value-stream costing and measures performance in a manner consistent with lean principles. Researchers have not discovered why management accountants in lean-manufacturing organizations have not changed their accounting methods and implemented lean accounting.

Management accounting has not changed significantly since the early 20th century. The use of standard costing and full-absorption costing continues to be the prevalent basis for MAS. Management accounting systems are technical in nature and require a decision to implement a change. Researchers have used the TAM to measure the impact of PEOU and PU of a technology on the individual's intent to accept the new technology. Researchers have used or recommended the TAM as a tool to measure acceptance of technical processes and documentation. I hypothesize that the same TAM variables may apply to the acceptance of value-stream costing by management accountants.

Chapter 3 provides the research methodology for this study. In the chapter, I define the population, explain the sampling procedure and the instrument used, and discuss the measurement methods. In Chapter 3, I specify the methods of data collection and data analysis.

Chapter 3: Research Method

Introduction

The purpose of this quantitative explanatory study was to investigate what factors influence the adoption of lean accounting in organizations that use lean manufacturing. In this study, I examined whether accountants may be influenced by their concern about the complexity of lean accounting or their perception that lean accounting may not be useful to their organization or to their required job responsibilities. I used the TAM, a quantitative methodology developed by Davis (1989) to determine if the PEOU and PU impacted the BI of accountants to implement value-stream costing in the adoption of lean accounting. Value-stream costing is a fundamental lean-accounting indicator, and although researchers have conducted TAM studies across disciplines, no researchers indicated the use of the TAM to study value-stream costing or other indicators of lean-accounting implementation.

Research methods provide a set of tools that the researcher draws on, as appropriate for a situation, to triangulate and validate findings (Remenyi, Williams, Money, & Swartz, 2005). The researcher must establish the philosophical orientation and research approach early in the research process (Remenyi et al., 2005; Ryan et al., 2002), and it is important for a researcher to consider alternative philosophies to determine the research method most appropriate for the research problem. Creswell (2007) stated that some research problems are better suited to either a quantitative or qualitative methodology, and Holden and Lynch (2004) noted that the inappropriate matching of methodology to a research problem might produce questionable results and negatively impact the researcher's authority. This chapter provides the research design and the

rationale. The chapter contains the chosen population along with the sampling procedure. Included in the chapter are the survey instrument and a discussion of the variable measurement, including the applicable reliability and validity issues, and a description of the data-analysis process.

Research Design and Rationale

Researchers select a design based on three criteria: the type of research question, the amount of control the researcher has over the behaviors, and whether the study analyzes contemporary events rather than historical events (Yin, 2009). The survey method is appropriate for "who, what, where, how many, how much?" (Yin, 2009, p. 8) questions, where control of behavioral events is not required, and the study is of contemporary issues (Fowler, 2014). A quantitative nonexperimental cross-sectional study using a survey design permits an assessment of relationships between variables related to the acceptance and adoption of value-stream costing. Previous researchers using the quantitative correlation design with multiple regression indicated this is a strong approach to the study of technology adoption and use (Yallah, 2014). The design is consistent with other research using the TAM when researchers based hypotheses on relationships between the independent and dependent variables (Davis, 1989; Venkatesh et al., 2003; Yallah, 2014). Researchers can use quantitative surveys to determine attitude or perspectives when the attitude is summarized in a brief statement and presented to the respondent to agree or disagree (Babbie, 2013). Presenting all participants with a standardized stimulus, like a survey, reduces the unreliability of researcher observations and reduces participants' unreliability when the questions are carefully worded (Babbie, 2013). Researchers design surveys to produce statistics about a sample and use inferential

statistics to describe the population (Fowler, 2014). The research questions addressed by this study fit those criteria, making the survey method appropriate.

Little quantitative research described lean accounting (Fullerton & Kennedy, 2010; Fullerton et al., 2013; Rao, 2013). In this study, I sought to examine management accountants' perceptions of the lean-accounting technique of value-stream costing, as applicable to manufacturing organizations that have implemented the lean-manufacturing technique of value streams. A search of the literature did not produce data to indicate the number of manufacturers in the United States that use lean-manufacturing methods, which confirmed Rao's (2013) findings. Without identifying which manufacturers have implemented lean manufacturing, researchers have difficulty determining which management accountants work in lean-manufacturing environments. A quantitative survey design applied to the appropriate sampling frame will measure the intention of management accountants familiar with lean accounting to implement value-stream costing, and allow for generalizations about relationships and the predictive value of PEOU and PU of value-stream costing on intention to implement.

I considered other research methods, but rejected them in favor of a quantitative nonexperimental cross-sectional study using the TAM instrument. Case studies can offer a more comprehensive perspective of an event or issue by allowing meaningful exploration (Remenyi et al., 2005) and can answer "how" and "why" questions related to a topic (Yin, 2009). A case study cannot yield robust generalizations (Remenyi et al., 2005). Although case studies have provided data related to specific implementations of lean accounting (Brosnahan, 2008; Kennedy & Widener, 2008), they have not addressed

the reason management accountants in lean-manufacturing organizations have not implemented lean-accounting techniques such as value-stream costing.

Case studies have gained acceptance in accounting research, particularly in management accounting, to understand the techniques, procedures, and systems used in practice (Ryan et al., 2002); yet, researchers use case studies in accounting research more for descriptive, illustrative, experimental, exploratory, or explanatory research, appropriate when theory is not well developed (Ryan et al., 2002). Case studies are context specific and make statistical generalizations problematic (Ryan et al., 2002); thus, I did not choose a case study. The lack of quantitative analysis on lean-accounting implementations is a gap in the literature that a case study would not address.

Researchers have used structural equations to study management-accounting changes in response to lean-manufacturing implementations (Baines & Langfield-Smith, 2003; Fullerton et al., 2013; Fullerton & Wempe, 2005). Although this design may allow researchers to examine relationships, it can expose insignificant relationships that are not revealed by selective correlation or regression analysis (Baines & Langfield-Smith, 2003). In addition, structural equations can be limited by variable relationships that may not be linear or exhibit linearity in a limited relevant range (Baines & Langfield-Smith, 2003). Researchers can evaluate the linearity of the relationships between variables using survey studies with more complex quantitative analysis (Field, 2013), which is appropriate in a study to examine the linearity of the relationships between variables.

Quantitative research begins by formulating hypotheses and verifying them empirically (Frankfort-Nachmias & Nachmias, 2008); by testing scientific hypotheses, the researcher eliminates personal values and biases from the research (Matveev, 2002).

According to Ting-Toomey (1984; as cited by Matveev, 2002), researchers can analyze respondents' answers without interacting with them. Strengths of quantitative approaches, such as the TAM, include stating the research problem in specific and fixed terms (Frankfort-Nachmias & Nachmias, 2008), eliminating or minimizing subjectivity of the researcher to arrive at more objective conclusions, clearly identifying the independent and dependent variables, and achieving high levels of reliability by gathering data using a controlled survey (Matveev, 2002). Weaknesses of the quantitative method are failure to provide the context of responses, and the inability to control the environment of respondents when completing the survey (Matveev, 2002). At the conclusion of this study, I present considerations for future studies using other methodologies to address these weaknesses; yet, the weaknesses do not outweigh the strengths of the quantitative methodology in this study.

Although Davis (1989) designed the TAM to explain the intention to accept technology, other researchers modified the questions to fit the type of technology they researched and added additional variables such as age, sex, and experience with the technology (Benamati & Rajkumar, 2008; Marchand & Raymond, 2008; Scott, 2008; Surendran, 2012). King and He (2006) concluded the following points, from a review of literature:

1. TAM measures are highly reliable and may be used in a variety of contexts.
2. TAM correlations, although strong, are also variable, suggesting that moderator variables can help explain events.
3. PU has a profound influence on intention to use technology.

4. Sample sizes required for significance are modest, although the ease of use to BI is variable enough that when focusing on this relationship, researchers must use a larger sample.

To operationalize the constructs PU and PEOU, Davis (1989) developed multi-item measurement scales for the two variables. According to Davis, the measurement scales used a multistep process. Davis conducted pretest interviews to assess and refine preliminary scale items, and completed a field study of the scales to ensure reliability and construct validity. Davis performed a second study to assess the relationship between PU, PEOU, and the self-reported usage of a new technology. The second study reflected high validity of the usefulness (PU) and ease of use (PEOU) scales and indicated a significant correlation of PU and PEOU with self-reported system usage. Both studies indicated PU linked more strongly to usage than PEOU. Davis believed that although PU and PEOU were the study participants' subjective assessment, those beliefs were meaningful variables that functioned as behavioral determinants.

To apply the TAM to this study, I examined five variables: four independent variables measured the PEOU and PU of value-stream costing for the individual (PEOU-I, PU-I) and to internal organizational users (PEOU-O, PU-O), and the dependent variable was the BI of management accountants to implement value-stream costing, measured without asserting control over the behavior. The independent and dependent variables were measured at a point in time and not longitudinally on the TAM 7-point Likert-type scale. This design answered the research questions, measuring perceptions of management accountants as to the usefulness and ease of using value-stream costing. The design determined the relationship and predictive value of the perceptions of

management accountants to the intention to implement value-stream costing. Further, because I assessed the relationship between the independent and dependent variables at a particular moment in time, a cross-sectional design rather than a longitudinal one was appropriate. In this study, I did not seek to compare control and test groups, nor did I seek to understand the results of any treatment protocols; thus, a nonexperimental design was most appropriate.

Although this study included perceptions of PEOU and PU for others, as assessed by respondents, it was not a subjective norm, as used in TAM 2. A subjective norm reflects respondents' assessments of what people important to them want them to do. Management accountants are responsible for providing information to internal users and may consider the impact of a change in reporting on internal users of financial reports. The original TAM measures perceptions of PEOU and PU related to the respondent's job. Because value-stream costing aligns with lean-manufacturing operations, the new reports generated may be more useful to managers and shop-floor supervisors than to management accountants. Researchers indicated traditional standard costing reports were unhelpful to internal users, but management accountants understand them. The research question was, how do management accountants' perceptions regarding usefulness to the organization and ease of use for the organization affect their intention to implement value-stream costing.

Research using the TAM examined adoption across a wide variety of technologies including acceptance of software (Davis, 1989; Davis et al., 1989), faculty acceptance of online education (Gibson, Harris, & Colaric, 2008), student acceptance of online education (Miller, Ranier, & Corley, 2003; Punnoose, 2012), cross-language information-

retrieval systems (Mavaluru & Shriram, 2013), online-task behaviors (Muthitacharoen et al., 2006), preservice teachers' computer attitudes (Teo, 2012; Teo, Lee, & Chai, 2008), and online-game acceptance (Yoon et al., 2013).

As indicated previously, researchers have extended and revised the TAM, which may impact the reliability of the model (Hess et al., 2014; Ma & Liu, 2004; Schepers & Wetzels, 2007). Studies using the original scales resulted in better reliability for PEOU and PU (Hess et al., 2014). According to Venkatesh and Bala (2008), the TAM consistently explains 40% of the variance in individuals' to use an IT and actual usage. Researchers found higher reliability scores when they used all six items from the original TAM (Davis, 1989) for PEOU and PU (Hess et al., 2014). To minimize criticism of use of the TAM for this study, I used the original scale items without additions or deletions.

The use of the TAM extended to topics outside the acceptance of a specific technology tool or software application, and the TAM was used to measure the usability of ERP systems documentation, which was not a type of technology in the traditional sense. Scott (2008) used a unified model based on the TAM to determine the relationship between PU and perceived usability of ERP documentation. The model used by Scott assumed users who perceive technology as easier to use would find documentation easier to follow and understand, therefore more useable. Scott found the PU of ERP documentation strongly affects its perceived usability. When users perceived the documentation as useful, they were more likely to use it efficiently, effectively, and with satisfaction (Scott, 2008).

Riemenschneider et al. (2002) used five models, including the TAM, to examine technology-tool acceptance to study methodology acceptance. Riemenschneider et al.

argued, because each of the tool-acceptance models derived from more general theories of human behavior, they generalize beyond tool acceptance to methodology-use intentions. The study was conducted to determine if acceptance models were applicable to methodologies. Riemenschneider et al. defended the similarity of technology-tool usage and methodology usage because both are workplace behaviors with job-performance consequences and both require effort and skill to learn and use. In all five models, usefulness was significant, which was consistent with findings when applied to tool acceptance (Riemenschneider et al., 2002). Because value-stream costing is a workplace behavior with job-performance consequences that require effort and skill to learn and use, and because value-stream costing is a management-accounting methodology, the TAM is an appropriate measure.

Benamati and Rajkumar (2008) extended the use of the TAM to analyze decision making by investigating the effect of PU and PEOU on the decision to outsource IT-application development. Researchers hypothesized that decision makers' perceptions of how application-development outsourcing would enhance performance of the IT department, and the degree to which the decision maker believed the application-development outsourcing would be free of effort, would influence their attitudes about outsourcing and the intent to outsource (Benamati & Rajkumar, 2008). Benamati and Rajkumar used a survey to empirically test a model that included TAM constructs, along with antecedent variables previous researchers found to influence decision making. The Benamati and Rajkumar (2008) study validated that the TAM has application to organizational decision makers and may be useful in the study of other organizational-level decisions. Slatten (2012) agreed that the TAM can explain "the mediating effects of

decision-maker attitude on organizational decision making (Benamati & Rajkumar, 2008, p. 94). The extension of TAM to decision making supports the use of the TAM to the decision to implement value-stream costing.

Moqbel et al. (2013) argued implementing IFRS will require significant IT applications changes and therefore the TAM was an appropriate theoretical model. IFRS implementation is a change in accounting methods, which extends the use of the TAM to accounting processes; because value-stream costing is an accounting process, implementation of which will also require significant IT application changes, the TAM is an appropriate instrument for research of value-stream costing implementation. Snead et al. (2005) found implementing new inventory costing systems had issues similar to IS implementations. Snead et al. argued new costing methods constitute a new IS and are subject to the same user-acceptance concerns as those affecting new IS implementations. This study extended the use of the TAM to value-stream costing implementations because this change in inventory-costing method will require significant IT application changes and have the same acceptance issues as IFRS and inventory costing-method implementations.

Researchers extended the TAM to study variables affecting the decision of nonprofit organizations to pursue voluntary nonprofit certification (Slatten, 2012). Slatten (2012) proposed certification was a proactive institutional intervention requiring the investment of organizational resources and personnel, and could be classified as an innovation. The pursuit of certification reflected the adoption of technological and other innovations which, according to Slatten, made the TAM a useful theoretical base. Slatten's use of the TAM extended the application to address a decision to accept a

process rather than a technical object or software application, which also supports the extension of the TAM to the decision to change a management-accounting process like value-stream costing.

Researchers proposed other studies using the TAM for topics different from traditional technology acceptance (Ghazizadeh, Lee, & Boyle, 2012; Pierce, Sarkani, Mazzuchi, & Sapp, 2013; Vasarhelyi, Chan, & Krahel, 2012). Vasarhelyi et al. (2012) proposed TAM as the framework to study accountant's acceptance of reporting financial data using the language XBRL, as recommended by the Securities and Exchange Commission, because the purpose was for financial-statement users to have more useful and easy-to-use financial information. Pierce et al. (2013) argued the TAM examines people's acceptance of new concepts and proposed using the TAM to assess U.S. acceptance of government healthcare reform. Ghazizadeh et al. (2012) proposed extending the TAM to study automation acceptance by operators, and defined automation as technology that performs tasks previously performed by humans. Automation changes the individual's task structure by introducing new tasks and responsibilities, which is similar to what happens to management accountants when changing MAS by implementing value-stream costing. Ghazizadeh et al. and Pierce et al. proposed using the TAM for acceptance of new concepts, tasks, and responsibilities, which supported use of the TAM to examine the acceptance of value-stream costing by management accountants. The review of TAM studies, completed and proposed, supported the use of the TAM for the study of acceptance of processes outside the traditional field of IT, which confirmed the extension of the TAM into the study of lean-accounting implementation.

Population, Sample, and Sampling Design

Findings from this study may be generalizable to accountants in all firms that use lean manufacturing; however, the size of that particular population is not well understood. The IMA claimed approximately 750,000 accountants work in U.S. organizations; more than 70,000 members of the IMA work in public and private corporations; and more than 20,000 active Certified Management Accountants are members (IMA, 2014). Rao (2013) surveyed 2,099 cost and management accountants working in manufacturing industries identified by the IMA. No readily available data exists on the extent of lean manufacturing in the United States, and no clear identification of lean manufacturers exists (Rao, 2013). The inability to identify lean manufacturing organizations limits the ability to identify management accountants in lean-manufacturing organizations.

For the scope of this study, I chose participants in the annual Lean Accounting Summit as the population of interest. The Lean Accounting Summit promotes lean accounting for lean manufacturers by educating management accountants in lean and lean-accounting principles. I assumed attendees of the Lean Accounting Summit attended to gain insights into how lean accounting benefits their lean organizations and would understand the survey questions. Previous researchers surveyed the 2005–2008 attendees (Fullerton & Kennedy, 2010; Fullerton et al., 2013, 2014). For this study, I invited attendees from 2005–2013 to participate in an online survey. I obtained 2,307 e-mail addresses from Lean Frontiers because they developed and manage the Lean Accounting Summit. For this study, the sampling frame was comprised of these Lean Accounting

Summit attendees for the years 2005 through 2013 who I invited to participate in the survey, with a minimum expected return rate of 5%.

Rao (2013) and Rao and Bargerstock (2011) surveyed 2,099 members of the IMA, along with 200 participants of the 2011 Lean Accounting Summit, and had a low response rate of less than 5% (Rao, 2013). Fullerton and Kennedy (2010) and Fullerton et al. (2013, 2014) surveyed 476 attendees of the Lean Accounting Summit from 2005 through 2008 and received a 54% response rate. Therefore, to ensure an adequate response rate and sample size, and to minimize nonresponse error, I distributed surveys to the entire sampling frame. Both previous studies used a medium effect size (0.15) size that was consistent with the effect-size relationships found in previous TAM studies (Ma & Liu, 2004). Ma and Liu (2004) found a medium effect size between PEOU and BI, and a large effect size for the relationships between PU and BI, and PEOU and PU, from a meta-analysis of TAM studies. Using an *a priori* sample-size calculator for multiple regression with two predictors and assumptions of a medium effect size of .15 and an alpha of .05, the minimum required sample size was 67 (Statistics Calculator, n.d.). Although I identified four independent variables, I calculated two multiple linear regressions each with only two predictors. The conservative 5% response-rate assumption yielded a sample of 117, which was greater than the minimum required sample size of 67.

Procedures for Recruitment, Participation, and Data Collection

First, I obtained the e-mail addresses for all attendees of the Lean Accounting Summit from 2005 through 2013 from the summit organizers. Second, I sent an invitation to participate to all the e-mail addresses (see Appendix D). In the letter, I provided a link to the online survey using SurveyMonkey, along with detailed information about the

survey and the survey procedures. I offered no incentives for participation. Third, when the respondent clicked on the link, the respondent saw the informed-consent language. They indicated acceptance by proceeding. Respondents who did not complete the survey in one sitting were disqualified and that data point discarded. At the end of the survey, participants received a message thanking them for their participation.

The survey was open for a month with reminder e-mails sent at 1 week, 2 weeks, and 3 weeks to all e-mail addresses. Because the survey was anonymous, I did not track respondents; thus, I sent reminders to all recipients. Because the minimum required sample size was not met, the survey was held open for another 2 weeks and I continued to send weekly reminders. Finally, at the close of the survey period, I downloaded the response data directly from SurveyMonkey into IBM's Statistical Package for the Social Sciences (SPSS) Version 20 for analysis.

Instrumentation

For this study, I used a survey instrument constructed from the previously used and validated TAM survey (Davis, 1989). Davis (1989) developed the TAM using the TRA, additionally supported by self-efficacy theory, the cost-benefit paradigm, and the channel-disposition model. The TAM was developed to determine if users' PU and PEOU of new technology influenced the likelihood that the user would use the technology (Davis, 1989). Perceived usefulness is equivalent to TRA and TPB measurement of attitude and subjective norm, whereas PEOU is the equivalent of behavioral control. Davis found PU and PEOU significantly correlated with self-reported indicators of system use. Usefulness significantly correlated more to usage than ease of use (Davis, 1989). According to Knapp and Mueller (2010), "The reliability of an

instrument is concerned with the consistency of measurements from time to time, from form to form, from item to item, or from one rater to another" (p. 337). King and He (2006) concluded (a) the TAM measures were highly reliable and could be used in a variety of contexts; (b) TAM correlations, although strong, are also variable; (c) moderator variables can help explain the events; (d) PU has a profound influence on intention to use the technology, and (e) the sample sizes required for significance are modest.

Reliability is the degree to which measurement of a variable is consistent and free from error, and is inversely related to measurement error (Hess et al., 2014). The ratio of the true score variance to observed is the reliability coefficient. Hess et al. (2014) noted measurement error is always present, which creates bias that reduces or attenuates the observed correlation between variables below the correlation of the true scores of the variables. Thus, researchers sometimes erroneously report documented reliability of a scale when reliability is not a property of the scale, but of the scores on a scale from one measurement of one sample, and internal consistency reliability is a more appropriate form to examine (Hess et al., 2014). "Internal consistency reliability assess the interrelatedness of measurement items used to measure a construct, and is often used in survey research as it can be assessed in a single administration of an instrument" (Hess et al., 2014, p. 3). Although internal consistency reliability is usually measured using Cronbach's alpha, the use of composite reliability has become more prevalent with the use of structural equation modeling (Hess et al., 2014). Commonly accepted thresholds for reliability coefficients range between .7 and .8. Hess et al. (2014) stated the TAM was cited over 2,400 times and used to measure the acceptance of a wide range of

technologies. In prior meta-analysis, reliability scores for TAM for PU, PEOU, and BI exceeded .88 and studies reporting a composite reliability type had higher reliability coefficients for PEOU and BI than those reporting Cronbach's alpha. King and He (2006) noted 88 TAM empirical studies and found reliability using Cronbach's alpha to indicate high reliability for the constructs PU, PEOU, and BI at higher than .86 (see Table 4), which is considered an acceptable range between .7 and .8 for reliability in the social and behavioral sciences (Knapp & Mueller, 2010).

Table 4

Technology-Acceptance Model Reliability

Scale	Cronbach's alpha	Composite reliability
PU (Mavaluru & Shriram, 2013)		.821
PU (Yoon et al., 2013)	.94	.9
PU (Teo, 2012)		.95
PU (Teo et al., 2008)	.89	
PU (Scott, 2008)	.935	
PU (Punnoose, 2012)	.939	
PU (Moqbel et al., 2013)	.71	.81
PU (Miller, Rainer, & Corley, 2003)	.96	
PU (Benamati & Rajkumar, 2008)	$\geq$ .77	
PEOU (Mavaluru & Shriram, 2013)		.902
PEOU (Yoon et al., 2013)	.904	.88
PEOU (Teo, 2012)		.91
PEOU (Teo et al., 2008)	.8	
PEOU (Scott, 2008)	.931	
PEOU (Punnoose, 2012)	.956	
PEOU (Miller, Rainer, & Corley, 2003)	.95	
PEOU (Benamati & Rajkumar, 2008)	$\geq$ .77	
BI (Teo, 2012)		.97
BI (Mavaluru & Shriram, 2013)		.865
BI (Benamati & Rajkumar, 2008)	$\geq$ .77	
AT (Teo et al., 2008)	.84	

Note. PU = perceived usefulness; PEOU = perceived ease of use; BI = behavioral intention; AT = Attitude.

To operationalize the constructs PU and PEOU, Davis (1989) developed multi-item measurement scales for the two variables. The measurement scales used a multistep process with pretest interviews conducted to assess and refine preliminary scale items, and a field study of the scales completed to ensure reliability and construct validity (Davis, 1989). A second study assessed the relationship between PU, PEOU, and the self-reported usage of a new technology and the second study reflected high validity of the

PU and PEOU scales and indicated a significant correlation of PU and PEOU with self-reported system usage (Davis, 1989). Both studies indicated PU was more strongly linked to usage than PEOU. Whereas PU and PEOU were the study participants' subjective assessment, those beliefs were meaningful variables that functioned as behavioral determinants (Davis, 1989). Table 5 summarizes recent TAM studies and the influences reported. The results are consistent with Davis (1989), including studies that examined acceptance of processes outside the original scope of technology and software.

Table 5

Reported Influences of Technology-Acceptance Model Variables

	PU with BI	PEOU with BI	PEOU with PU
Davis (1989)	Yes	Yes	Yes
Punnoose (2012)	Yes, stronger	Indirect	Yes
Mavaluru & Shriram (2013)	Yes, stronger	Yes	
Yoon et al. (2013)	Yes	No	Males, Yes; Females, No
Moqbel et al. (2013)	Yes		
Miller et al. (2003)	Yes	Yes	
Teo (2012)	Yes	Yes	Yes
Benamati & Rajkumar (2008)	Yes	Yes	
Teo et al. (2008)	Yes	Yes	Yes, stronger
Gibson et al. (2008)	Yes	No	

The TAM's prior demonstration of validity and reliability to predict technology acceptance provided researchers and practitioners the opportunity to extend the model to multiple variables and varied technologies. Researchers have applied the TAM (Davis, 1989) to multiple technologies and tasks, including usefulness of documentation, decision making, and implementation of new accounting standards. The use of new technology requires tasks to be performed in new ways. Accounting processes are complex and

changes to those processes require accounting tasks to be performed differently. The TAM offers a model to study management accountants' intention to implement a new MAS, specifically value-stream costing.

The TAM is the basis for survey questions measuring PEOU-I, PEOU-O, PU-I, PU-O, and BI. The survey appears in Appendix B. The descriptive and demographic questions in Part 2 of the survey are from a survey by Fullerton and Kennedy (2010). The questions were a small portion of the Fullerton and Kennedy survey administered to Lean Accounting Summit attendees from 2005 to 2008. Permission to use this survey appears in Appendix C. These questions were not of primary interest in this study but may offer insights and areas for future research.

Questions relating to the individual, Part 3, Questions 1–12 and 25, are the original TAM questions (Davis, 1989) with the only change being the words value-stream costing inserted in place of chart-master. I received permission from Davis, included in Appendix A. I used the original TAM questions because studies using the original scales resulted in better reliability for PEOU and PU (Hess et al., 2014). Researchers found higher reliabilities when using all six items from the original TAM (Davis, 1989) for PEOU and PU (Hess et al., 2014). To minimize criticism of use of the TAM for this study, I used the original scale items. I made no additions or deletions to the original scale items and the only modifications were inserting value-stream costing in place of the original chart-master wording.

In questions related to the organization, Part 3, Questions 13–24 are the original TAM questions revised to ask the respondent to perceive the ease of use and usefulness of value-stream costing to internal users of the financial reports. Slatten (2012) supported

the measurement of ease of use and usefulness for people other than the respondent. Slatten used parallel survey questions to measure respondents' perceptions of the value of nonprofit certification to themselves and to the organization.

Management accountants must provide information to internal users and may have concerns about the impact of a change in reporting on internal users of financial reports. The original TAM measures perceptions of PEOU and PU related to the respondent's job. Because value-stream costing aligns with lean-manufacturing operations, the new reports generated may be more useful to management and shop-floor supervisors than to management accountants. I selected PEOU-O and PU-O as independent variables and not a subjective norm, as in TAM 2, because the subjective-norm definition comes from the TRA and TPB, signifying "a person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302). A management accountants' perceptions of the PEOU and PU of value-stream costing reflects how the change to value-stream costing will affect users of the information generated by MAS, not perceptions about whether someone important to them wants them to implement value-stream costing. The measurements of PEOU-O and PU-O were an extension of the TAM.

I selected a 7-point Likert-type scale because the original Davis (1989) TAM instrument used a 7-point Likert-type scale. According to Field (2013), perceptions are measured as continuous interval variables; therefore, the Likert-type scale has all nominal and ordinal properties and assigns equal value between points on the scale (Treiblmaier & Filzmoser, 2011). Social scientists often gather information on attitudes, emotions, opinions, personalities, and description of people's environment using Likert-type scales

(Gliem & Gliem, 2003). Researchers use multiple-item scales and summated ratings to quantify constructs that are not directly measurable (Gliem & Gliem, 2003), which is applicable to perceptions measured in this study. Nunnally and Bernstein (1994, as cited in Gliem & Gliem, 2003) supported the use of multiple items to measure psychological attributes because measurement error of individual scores averages out when summing individual scores. Using multiple measures, as in the TAM instrument, allows for greater discrimination in the degrees of an attribute (Gliem & Gliem, 2003). Numerous researchers have tested the validity and reliability of the Likert-type scale, when used with the TAM, in previous TAM studies (Aquino, 2014; Davis, 1989; Davis et al., 1989; Hess et al., 2014; Yallah, 2014)

Operationalization of Variables

The survey questions extended the use of the TAM to value-stream costing, allowing me to gather the four independent variables and the dependent variable in this study, operationalized as follows:

Perceived Ease of Use for the Individual (PEOU-I)

Perceived ease of use for the individual is the degree to which a person believes using value-stream costing would be free of effort (Davis, 1989) for the individual responding to the survey. Perceived ease of use for the individual is an interval-level independent variable, measured using a 7-point Likert-type scale (1 = strongly disagree; 7 = strongly agree), and treated as an interval variable in this study. Part 3 Survey Items 1–6 measured PEOU-I to create Likert-scale data.

Perceived Usefulness to the Individual (PU-I)

Perceived usefulness to the individual is the degree to which a person believes using value-stream costing would enhance job performance (Davis, 1989) of the person responding to the survey. Perceived usefulness to the individual is an interval-level independent variable, measured using a 7-point Likert-type scale (1 = strongly disagree; 7 = to strongly agree), and treated as an interval variable in this study. Part 3 Survey Items 7–12 measured PU-I to create Likert-scale data.

Perceived Ease of Use for the Organization (PEOU-O)

Perceived ease of use for the organization is the degree to which a person believes using value-stream costing would be free of effort (Davis, 1989) for internal users of the respondent's organization management-accounting reports generated by using value-stream costing. Perceived ease of use for the organization is an interval-level independent variable, measured using a 7-point Likert-type scale (1 = strongly disagree; 7 = strongly agree), and treated as an interval variable in this study. Part 3 Survey Items 13–18 measured PEOU-O to create Likert-scale data.

Perceived Usefulness to the Organization (PU-O)

Perceived usefulness to the organization is the degree to which a person believes using value-stream costing would enhance the job performance (Davis, 1989) of internal users of the respondent's organization using management-accounting reports generated by using value-stream costing. Perceived usefulness to the organization is an interval-level independent variable, measured using a 7-point Likert-type scale (1 = strongly disagree; 7 = to strongly agree), and treated as an interval variable in this study. Part 3 Survey Items 19–24 measured PU-I to create Likert-scale data.

Behavioral Intention (BI) of Management Accountants to Implement Value-Stream Costing

BI is the cognitive representation of a person's readiness to perform a given behavior (Schwarze et al., 2007), which in this study was to implement value-stream costing. BI is an interval-level dependent variable, measured using a 7-point Likert scale (1 = strongly disagree; 7 = to strongly agree), and treated as an interval variable in this study. Part 3 Survey Item 25 measured BI.

Data-Analysis Plan

I exported data from survey results from SurveyMonkey.com into SPSS for statistical analysis and reviewed for missing data prior to analysis. The research questions, related hypotheses, and data analysis follow:

Q1. Do management accountants' perceptions of the usefulness of value-stream costing to the individual and to the organization relate to their intentions to implement value-stream costing? A descriptive analysis included finding the mean and standard deviation of PU-I and PU-O of the related Likert-type survey items; then I used the Pearson correlation coefficient to study the strength of association between the variables using Likert scales, made up of the composite scores for each variable.

H_{10}. There is no significant relationship between management accountant PU for the individual and value-stream costing adoption as measured by BI.

$H_{1A.}$ There is a significant relationship between management accountant PU for the individual and value-stream costing adoption as measured by BI.

$H_{20.}$ There is no significant relationship between management accountant PU for the organization and value-stream costing adoption as measured by BI.

$H_{2A.}$ There is no significant relationship between management accountant PU for the organization and value-stream costing adoption as measured by BI.

Q2. Do management accountants' perceptions of ease of use of value-stream costing for the individual and to the organization relate to their intention to implement value-stream costing? I completed a descriptive analysis to find the mean and standard deviation of PU-I and PU-O of the related Likert-type survey items; then I used the Pearson correlation coefficient to study the strength of association between the variables using Likert scales made up of the composite scores for each variable.

$H_{30.}$ There is no significant relationship between management accountant PEOU for the individual and value-stream costing adoption as measured by BI.

H_{3A}. There is a significant relationship between management accountant PEOU for the individual and value-stream costing adoption as measured by BI

.$H_{40.}$ There is no significant relationship between management accountant PEOU for the organization and value-stream costing adoption as measured by BI.

$H_{4A.}$ There is a significant relationship between management accountant PEOU for the organization and value-stream costing adoption as measured by BI.

Q3. How do management accountants' perceptions regarding usefulness to the individual and ease of use for the individual affect their intentions to implement value-stream costing? I used a multiple linear regression with Likert scale data for PU-I and PEOU-I as independent variables, and the BI of management accountants to answer this question.

$H_{50.}$ PU to the individual and PEOU for the individual are not significant predictors of value-stream costing adoption as measured by BI.

$H_{5A.}$ PU to the individual and PEOU for the individual are significant predictors of value-stream costing adoption as measured by BI.

Q4. How do management accountants' perceptions regarding usefulness to the organization and ease of use for the organization affect their intention to implement value-stream costing? I used a multiple linear regression using Likert scale data for PU-O and PEOU-O as independent variables and the BI of management accountants to answer this question.

$H_{60.}$ PU to the organization and PEOU for the organization are not significant predictors of value-stream costing adoption as measured by BI.

$H_{6A.}$ PU to the organization and PEOU for the organization are significant predictors of value-stream costing adoption as measured by BI.

Because the work responsibilities of respondents are important in understanding the validity of their responses, if the respondent's job title was not included, I did not include the respondent in the sample. This exclusion ensured I included only management accountants in the final sample. If respondents failed to indicate any other descriptive data than job title, and answer all other questions related to the variables, I included the respondent's survey in the sample.

As with any survey research, a nonresponse bias may exist (Frankfort-Nachmias & Nachmias, 2008); therefore, I compared late responses with early responses to determine if responses differed significantly. I examined nonresponse bias to determine if it affected the results by examining the bivariate correlation coefficients using

Spearman's rho (Field, 2013; Slatten, 2012). I analyzed data by examining the descriptive statistics of the variables including mean and standard deviation (Teo et al., 2008) and the scale reliabilities using a the matrix of Pearson product-moment correlation coefficients (Field, 2013). An item analysis using SPSS measured internal consistency of items (Gliem & Gliem, 2003).

I tested data assumptions for multiple regression to determine if the linearity, independence of errors, homoscedasticity, and normality assumptions for regression were met (Field, 2013). I plotted and visually inspected histograms and scatter plots of data for all variables to determine if the data were normally distributed (Field, 2013). Additionally, using SPSS, I produced and visually inspected histograms with plotted normal curves for the four independent variables and the dependent variable for normal distribution (Field, 2013). If histograms looked nonnormal, I used boxplots, Q-Q plots, and P-P plots. If a sample size is small, random deviations from normality can make a histogram appear nonnormal (Miles & Shevlin, 2014). I calculated skew and kurtosis using SPSS (Miles & Shevlin, 2014). If some independent variables (PEOU-I, PU-I, PEOU-O, or PU-O) had exhibited extreme skewness, I could have transformed the data to achieve a more uniform distribution, because if the distribution is not normal, least-squares estimates and their standard errors will be inaccurate (Miles & Shevlin, 2014). The dependent variable (BI) does not have to be normal, but if not normally distributed, the researcher must perform additional examination to determine if transformation is required, or if there is a possibility of some form of multiple-population structure (Smith, n.d.).

I ran the Durbin–Watson test to determine if the assumption of independence of errors was violated (Field, 2013) because a visual inspection of the plot of residuals is an unsatisfactory method when there are more than two variables (Miles & Shevlin, 2014). I verified by visual inspection and examination of scatterplots the assumptions of homoscedasticity and linearity (Field, 2013). Further, I examined variance inflation factors to ensure that no unacceptable levels of multicollinearity existed among the independent variables, and assessed goodness of fit for the model (Field, 2013).

To examine the degree to which PU-I, PEOU-I, PU-O, and PEOU-O individually associated with BI, I calculated four separate multiple regressions. Each multiple regression included all responses to the six survey items related to the associated independent variable, and incorporated all responses to PU-I and PEOU-I survey items and the associated BI survey results. Finally, I calculated a multiple regression analysis using all responses to PU-O and PEOU-O and the associated BI survey results.

Ethical Procedures

This study complied with all principles of ethical data collection, including ensuring that no harm came to participants and that all participants provided informed consent. First, participants received all necessary information about the survey purpose and procedures in the e-mail sent requesting their participation. Second, an informed-consent letter was the first screen they encountered in the survey and they indicated agreement to proceed. Third, all participant information remained confidential and known only to me. I collected no names or identifying information. Specific e-mail addresses could not be linked to specific survey responses. Fourth, all information was kept in a password-protected file (with the password only known to me) and will be securely

destroyed after 5 years. Fifth, no conflict of interest existed as respondents do not work for or with me and I do not personally know them. Sixth, no risk attached to participants because I cannot identify responses or link them to specific respondents. Finally, I received approval from the Walden University Office of Research Ethics and Compliance Institutional Review Board, approval number 03-23-15-0087995, before initiating any data-collection procedures.

Threats to Validity

Reliability and validity are essential properties of a measuring instrument (Knapp & Mueller, 2010). Knapp and Mueller (2010) described validity of an instrument as "the extent to which the instrument actually measures 'what it is designed to measure' or 'what it purports to measure.' Validity is therefore concerned with the relevance of an instrument for addressing a study's purpose(s) and research question(s)" (p. 337). I established content validity for the instrument by having experts in lean accounting review the survey and by using the original TAM instrument, which others have previously validated and assessed for reliability in over 2,400 studies over a wide range of technologies and processes (Hess et al., 2014). Use of a nonexperimental correlational research design potentially limits internal validity because there is no administration or control of a treatment, as with experimental research designs (Punnoose, 2012; Venkatesh & Bala, 2008).

Threats to validity include history, maturation, testing, and instrumentation (Singleton & Straits, 2010). There is the chance for an event to happen outside the study that might cause the effect rather than the measured variables (Singleton & Straits, 2010) and such threats to validity must be monitored during the survey period. By using a cross-

sectional study rather than a longitudinal design, the threat of maturation is controlled (Singleton & Straits, 2010). Testing occurred only once, which made the testing threat inapplicable (Singleton & Straits, 2010).

Summary

The lack of implementation of lean accounting, and in particular, value-stream costing, by lean-manufacturing companies is a problem. In addition, little empirical research exists on lean-accounting implementations. The TAM (Davis, 1989) was the chosen theoretical framework to study the intention of management accountants to implement value-stream costing and the effects of independent variables on intention. This study used the TAM instrument developed by Davis (1989) to determine if PEOU and PU impact the BI of accountants to implement value-stream costing. This study filled the gaps in the literature related to quantitative data on lean-accounting implementations and extended the use of the TAM to the study of lean-accounting implementation.

This chapter provided the research design and the rationale to use the TAM, including the reliability and validity of the TAM instrument. The chapter included a description of the population and sampling frame, along with the procedures for recruiting participants, ethical procedures, and data collection. The chapter established the survey instrument, including reliability and validity considerations, and the variable operationalization and data-analysis plan. Chapter 4 incorporates the results of the study and Chapter 5 contains a summary of the results, the conclusions drawn from the data, and recommendations for future research.

Chapter 4: Results

The purpose of this quantitative, explanatory study was to investigate factors that influence the adoption of lean accounting in organizations that use lean manufacturing. The lack of research to identify why manufacturers using lean manufacturing do not use lean accounting indicates a gap in the literature reported by many researchers (Fullerton & Kennedy, 2010; Fullerton et al., 2014; Rao & Bargerstock, 2011). In this study, I examined whether concern about the complexity of value-stream costing, or accountants' perceptions that value-stream costing may not be useful to their organization or to their required job responsibilities, may influence their adoption of value-stream costing.

The study used the TAM developed by Davis (1989) to determine if PEOU and PU impact the BI of accountants to implement value-stream costing. Value-stream costing is a fundamental lean-accounting indicator and is the specific lean-accounting technique studied here. A quantitative, explanatory design will aid in determining inferential relationships (Babbie, 2013) and explaining predictors of lean-accounting adoption based on the TAM principles. In this study, I examined four independent variables: PEOU for the individual (PEOU-I) and the organization (PEOU-O), PU for individuals (PU-I) and organizations (PU-O), and the dependent variable of BI of management accountants to adopt lean accounting using value-stream costing.

Chapter 4 first discusses the data-collection procedures followed and the demographics of the sample. Then I explain the results of data-assumption testing, the descriptive statistics, and the hypothesis testing. Finally, I summarize and synthesize the results.

Data Collection

As described in Chapter 3, I distributed the survey to four experts in the field of lean accounting for their review and feedback. They made no recommendations for changes to the instrument. I input the survey into the online survey tool SurveyMonkey. The first page included the consent language related to the background of the problem, procedure, voluntary nature of the study, risks and benefits of participating, confidentiality, contacts and questions, and consent (see Appendix D).

I received the e-mail addresses of all attendees of the Lean Accounting Summit from 2005 through 2013 from the summit organizers. I imported 2,307 e-mail addresses into SurveyMonkey for distribution of the survey and on March 24, 2015, I sent the first e-mail invitations. Of the 2,307 e-mail addresses, 41 opted out of receiving invitations from SurveyMonkey, and 387 e-mail invitations were undeliverable to the e-mail address used. I sent invitations using my Walden University Gmail account to the e-mail addresses that had opted out of SurveyMonkey invitations and those that were undeliverable by SurveyMonkey and included a web link to the survey.

At the end of Weeks 1, 2, and 3, I sent reminders to the sampling frame using the reminder e-mail documented in Appendix E. The e-mail addresses that were deliverable by SurveyMonkey received the reminder through the SurveyMonkey program and I continued to send reminders through my Walden University Gmail account to the original opted-out group and any remaining e-mail addresses that appeared to have a valid e-mail address.

The survey procedure described in Chapter 3 kept the survey open for 4 weeks. If at the end of the 4-week period the required sample size was not achieved, the survey was

to be extended for an additional 2 weeks. At the end of 4 weeks, although I had received 101 responses, only 62 had answered all the TAM questions required to address the research questions and related hypotheses. I kept the survey open for another 2 weeks, with a reminder sent at the end of Weeks 4 and 5.

At the end of 6 weeks, the survey automatically closed and was unavailable for access on SurveyMonkey. During the survey period, 137 respondents submitted survey responses. I downloaded the survey results into Excel initially for data cleaning, review, and editing of demographic data to numeric format, if necessary. If the respondent indicated "Other" for their job function, I reviewed the job title provided by them in the description field. I reclassified the respondent as other-management accounting related or other-non-accounting based on the job description provided.

To answer the research questions, respondents had to respond to the TAM questions. Of the 137 survey responses, 92 answered at least one TAM question, but 18 did not designate they currently have accounting-related responsibilities in a manufacturing company and were removed from the sample. Of the remaining 74 responses, I eliminated three because of incomplete responses. Four respondents left only one of the 25 questions blank, but did answer the BI question. The four responses were given a dummy variable designation for the missing answer so SPSS could still include the submitted data in the analysis. The final sample size imported into SPSS was 71, which was a 3% response rate.

Using an *a priori* sample-size calculator for multiple regression with two predictors and assumptions of a medium effect size of .15 and an alpha of .05, the minimum required sample size was 67 (Statistics Calculator, n.d.). Although I identified

four independent variables, I calculated two multiple linear regressions, each with only two predictors. The TAM calculates the effect of PEOU and PU on BI. The two separate multiple linear regressions measured the effects of PEOU and PU to the individual on BI, and the effects of PEOU and PU to the organization on BI. The sample size required for a medium effect size of 67 was achieved (Statistics Calculator, n.d.). After one outlier was removed, the sample size of 70 was sufficient for a medium effect size.

Demographic Characteristics

Appendix E contains the demographic-frequency tables including the partition of job functions for the final sample with the Controller function the highest frequency at 46.5%. Only 9% of the sample respondents use value-stream costing, yet 53.5% of respondents indicated either a considerable or a great deal of lean implementation in their manufacturing processes. Respondents indicated 78.9% were only somewhat, little, or not at all satisfied with their current MAS (see Appendix E), yet 83.1% indicated that their costing methods changed only somewhat, little, or not at all in the past 5 years, and 32.4% have not discussed using value-stream costing in their company.

Study Results

The data required to answer the research questions were the answers to the TAM questions. Table 6 lists the variables and the related survey questions from Part 3 of the survey (see Appendix B). I coded the data imported into SPSS with Numbers 1–7 to correspond with the answers given on the Likert scale, with one being strongly disagree, and seven being strongly agree.

Table 6

Technology Acceptance Model Operationalized Variables

Variable name	Questions from Part 3 of survey	How measured	Scale
PEOU-I	1–6	Likert	1–7
PU-I	7–12	Likert	1–7
PEOU-O	13–18	Likert	1–7
PU-O	19–24	Likert	1–7
BI	25	Likert	1–7

Note. PEOU-I = individual perceived ease of use; PU-I = individual perceived usefulness; PEOU-O = organization perceived ease of use; PU-O = organization perceived usefulness; BI = behavioral intention.

Data Assumptions and Reliability Assessment

It was necessary to determine whether data assumptions were met to pursue parametric Pearson correlation and multiple regressions prior to hypothesis testing. Researchers may remove outliers from the data set in a compromise to allow the final dataset to be modeled (Miles & Shevlin, 2014); thus, I removed one respondent from the data set for a final sample size of 70. I computed composite scores for the survey items for each corresponding variable, calculated by summing scores for the survey items that were consolidated to represent each study variable: PEOU-I, PU-I, PEOU-O, and PU-O using SPSS. I visually inspected data for normality for all study variables by using P-P and Q-Q plots (see Appendix F), and data presented normally. This was confirmed by a Shapiro-Wilk test ($p < .05$), which indicated no significant difference from a normal distribution for the study variables, and the results of a Durbin Watson test (1.92) indicated independence of errors was not violated. The assumptions of homoscedasticity and linearity were also verified by visual inspection and examination of scatterplots (see Appendix F), and variance inflation factors showed the assumption for multicollinearity

was met (2.017, 2.712, 2.943, 3.18; Field, 2013). I calculated Spearman's rho to check for nonresponse bias and found no statistically significant correlations. Finally, I assessed the study instrument prior to hypothesis testing using Cronbach's alpha for reliability assessment of all survey items (see Table 7), and all items exhibited a high level of internal consistency (.968–.973), and an overall high level of reliability for the study instrumentation (.971; Field, 2013).

Table 7

Reliability Assessment: Cronbach's Alpha

Survey item	α
PEOUI1	0.973
PEOUI2	0.970
PEOUI3	0.970
PEOUI4	0.969
PEOUI5	0.971
PEOUI6	0.970
PUI1	0.970
PUI2	0.969
PUI3	0.969
PUI4	0.969
PUI5	0.969
PUI6	0.969
PEOUO1	0.969
PEOUO2	0.969
PEOUO3	0.969
PEOUO4	0.969
PEOUO5	0.969
PEOUO6	0.969
PUO1	0.969
PUO2	0.969
PUO3	0.969
PUO4	0.969
PUO5	0.969
PUO6	0.968
BI	0.970

Note. $N = 70$.

Hypothesis Testing

Prior to hypothesis testing, I conducted descriptive analysis to assess variability within and among variable responses (Treiblmaier & Filzmoser, 2011). I ran descriptive statistics of all the Likert-type survey items for all questions on Part 3 of the survey to measure PEOU-I, PU-I, PEOU-O, and PU-O as reported in Appendix G (M = 4.47 to 5.41), which indicated the means were on the positive side of the Likert-type scale responses. I then used the Pearson correlation coefficient to assess the strength of associations between the study variables, and identified 10 significant correlated pairs (see Table 8). Multiple regression analysis followed the Pearson-correlation assessment; I found three individual predictors and two significant regression models (see Tables 9–10). The results are presented by hypothesis.

Research Question 1

Q1. Do management accountants' perceptions of the usefulness of value-stream costing to the individual and to the organization relate to their intentions to implement value-stream costing?

H_{10}. There is no significant relationship between management accountant PU for the individual and value-stream costing adoption as measured by BI.

H_{1a}. There is a significant relationship between management accountant PU for the individual and value-stream costing adoption as measured by BI.

I found a statistically significant positive relationship between PU-I and BI (r = .674; $p < .05$). I rejected Null Hypothesis 1 and found support for Alternative Hypothesis 1.

H_{20}. There is no significant relationship between management accountant PU for the organization and value-stream costing adoption as measured by BI.

$H_{2a.}$ There is a significant relationship between management accountant PU for the organization and value-stream costing adoption as measured by BI.

I found a statistically significant positive relationship between PU-O and BI (r = .681; p < .05). Therefore, I rejected Null Hypothesis 2 and found support for Alternative Hypothesis 2.

Table 8

Pearson Correlation: Five Study Variables

Variable	V1	V2	V3	V4	V5
V1. BI	–	.616*	.674*	.616*	.681*
V2. PEOU-I		–	.565*	.703*	.618*
V3. PU-I			–	.693*	.775*
V4. PEOU-O				–	.753*
V5. PU-O					–

Note. N = 70; *p < .05.

Research Question 2

Q2. Do management accountants' perceptions of ease of use of value-stream costing for the individual and for the organization relate to their intentions to implement value-stream costing?

$H_{30.}$ There is no significant relationship between management accountant PEOU for the individual and value-stream costing adoption as measured by BI.

$H_{3a.}$ There is a significant relationship between management accountant PEOU for the individual and value-stream costing adoption as measured by BI

I found a statistically significant positive relationship between PEOU-I and BI (r = .616; p < .05). Therefore, I rejected Null Hypothesis 3 and found support for Alternative Hypothesis 3.

H_{40} There is no significant relationship between management accountant PEOU for the organization and value-stream costing adoption as measured by BI.

H_{4A}a There is a significant relationship between management accountant PEOU for the organization and value-stream costing adoption as measured by BI.

I found a statistically significant positive relationship between PEOU-O and BI (r = .616; p < .05). Therefore, I rejected Null Hypothesis 4 and found support for Alternative Hypothesis 4.

Research Question 3

Q3. How do management accountants' perceptions regarding usefulness to the individual and ease of use for the individual affect their intentions to implement value-stream costing?

H_{50} PU to the individual and PEOU for the individual are not significant predictors of value-stream costing adoption, as measured by BI.

H_{5}a PU to the individual and PEOU for the individual are significant predictors of value-stream costing adoption, as measured by BI.

I calculated a multiple linear regression using the computed variables for PEOU-I, PU-I, and BI to determine if management accountants' perceptions regarding usefulness and ease of use to the individual affect their intentions to implement value-stream costing (see Table 9). Collectively, PEOU-I and PU-I accounted for 53% of the variance of BI,

$F(2,64) = 35.85$, $p < .05$, and both PEOU-I and PU-I were significant individual predictors of BI ($p < .05$). Therefore, I rejected Null Hypothesis 5 and found support for Alternative Hypothesis 5. The resulting predictor equation was

$$BI = -.26 + .08*PEOU\text{-}I + .11*PU\text{-}I$$

Table 9

Regression Analysis: Perceived Ease of Use–Individual and Perceived Usefulness–Individual

Variable	*b*	SE *B*	*B*	*p*
Constant	-.26	.69		.711
PEOU-I	.08	.03	.33	.002*
PU-I	.11	.02	.49	.000*
R^2	.53*			
F	35.85			

Note. PEOU-I = individual perceived ease of use; PU-I = individual perceived usefulness; $N = 70$;*$p < .05$.

Research Question 4

Q4. How do management accountants' perceptions regarding usefulness to the organization and ease of use for the organization affect their intentions to implement value-stream costing?

$H_{60.}$ PU to the organization and PEOU for the organization are not significant predictors of value-stream costing adoption, as measured by BI.

$H_{6a.}$ PU to the organization and PEOU for the organization are significant predictors of value-stream costing adoption, as measured by BI.

I calculated multiple regression analysis using the computed variables for PEOU-O, PU-O, and BI to determine whether management accountants' perceptions regarding usefulness and ease of use to the organization predicted their intentions to implement

value-stream accounting (see Table 10). Collectively, PEOU-O and PU-O accounted for 49% of the variance of BI, $F(2,66) = 31.21$, $p < .05$, and PU-O was found to be a significant individual predictor of BI ($p < .05$). Therefore, I rejected Null Hypothesis 6 and found support for Alternative Hypothesis 6. The resulting predictor equation was

$$BI = .99 + .05*PEOU\text{-}O + .10*PU\text{-}O$$

Table 10

Regression Analysis: Perceived Ease of Use–Organization and Perceived Usefulness–Organization

Variable	*b*	SE *B*	*B*	*p*
Constant	.99	.56		.083
PEOU-O	.05	.03	.24	.075
PU-O	.10	.03	.50	.000*
R^2	.49*			
F	31.21			

Note. PEOU-O = organization perceived ease of use; PU-O = organization perceived usefulness; *N = 70;* *$p < .05$.

Finally, to examine the degree to which the individual survey items used to measure PEOU-I, PU-I, PEOU-O, and PU-O were individual or collective predictors of BI, I calculated four separate multiple regression analyses. Each multiple regression analysis included all responses to the six survey items related to the associated predictor variable. I calculated a multiple regression and incorporated all responses to PEOU-I and PU-I survey items and the associated BI survey results and another analysis using all survey-item responses for the study variables PEOU-O and PU-O and the associated BI. I found three survey items, PEOUI1, PUI6, and PEOUO3, to be a significant individual predictors of BI (see Appendix H).

Summary

The purpose of this study was to examine whether concern about the complexity of value-stream costing, or accountants' perceptions that value-stream costing may not be useful to their organization or to their required job responsibilities may influence their adoption of value-stream costing. In addition, demographic data offered insights into the current state of lean manufacturing and value-stream costing. Using Pearson correlation coefficient, 10 significant pairwise correlations emerged. Using Pearson correlation coefficient, a statistically significant positive relationship emerged between PU-I and BI ($r = .672$; $p < .05$). I rejected Null Hypothesis 1 and found support for the alternative hypothesis that there is a significant relationship between management accountant PU for the individual and value-stream costing adoption as measured by BI. A statistically significant positive relationship emerged between PU-O and BI ($r = .673$; $p < .05$). Therefore, I rejected Null Hypothesis 2 and found support for the alternative hypothesis that there is a significant relationship between management accountant PU for the organization and value-stream costing adoption.

I found a statistically significant positive relationship between PEOU-I and BI ($r = .616$; $p < .05$). Therefore, I rejected Null Hypothesis 3 and found support for the alternative hypothesis that there is a significant relationship between management accountant PEOU for the individual and value-stream costing adoption, as measured by BI. I found a statistically significant positive relationship between PEOU-O and BI ($r = .608$; $p < .05$). Therefore, I rejected Null Hypothesis 4 and found support for the alternative hypothesis that a significant relationship exists between management

accountant PEOU for the organization and value-stream costing adoption. I will discuss the implications of these findings in Chapter 5.

I calculated multiple regression analysis using the computed variables for PEOU-I, PU-I, and BI to determine if management accountants' perceptions regarding usefulness and ease of use to the individual affected their intentions to implement value-stream costing. Collectively, PEOU-I and PU-I accounted for 51% of the variance of BI, $F(2,64) = 35.85$, $p < .05$ and both PEOU-I and PU-I were significant individual predictors of BI ($p < .05$). Therefore, I rejected Null Hypothesis 5 and found support for the alternative hypothesis. I calculated multiple regression using the computed variables for PEOU-O, PU-O, and BI to determine whether management accountants' perceptions regarding usefulness and ease of use to the organization predicted intentions to implement value-stream. Collectively, PEOU-O and PU-O accounted for 49% of the variance of BI, $F(2,66) = 31.21$, $p < .05$, and PU-O was a significant individual predictor of BI ($p < .05$). Therefore, I rejected Null Hypothesis 6 and found support for the alternative hypothesis. I will discuss the implications of these findings in Chapter 5.

Chapter 5 will include a discussion of the ways the findings confirm, disconfirm, or extend knowledge of value-stream costing and the TAM by comparing the literature with an analysis and interpretation of the findings. I discuss the limitations of the findings in Chapter 5. Also, Chapter 5 includes implications of the results and recommendations for further study.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative, explanatory study was to investigate factors that influence the adoption of lean accounting in organizations that use lean manufacturing. The lack of research to identify why manufacturers using lean manufacturing do not use lean accounting indicates a gap in the literature reported by many researchers (Fullerton & Kennedy, 2010; Fullerton et al., 2014; Rao & Bargerstock, 2011). The problem addressed by this study was to determine factors that influence the adoption of lean accounting by U.S. manufacturers that use lean-manufacturing techniques. To add to understanding of why lean accounting is or is not implemented by lean manufacturers in the United States, I selected the TAM (Davis, 1989) as the methodology to study the impact of PEOU and PU of value-stream costing on management accountants' BI to implement lean accounting using value-stream costing. I examined four independent variables—PEOU-I PU-I, PEOU-O, and PU-O—and the dependent variable of BI of management accountants to adopt lean accounting using value-stream costing.

Key findings in the current study led to a rejection of Null Hypotheses 1–6 as I found support for Alternative Hypotheses 1–6. I included four significant correlated pairs between the predictor variables, PEOU-I, PU-I, PEOU-O, and PU-O, and value-stream costing adoption (BI; $p < .05$), and six intercorrelations between the four predictor variables ($p < .05$). In addition, PEOU-I, PU-I, and PU-O were significant individual predictors of BI ($p < .05$). Two significant regression models determined that, collectively, PEOU-I and PU-I accounted for 53% of the variance of BI ($p < .05$) and PEOU-O and PU-O accounted for 49% of the variance of BI ($p < .05$). Finally, when I

analyzed individual survey items apart from the computed variables, three survey items—PEOUI1, PUI6, and PEOUO3—were also significant predictors of BI ($p < .05$).

Interpretation of Findings

The purpose of this study was to add to understanding of why lean accounting is or is not implemented by lean manufacturers in the United States. I selected the TAM (Davis, 1989) as the methodology to study the impact of PEOU and PU of value-stream costing on management accountants' BI to implement lean accounting using value-stream costing. Based on the outcomes of this study, findings can be interpreted as follows.

Research Question 1

Do management accountants' perceptions of the usefulness of value-stream costing to the individual and to the organization relate to their intentions to implement value-stream costing?

I found a statistically significant positive relationship between PU-I and BI ($r = .674$; $p < .05$) and a statistically significant positive relationship between PU-O and BI ($r = .681$; $p < .05$). This means that the more useful management accountants perceived value-stream costing to be to their own job or to members of the organization, the higher their intent to implement value-stream costing.

Research Question 2

Do management accountants' perceptions of ease of use of value-stream costing for the individual and for the organization relate to their intentions to implement value-stream costing?

I found a statistically significant positive relationship between PEOU-I and BI ($r = .616$; $p < .05$) and a statistically significant positive relationship between PEOU-O

and BI (r = .616; p <. 05). This means that the easier management accountants perceive it is to use value-stream costing in their own job or for members of the organization to use, the higher their intent to implement value-stream costing.

The results for the first two research questions were important because this was the first empirical study to find variables that positively affected the intention to implement value-stream costing in the context of lean accounting. As discussed in Chapter 2, Davis's (1989) original TAM research indicated PU was linked more strongly to usage than PEOU, and meta-analysis of TAM literature concluded PU has a profound influence on intention (King & He, 2006; Ma & Liu, 2004). The results of this study were consistent with the conclusion that PU linked more strongly to BI than PEOU to BI, and the strongest correlations were PU-I to BI (.674), and PU-O to BI (.681). Other technology-tool models found usefulness was significantly related to technology-tool acceptance (Riemenschneider et al., 2002), and this study confirmed, like other TAMs, usefulness significantly related to BI.

Research Question 3

How do management accountants' perceptions regarding usefulness to the individual and ease of use for the individual affect their intentions to implement value-stream costing?

I calculated a multiple regression using the computed variables for PEOU-I, PU-I, and BI to determine whether management accountants' perceptions regarding usefulness and ease of use to the individual predicted intentions to implement value-stream costing. Collectively, PEOU-I and PU-I accounted for 53% of the variance of BI (p < .05), and both PEOU-I and PU-I were significant individual predictors of BI (p < .05). This was

the first empirical study to identify predictors of the intention to implement value-stream costing. I will discuss these results in the recommendations section of this chapter.

Research Question 4

How do management accountants' perceptions regarding usefulness to the organization and ease of use for the organization affect their intentions to implement value-stream costing?

I calculated a multiple regression using the computed variables for PEOU-O, PU-O, and BI to determine whether management accountants' perceptions regarding usefulness and ease of use to the organization predicted intentions to implement value-stream costing. Collectively, PEOU-O and PU-O accounted for 49% of the variance of BI ($p < .05$), and PU-O was a significant individual predictor of BI ($p < .05$).

The addition of a variable that measured the perceptions of the ease of use and usefulness to other members of the organization was an extension of the TAM. Management accountants' perceptions of the PEOU and PU of value-stream costing may reflect how the change to value-stream costing will affect users of the information generated by MAS, not perceptions about whether someone important to them wants them to implement value-stream costing. This study supported the extension of TAM to include the addition of the variables PEOU-O and PU-O. This may be useful for other studies where the tool acceptance being measured will affect others in the organization in addition to the individual.

TAM as a Theoretical Framework

Researchers in a variety of fields have used the TAM to study topics other than technology-tool acceptance (Benamati & Rajkumar, 2008; Moqbel et al., 2013;

Riemenschneider et al., 2002; Scott , 2008; Slatten, 2012), but this is the first use of TAM for MAS procedural change, and specifically value-stream costing. Researchers proposed other studies using the TAM for topics different from traditional technology acceptance (Ghazizadeh et al., 2012; Pierce et al., 2013; Vasarhelyi et al., 2012), and results from this study indicated the original TAM tool provided reliable measures for PEOU-I, PU-I, PEOU-O, PU-O, and BI for value-stream costing, confirmed by a Cronbach's alpha reliability assessment, as all items exhibited a high level of internal consistency (.968-.973), and an overall high level of reliability for the study instrumentation (.971; Field, 2013). The resulting measures for PEOU-I, PU-I, PEOU-O, PU-O and BI also had an overall high level of reliability, which compared favorably to Hess et al. (2014) who reported reliability for the TAM measures of PEOU (.620–.980), PU (.600–.980), and BI (.500–.990). The study results provided support for the use of the TAM for acceptance of procedures or processes other than technology-tool acceptance, like new MAS acceptance, and specifically value-stream costing.

Limitations of the Study

Weaknesses of the quantitative method are failure to provide the context of respondent responses, and the inability to control the environment of respondents when completing the survey (Matveev, 2002). Although response rate can be a limitation in survey research, this study achieved the robust sample size required for a medium effect size (Statistics Calculator, n.d.) and the response rate did not limit results. As with any survey research, a nonresponse bias may exist (Frankfort-Nachmias & Nachmias, 2008); however, a nonresponse bias did not emerge. To test for nonresponse bias, I compared late responses with early responses to determine if significant differences existed using

the Spearman Rho, and no significant correlations arose between any survey item and the date the survey was completed.

The sampling frame of attendees of the Lean Accounting Summit may have been a limitation, but no readily available data existed on the extent of lean manufacturing in the United States, and there was no clear identification of lean manufacturers (Rao, 2013). The inability to identify lean-manufacturing organizations limited the ability to identify management accountants in lean-manufacturing organizations. This study used data gathered through self-reports and a single method of data collection, which may have led to the common method variance where the associations between variables tend to become inflated (Slatten, 2012); therefore, future research could use the multitrait multimethod (Teo, 2012).

Weaknesses of the quantitative method are failure to provide the context of respondent responses, and the inability to control the environment of respondents when completing the survey (Matveev, 2002). Surveys can be also susceptible to reactivity, which causes systematic measurement error and relies on self-reporting of intention that cannot be observed (Singleton & Straits, 2010). I assumed respondents were honest in their responses, spent adequate time reading and responding, and did not suffer from survey fatigue. A final limitation was that results of multiple regression and correlation indicated significant associations and predictive models, but results were not sufficient to claim causation (Field, 2013; Miles & Shevlin, 2014).

Recommendations

Venkatesh and Davis (1996) stated it was important to understand the antecedents of the key TAM constructs of PU and PEOU, and understanding the key determinants

offers the opportunity to develop interventions, which further indicates a need for future research to identify the antecedents to PEOU-I, PU-I, PEOU-O, and PU-O of value-stream costing. Venkatesh and Davis identified increased training as a method to increase PEOU and PU, but the effect was measured on IS acceptance and not in the context of the current study. Although one may assume that additional training and education increase management accountants' perceptions of the ease of use and usefulness of value-stream costing, further research must be conducted to support this assumption. Once researchers identify antecedents for PEOU-I, PU-I, PEOU-O, and PU-O of value-stream costing, leaders in the field of value-stream costing may be able to develop interventions that will improve the intention to implement value-stream costing.

The TAM measures the effect of variables on intention to implement technology; yet, it remains unclear if intention indicates actual usage (Bagozzi, 2007), which also is an opportunity for future research. Venkatesh et al. (2003) found, using the UTAUT, that intention and facilitating conditions directly determine usage behavior. Therefore, the UTAUT could be used in future quantitative inferential research to identify facilitating conditions that determine usage of value-stream costing.

As statistically significant relationships between PEOU-I, PU-I, PEOU-O, PU-O and BI emerged, those interested in increasing the use of value-stream costing should find ways to increase the PEOU and PU to individuals and organizations of value-stream costing. Although research to identify the antecedents for PEOU, and PU of value-stream costing needs to be conducted through additional studies using structural-equation modeling (Baines & Langfield-Smith, 2003) and additional inferential TAM studies

(Venkatesh & Davis, 1996), accounting education has previously been identified as lacking in terms of lean accounting.

Accounting education has historically focused on preparing graduates for careers in public accounting (Grasso, 2007). Very few baccalaureate accounting programs in the United States cover lean principles or lean accounting (Grasso, 2007). Educators must instruct management accountants on lean principles and accountants' role in successful implementation (Grasso, 2007). Increasing coverage in management-accounting textbooks and increased training opportunities for current accounting instructors may increase new college graduates' understanding of value-stream costing and the usefulness to manufacturing firms using the lean-manufacturing technique of value streams. Lean-accounting proponents should document this need through additional inferential quantitative research and measure the impact that increased education has on future accounting graduates.

This study extended the use the TAM to MAS procedural changes, which implied the TAM may be useful in studying other accounting procedural changes. Prior to this study, the only accounting procedural or nontechnology change study using the TAM examined whether U.S. academics and professionals were ready for IFRS; the model was modified to include TPB and did not use the original TAM items (Moqbel et al., 2013). Because TAM was a reliable measure of PEOU, PU, and BI, future research should be conducted on other accounting procedural changes using the TAM with the original survey items (Hess et al., 2014). Future research using the TAM should also consider the variables of PEOU-O and PU-O in the measures, where appropriate.

This study was conducted using a sampling frame of individuals assumed to be familiar with lean accounting. The sampling frame included nonaccountants, which may have impacted the return rate. This survey should be replicated in a future correlational study using a sampling frame of management accountants ideally working in companies that have implemented lean-manufacturing techniques. Using a sampling frame from this specific population may allow for measurement of usage of value-stream costing instead of assessment of the intention to implement. Because of the low level of lean implementations (Rao, 2013), the required sample size may be difficult to achieve; therefore, proponents of lean accounting need to assist researchers in identifying appropriate sampling frames, which may require an increased effort to identify the population of manufacturing firms that actually use lean manufacturing by those promoting the use of lean accounting. The study may also be replicated with future attendees of the Lean Accounting Summit and results may be compared with this study to determine whether the associations found in this study could be replicated in future study.

Future researchers may wish to use a qualitative methodology. Weaknesses of the quantitative method fail to provide context for responses, and an inability to control the environment for respondents in survey completion (Matveev, 2002). An in-depth qualitative study using semistructured interviews with open-ended questions (Zikmund, Babin, Carr, & Griffin, 2009) could be completed at a Lean Accounting Summit, to find management accountants familiar with lean accounting and to identify contextual responses, which may indicate new or adapted variables to be studied.

Implications

Lean manufacturing has the potential to change the U.S. manufacturing economy, resulting in positive social change, and when successfully implemented, offer positive benefits to organizations. As explained in Chapter 1, lean accounting is essential to the long-term success of lean-manufacturing implementations. Successful lean implementations require a change in culture across the organization (Solomon & Fullerton, 2007). Management accountants must assist in building a cooperative culture for lean to be successful (Fullerton et al., 2014; Grasso, 2007). The results of the current study have implications for lean-accounting implementation and improvement.

Management-Accounting Systems

One barrier to successful lean implementation is a MAS incompatible with lean-manufacturing principles (Li et al., 2012). Accounting departments impeded successful lean implementations when they did not change and become a lean support system (Cunningham & Fiume, 2003; Grasso, 2007). The use of a traditional standard-costing structure promotes nonlean behavior (Baggaley & Maskell, 2003b; Carnes & Hedin, 2005; Hutchinson & Liao, 2009; Maskell, 2006). The lack of lean-accounting implementations (Rao, 2013) is a problem and the focus of this study. Multiple reasons may exist as to why management accountants may not change accounting methods when companies implement lean manufacturing and this study sought to determine whether perceptions of management accountants influenced their intention to implement value-stream costing.

Researchers have conducted little quantitative research related to lean accounting (Fullerton & Kennedy, 2010; Fullerton et al., 2013; Rao, 2013), and the literature clearly

documents the inadequacies of traditional standard costing for lean manufacturers, but little research describes implementing lean principles under different MAS environments (Li et al., 2012; Rosa & Machado, 2013; Ruiz-de-Arbulo-Lopez et al., 2013). The trend to increase use of lean-manufacturing techniques implies an increase in MAS changes to support the new strategy; however, this increase in changes is not the case. Although researchers have shown the potential value of lean-accounting, researchers must determine why management accountants have not adopted lean-accounting methods, such as value-stream costing, when a company has implemented lean-manufacturing processes, which was the problem addressed by this study.

The current study is the first to seek reasons that may influence management accountants' decision to implement value-stream costing. Study results indicated a statistically significant positive relationship between each of the predictor variables—PEOU-I, PU-I, PEOU-O, and PU-O—with the criterion variable, BI, to implement value-stream costing. This study also found PEOU-I and PU-I were significant predictors of BI and PEOU-O and PU-O were also significant predictors of BI. These findings provide insight into variables that may to increase intent to implement value-stream costing. Although researchers do not know if intention to implement predicts future implementation, Bagozzi (2007) questioned whether BI leads to actual usage and argued the TAM was not suitable to explain and predict use. The results of the current study indicated these factors may predict intention to do so.

The Technology-Acceptance Model

The current study was the first empirical study applying the TAM questionnaire to an accounting-system change that is procedural rather than a technology-tool

implementation. This study was also significant in extending the use of the TAM to value-stream costing, and for extending the use of the TAM to MAS procedural changes rather than the original purpose of study in IT implementations. Researchers proposed using the TAM to examine ABC (Kellermanns & Islam, 2004), but collected no empirical data. Although researchers used the TAM to examine the adoption of IFRS, they did not use the original TAM question format (Moqbel et al., 2013).

The study included the perceptions of PEOU and PU for others, as assessed by respondents; this was not a subjective norm, as used in TAM 2. A subjective norm reflects respondents' assessments of what people important to them want them to do. Management accountants are responsible for providing information to internal users and may consider the impact of a change in reporting on internal users of financial reports. The original TAM measures perceptions of PEOU and PU related to the respondent's job. Because value-stream costing aligns with lean-manufacturing operations, the new reports generated may be more useful to managers and shop-floor supervisors than to management accountants. The study included PEOU-O and PU-O to answer the question of how management accountants' perceptions regarding usefulness to the organization and ease of use for the organization affect their intention to implement value-stream costing. A statistically significant positive relationship emerged between PU-O and BI ($r = .681$; $p < .05$), and a statistically significant positive relationship also emerged between PEOU-O and BI ($r = .616$; $p < .05$). In addition, collectively, PEOU-O and PU-O accounted for 49% of the variance of BI ($p < .05$), and PU-O was a significant individual predictor of BI ($p < .05$).

Social Change

As U.S. manufacturers implement lean strategies, lean manufacturing has the potential to change the economy. Without the support of the accounting department, companies may have difficulty establishing long-term success with lean (Cunningham & Fiume, 2003; Fullerton et al., 2014; Grasso, 2007). Successful lean implementation requires the organization's culture to change (Bhasin & Burcher, 2006); Lean-transformation champions want management accountants to be change agents, helping to build and reinforce the cooperative culture necessary for lean to thrive. The change to a cooperative culture can be subverted, dooming the lean transformation to failure if the accounting system continues to support a command-and-control culture, (Grasso, 2007, p. 185) therefore, accounting in a lean organization must change to support the lean implementation. This study contributed to positive social change by providing insights into reasons for accountants in lean-manufacturing enterprises intention, or lack thereof, to implement value-stream costing, which may increase the rate of lean-accounting implementations and thereby increase the success of lean-manufacturing implementations. Thus, study results contributed initial empirical research on lean accounting by quantitatively examining management-accountant perceptions regarding value-stream costing and the relationship to their intention to implement value-stream costing.

Conclusions

The problem addressed by this study was to determine factors that influence the adoption of lean accounting by U.S. manufacturers that use lean-manufacturing techniques (Rao, 2013; Rao & Bargerstock, 2011, 2013). With little prior quantitative

research in lean accounting (Fullerton & Kennedy, 2010; Fullerton et al., 2014; Rao & Bargerstock, 2011; Rosa & Machado, 2013), this study provided new information on variables that predicted intention to implement value-stream costing, and is the first study to use the TAM original survey items for an accounting procedural change. This study was also significant for including two additional variables, PEOU-O and PU-O, that evaluated respondents' perceptions of the ease of use and usefulness for others in the organization and not solely for individuals.

The results of this study supported the use of the TAM for a research problem beyond a technology-tool acceptance by confirming the results of TAM studies by other researchers and in other contexts (Davis, 1989; King & He, 2006; Ma & Liu, 2004; Riemenschneider et al., 2002). Therefore, proponents of the use of value-stream costing have foundational information that management accountants' perceptions of the ease of use and usefulness, for both the individual and organization, of value-stream costing have a positive correlation with the intention to implement value-stream costing. Additionally, PEOU and PU may predict intention to implement value-stream costing.

Recommendations included improvement in accounting higher education to expand coverage of lean accounting and for researchers to find antecedents of PEOU and PU of value-stream costing. The current study results offered further knowledge of how the perceptions of management accountants related to usefulness and ease of use of value-stream costing, and influenced the intention to implement value-stream costing. Thus, advocates can increase efforts to gain positive perceptions, with the goal to influence the use of value-stream costing in manufacturing firms that have implemented lean manufacturing. Increased use of lean-accounting techniques, like value-stream

costing, will increase the success of lean-manufacturing implementations and promote positive social change (Cunningham & Fiume, 2003; Fullerton et al., 2014; Grasso, 2007; Maskell et al., 2011).

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Appendix A: Davis Usage Permission

RE: Usage permission for original Technology Acceptance Model survey
Fred Davis (FDavis@walton.uark.edu)
7/09/14
To: Patricia Timm
You have my permission to use and adapt the TAM scales for your dissertation.
Best wishes
Fred Davis

From: Patricia Timm [patricia.hart@waldenu.edu]
Sent: Wednesday, July 09, 2014 2:17 PM
To: Fred Davis
Subject: Usage permission for original Technology Acceptance Model survey

Dear Dr. Davis,

I am a student at Walden University and currently writing my dissertation proposal. I would like your permission to use the original TAM questions with the only modification being changing the technology studied. I will cite all appropriate source articles.
I am applying the TAM to the acceptance of a new method of management accounting used for lean manufacturing companies. This not an IT technology, but it is a complex, technical process which is much different than traditional costing methodology. Others have used the TAM for non-IT processes, and I hope to add to the knowledge base.

Thank you so very much,
Patricia Hart Timm

Appendix B: Survey Instrument

Survey of Lean Manufacturers and Value Stream Costing

Part 1:

1. What best describes your job function?

    a. Chief Financial Officer
    b. Controller functions
    c. Cost accountant
    d. General accounting
    e. Manufacturing management
    f. Other: explain

2. How many years of accounting experience do you have? _____

3. How many of those years have been in manufacturing? _____

4. How many years have you worked at your current company?_____

5. Approximately what are the annual sales of your company? _____

6. How many manufacturing locations does your company have? _____

Part 2:

1. Please indicate what type of cost accounting system is generally used at your company

    a. Job order costing
    b. Process costing
    c. Back flush costing
    d. Value stream costing
    e. Other: explain

2. Please indicate which method you generally use **internally** to estimate inventory cost

    a. Absorption costing
    b. Direct costing
    c. Other: explain

3. For your main product, indicate the primary cost driver used to allocate overhead costs.

    a. Direct labor
    b. Machine hours
    c. Multiple drivers
    d. Other: explain

4. Indicate below the level of lean manufacturing implementation on the production floor

Not at all	Little	Some	Considerable	A great deal

5. Indicate below how much the product costing techniques have changed in your firm over the past 5 years

Not at all	Little	Some	Considerably	Extremely

6. Indicate below how satisfied you are with your management accounting system

Not at all	Little	Some	Considerably	Extremely

7. If you currently do not use value stream costing, has your company discussed using value stream costing? Yes ____ No ____

Part 3

		Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	No Opinion/ Neutral (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
Perceived Ease of Use for Individual (PEOU-I)								
1.	Learning value stream costing will be easy for me.							
2.	It will be easy to get information I need from value stream costing							
3.	Value stream costing financial reporting will be clear and understandable.							
4.	Value stream costing will be flexible.							
5.	It will be easy for me to become skillful at using value stream costing.							
6.	Value stream costing will be easy to use.							
	Perceived Usefulness for Individual (PU-I)							
7.	Using value stream costing in my job will enable me to accomplish tasks more quickly.							
8.	Using value stream costing will improve my job performance.							
9.	Using value stream costing in my job will increase my productivity.							
10.	Using value stream costing will enhance my effectiveness on the job.							
11.	Using value stream costing will make it easier to do my job.							

		Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	No Opinion/ Neutral (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
12.	I will find value stream costing useful in my job.							
Perceived Ease of Use for the Organization (PEOU-O)								
13.	Learning value stream costing will be easy for internal users of management accounting reports.							
14.	It will be easy for internal users to get information they need from value stream costing reports							
15.	Value stream costing financial reporting will be clear and understandable to internal users.							
16.	Value stream costing will be flexible for internal users.							
17.	It will be easy for internal users to become skillful at using value stream costing reports.							
18.	Value stream costing reports will be easy for internal users to use.							
Perceived Usefulness for the Organization (PU-O)								
19.	Using value stream costing reports in their job will enable internal users to accomplish tasks quicker.							
20.	Using value stream costing reports will improve the job performance of internal users.							
21.	Using value stream costing reports in their job will increase internal users' productivity.							

		Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	No Opinion/ Neutral (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
22.	Using value stream costing reports will enhance internal users' effectiveness on the job.							
23.	Using value stream costing reports will make it easier for internal users to do their job.							
24.	Internal users will find value stream costing useful in their job.							
Value Stream Intention (BI)								
25.	Assuming my company implements value streams, I intend to use value stream costing							

Appendix C: Fullerton Usage Permission

Rosemary Fullerton [rosemary.fullerton@usu.edu]

Actions
In response to the message from Hart, Patricia, 7/8/2014
To: Hart, Patricia
Attachments: jitsurvey_JOM.pdf (41 KB)[Open as Web Page]
Inbox
Friday, July 18, 2014 5:51 PM

You replied on 7/21/2014 10:14 AM.
Hello Patti,

I hope your surgery went well. Surgeries are never fun and always a worry.

I talked with my co-authors who are still active researchers, and they said it was fine to share the survey with you. As you know, surveys take considerable time and thought to prepare, so I have been somewhat reluctant to share my surveys in the past--especially since the questions are really fully included in my papers. But each paper has a different part of the survey, so it may be helpful to you to see all of the questions that were included. Also, I have several different versions of surveys, and I think this is my latest one.

If you have any questions, let me know.

Rosemary

Appendix D: Informed Consent

To: [email address]
From: Patricia Timm
Subject: Survey on Value Stream Costing Acceptance
Date: [Date of distribution]

You are invited to take part in a study of the perceptions and acceptance of value-stream costing. I am a doctoral candidate in Management with a specialization in Accounting at Walden University and conducting this study for my dissertation. You have been invited because of your attendance at a Lean Accounting Summit. Your attendance at a Lean Accounting Summit indicates you have some knowledge of lean accounting and value streams. The study is designed to be completed by accountants, therefore if your job is not accounting related you will not be included in the study.

Background Information

There is very little data on lean accounting usage. This study's purpose is to evaluate how the perceived usefulness and perceived ease or difficulty of value-stream costing may influence the likelihood it will be implemented in companies using value streams on their production floors.

Procedure

You have been provided with a link to the online survey instrument that should take no more than 15 minutes to complete. Please complete the survey and submit it as instructed. It does not matter if more than one person at a company completes the survey because the questions relate to the individuals' perceptions. The questions address your perceptions as they relate to you, personally, and your perceptions of the usefulness and ease of use to internal users of management accounting reports at your company.

Voluntary Nature of the Study

Your participation in the study is voluntary. Your decision to participate or not, will be respected. No one at your company or the Lean Accounting Summit will know if you participated. You may discontinue your participation at any time. Because the survey is anonymous, your choice to participate, decline, or discontinue participation will have no impact on your relationship with the researcher.

Risks and Benefits of Participating

There are no known or assumed risks associated with participating in this study, and there is no individual benefit to participation. There is no compensation offered for completing this survey. The overall benefits of this study may be in its contribution to understanding perceptions of value-stream costing and intentions to implement value-stream costing. This research may allow proponents of lean accounting to tailor training and research to increase the rate of value-stream costing usage.

Confidentiality

Any information provided will be kept confidential. The researcher was provided email addresses, but no names or other identifying information will be collected. The researcher will not include your email address or anything else that may identify you in any reports of this study.

Contacts and Questions

The researcher is Patricia Hart Timm. You may ask me questions by emailing me at patricia.hart@waldenu.edu or calling 231-218-2663. If there are questions regarding your rights as participants please contact Dr. Leilani Endicott at irb@waldenu.edu

Consent

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By submitting the online survey instrument I understand that I am agreeing to the terms described above.

If you participate in the study you may want to print and keep a copy of this consent form.

Thank you for your assistance and time.

Best regards,
Patricia Hart Timm, CPA
Ph.D. Candidate, Walden University

Appendix E: Demographic Characteristics Tables

Table E1

Job Function

	Frequency	Percent	Valid percent	Cumulative percent
Chief Financial Officer	16	22.5	22.5	22.5
Controller	33	46.5	46.5	69.0
Cost Accountant	3	4.2	4.2	73.2
General Accounting	4	5.6	5.6	78.9
Other Accounting	15	21.1	21.1	100.0
Total	71	100.0	100.0	

Note. $N = 71$.

Table E2

Current Costing Method

	Frequency	Percent	Valid percent	Cumulative percent
Job Order Costing	17	23.9	23.9	23.9
Process Costing	14	19.7	19.7	43.7
Back Flush Costing	20	28.2	28.2	71.8
Value-stream costing	9	12.7	12.7	84.5
Other	11	15.5	15.5	100.0
Total	71	100.0	100.0	

Note. $N = 71$.

Table E3

Level of Lean Manufacturing Implementation

	Frequency	Percent	Valid percent	Cumulative percent
Not At All	2	2.8	2.8	2.8
Little	5	7.0	7.0	9.9
Some	26	36.6	36.6	46.5
Considerable	30	42.3	42.3	88.7
A Great Deal	8	11.3	11.3	100.0
Total	71	100.0	100.0	

Note. $N = 71$.

Table E4

Satisfaction With Current Management Accounting System

	Frequency	Percent	Valid percent	Cumulative percent
Not At All	5	7.0	7.0	7.0
Little	14	19.7	19.7	26.8
Some	37	52.1	52.1	78.9
Considerably	12	16.9	16.9	95.8
Extremely	3	4.2	4.2	100.0
Total	71	100.0	100.0	

Note. $N = 71$.

Table E5

Amount Product Costing has Changed Over the Past 5 Years

	Frequency	Percent	Valid percent	Cumulative percent
Not At All	7	9.9	9.9	9.9
Little	17	23.9	23.9	33.8
Some	35	49.3	49.3	83.1
Considerable	7	9.9	9.9	93.0
Extremely	5	7.0	7.0	100.0
Total	71	100.0	100.0	

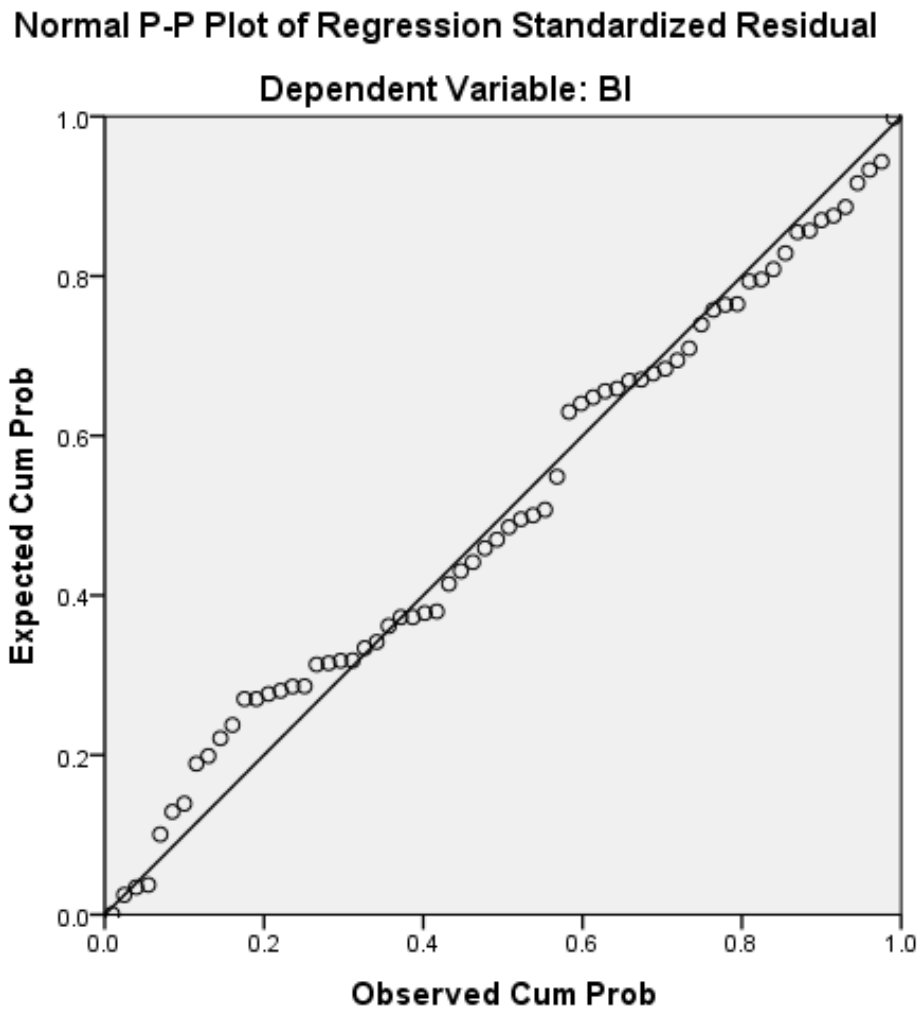
Note. $N = 71$.

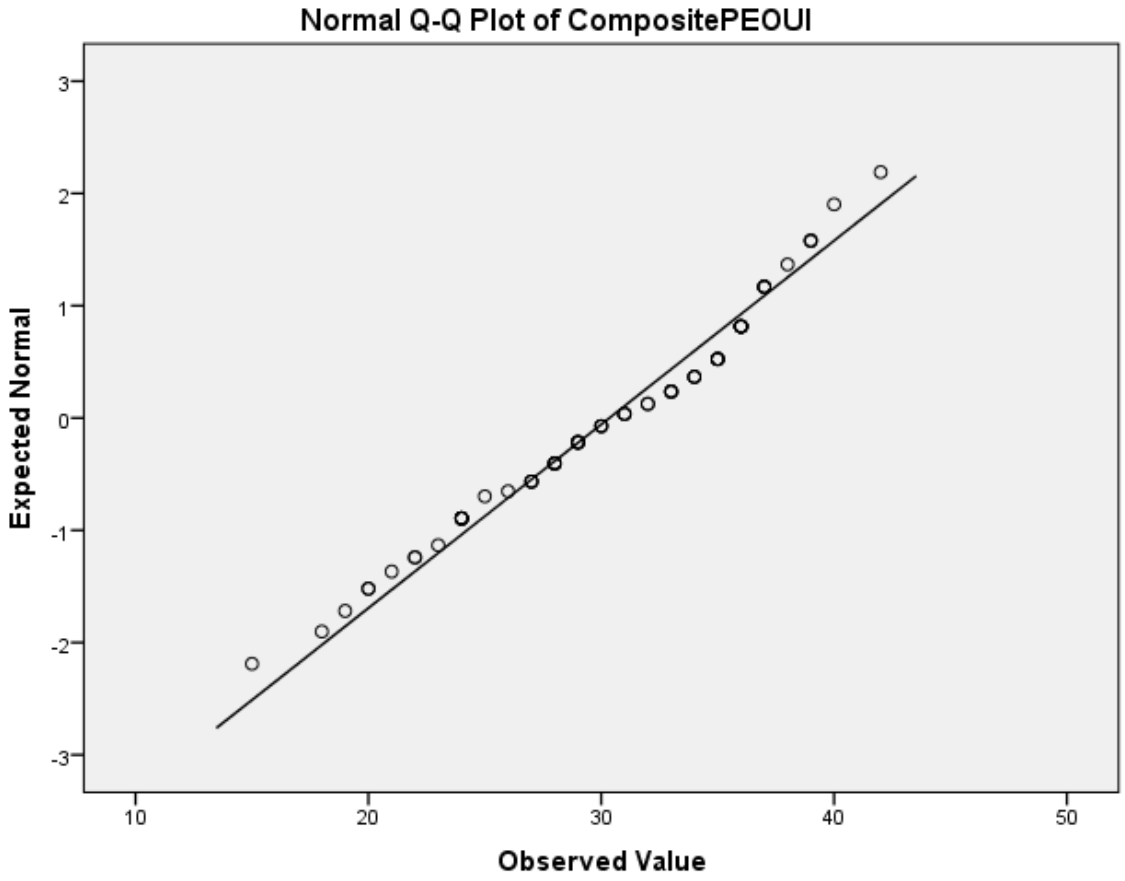
Table E6

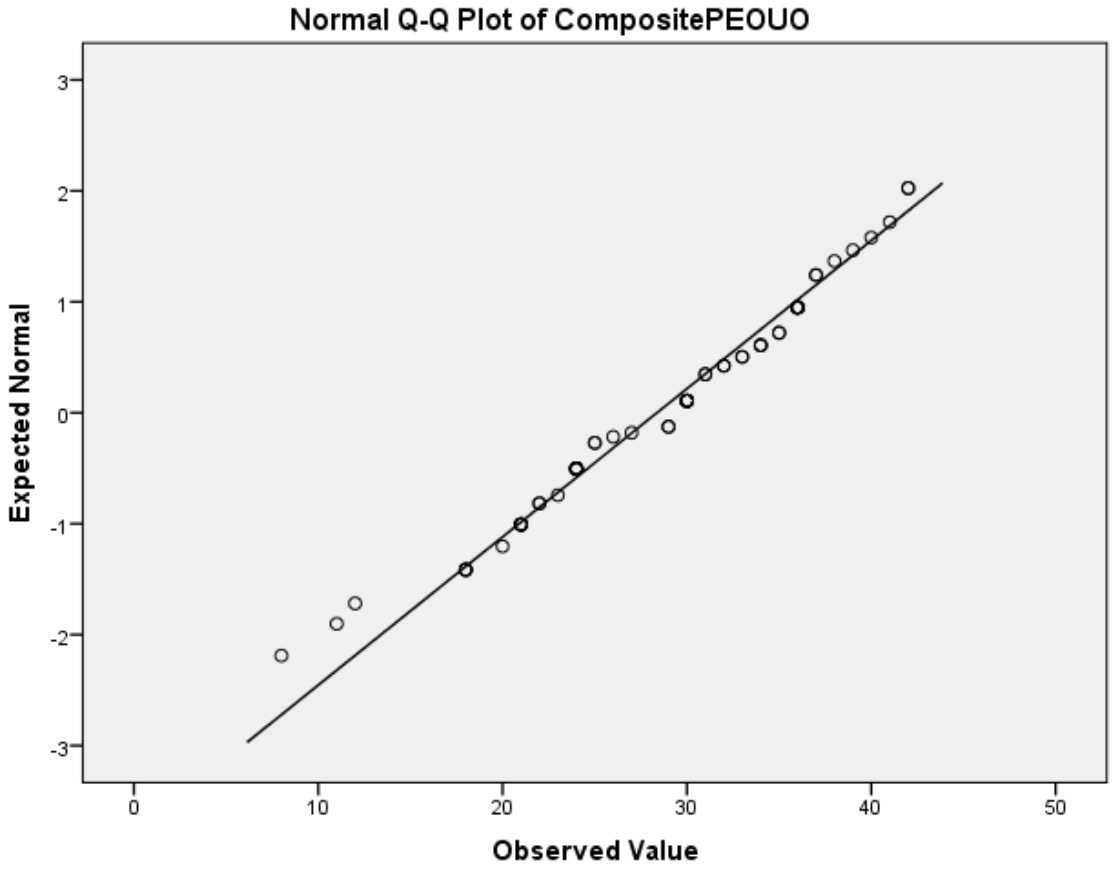
If You Currently Do Not Use Value-Stream Costing, Has Your Company Discussed?

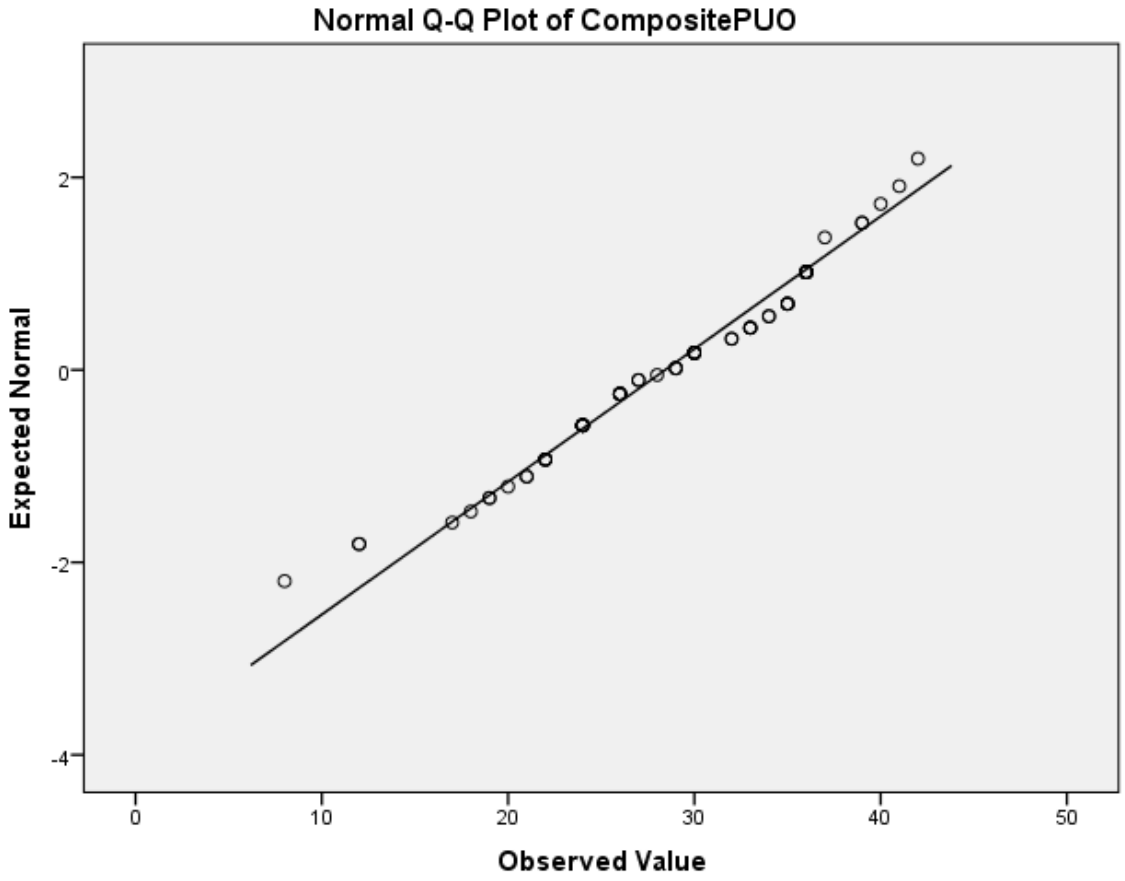
	Frequency	Percent	Valid percent	Cumulative percent
No answer	12	16.9	16.9	16.9
Yes	36	50.7	50.7	67.6
No	23	32.4	32.4	100.0
Total	71	100.0	100.0	

Appendix F: Data Assumptions




Normal Q-Q Plot of CompositePEOUI
Expected Normal
3
2
1
0
-1
-2
-3
10
20
30
40
50
Observed Value


Normal Q-Q Plot of CompositePEOUO
Expected Normal
Observed Value
3
2
1
0
-1
-2
-3
0
10
20
30
40
50


Normal Q-Q Plot of CompositePUO
Expected Normal
2
0
-2
-4
0
10
20
30
40
50
Observed Value

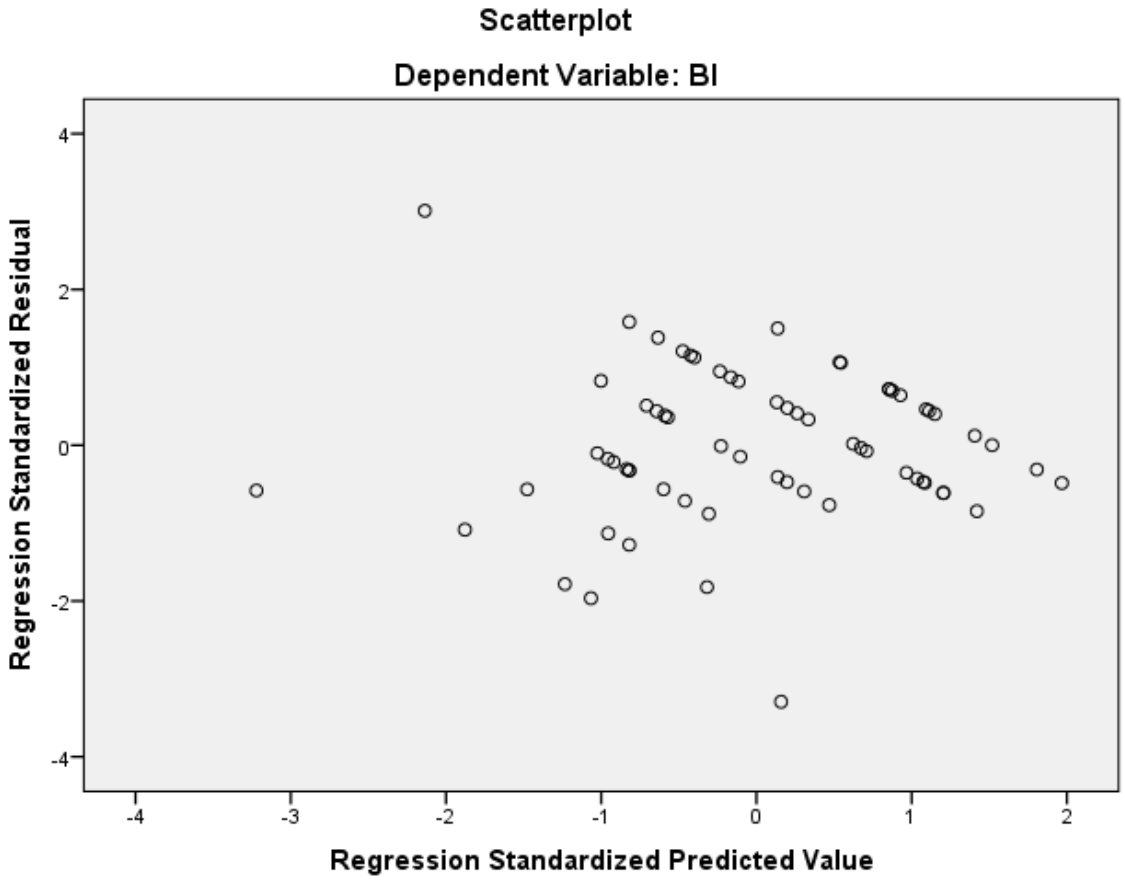
Appendix G: Results Analyses

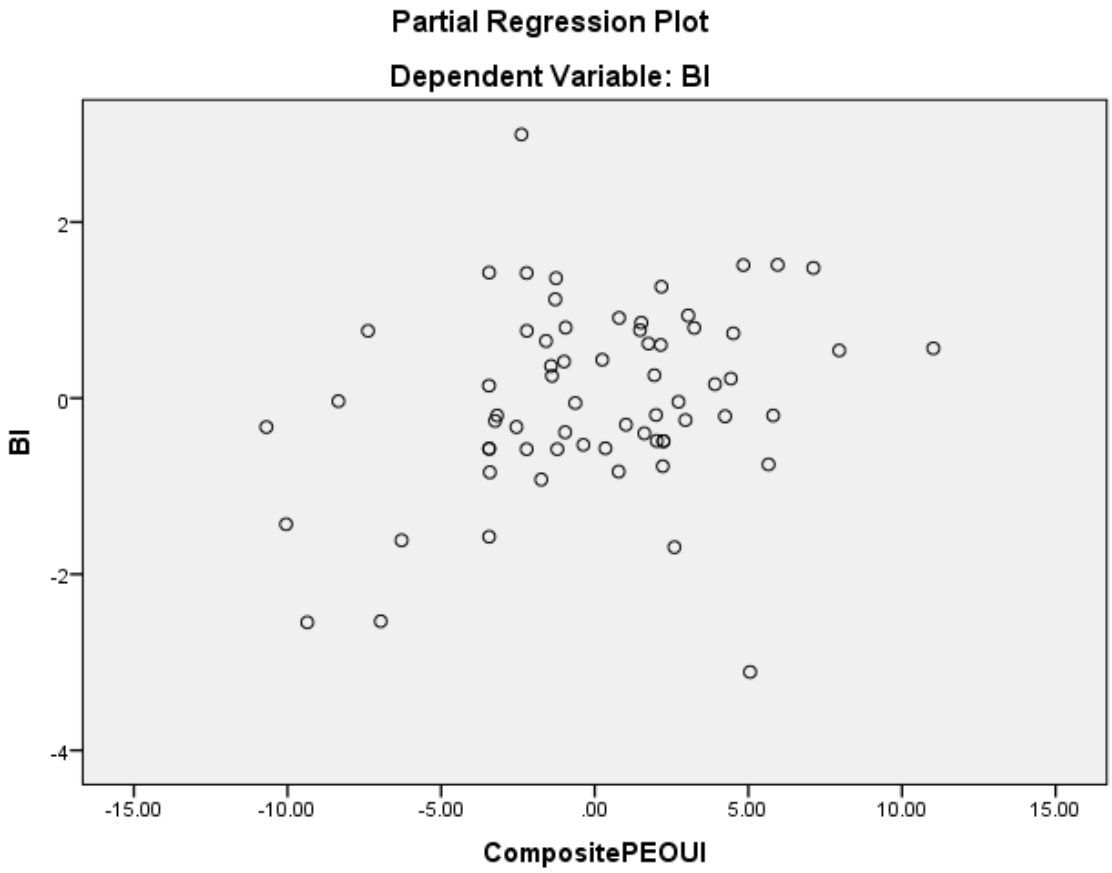
Table G1

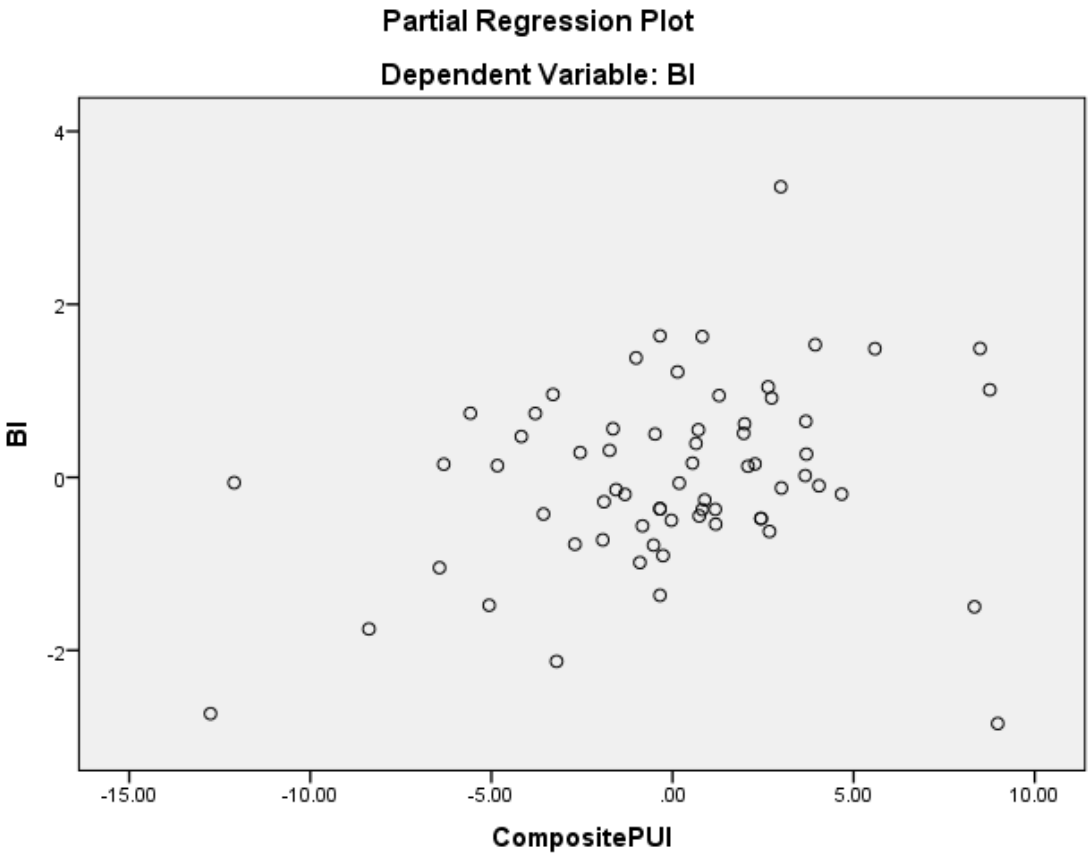
Individual Perceived Ease of Use, Individual Perceived Usefulness, Organization Perceived Ease of Use, and Organization Perceived Usefulness Likert-Type Scale Items

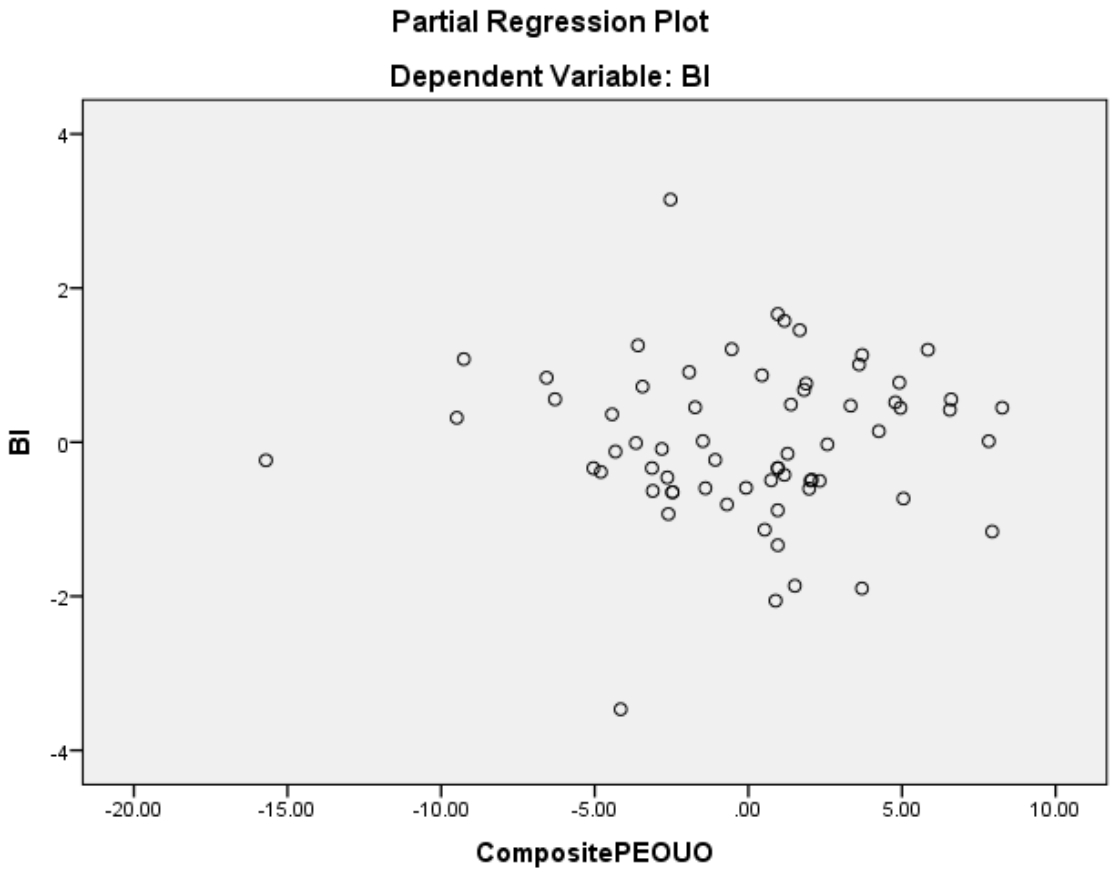
	N	Minimum	Maximum	Mean	Std. Deviation
PEOUI1	70	2	7	5.41	1.173
PEOUI2	70	1	7	4.77	1.446
PEOUI3	69	1	7	4.96	1.490
PEOUI4	70	1	7	4.97	1.116
PEOUI5	70	2	7	5.27	1.128
PEOUI6	70	1	7	4.93	1.300
PUI1	70	1	7	4.47	1.259
PUI2	69	1	7	4.64	1.248
PUI3	70	1	7	4.63	1.241
PUI4	69	1	7	4.83	1.283
PUI5	70	1	7	4.47	1.224
PUI6	70	1	7	5.01	1.335
PEOUO1	70	1	7	4.67	1.432
PEOUO2	70	1	7	4.67	1.432
PEOUO3	70	1	7	4.97	1.484
PEOUO4	70	2	7	4.76	1.197
PEOUO5	70	1	7	4.63	1.353
PEOUO6	69	1	7	4.77	1.363
PUO1	70	1	7	4.56	1.270
PUO2	70	1	7	4.63	1.395
PUO3	70	2	7	4.69	1.269
PUO4	70	2	7	4.81	1.277
PUO5	70	1	7	4.74	1.337
PUO6	70	1	7	5.00	1.274

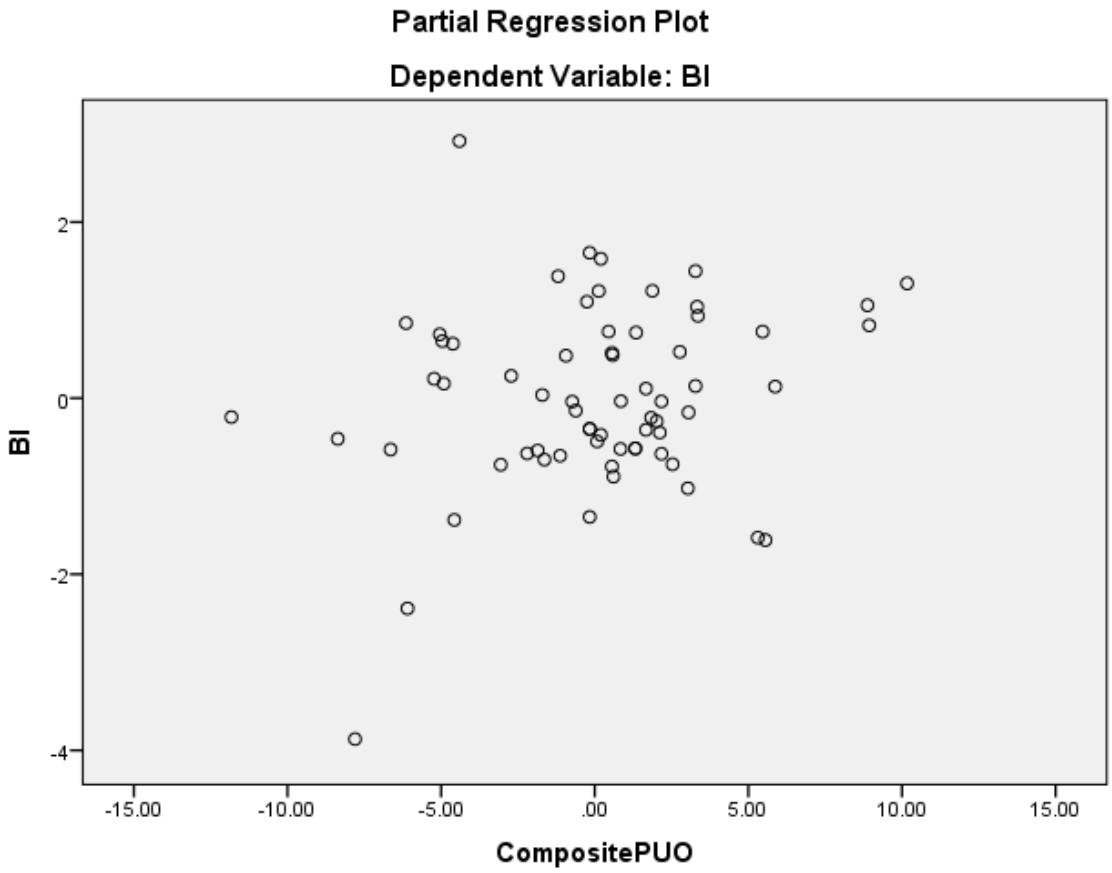
Note. PEOUI = perceived ease of use individual; PUI = perceived usefulness individual; PEOUO = perceived ease of use organization; PUO = perceived usefulness organization; *N* = 70.


Scatterplot
Dependent Variable: BI
Regression Standardized Residual
Regression Standardized Predicted Value
4
2
0
-2
-4
-4
-3
-2
-1
0
1
2


Partial Regression Plot
Dependent Variable: BI
BI
2
0
-2
-4
-15.00
-10.00
-5.00
.00
5.00
10.00
15.00
CompositePEOUI


Partial Regression Plot
Dependent Variable: BI
BI
4
2
0
-2
-15.00
-10.00
-5.00
.00
5.00
10.00
CompositePUI


Partial Regression Plot
Dependent Variable: BI
BI
4
2
0
-2
-4
-20.00
-15.00
-10.00
-5.00
.00
5.00
10.00
CompositePEOUO


Partial Regression Plot
Dependent Variable: BI
BI
2
0
-2
-4
-15.00
-10.00
-5.00
.00
5.00
10.00
15.00
CompositePUO

Appendix H: Results Tables

Table H1

Regression Analysis: Individual Perceived Ease of Use All Survey Items

Variable	*b*	SE *B*	*B*	*p*
Constant	.34	.77		.66
PEOUI1	.30	.18	.23	.106
PEOUI2	.08	.14	.07	.59
PEOUI3	-.18	.14	-.17	.22
PEOUI4	.69	.20	.51	.00*
PEOUI5	-.31	.22	-.23	.16
PEOUI6	.41	.20	.36	.04*
R^2	.51			
F	10.83			

Note. PEOUI = perceived ease of use individual; $N = 70$; $R^2 = .51$ ($p < .05$).

Table H2

Regression Analysis: Individual Perceived Usefulness all Survey Items

Variable	*b*	SE *B*	*B*	*p*
Constant	.86	.54		.117
PUI1	.39	.15	.33	.012*
PUI2	.16	.27	.13	.56
PUI3	-.38	.24	-.31	.11
PUI4	.23	.30	.20	.44
PUI5	-.13	.22	-.11	.54
PUI6	.63	.18	.56	.001*
R^2	.57			
F	13.42			

Note. PUI = perceived usefulness individual; $N=70$; $R^2 = .57$ ($p<.05$).

Table H3

Regression Analysis: Organization Perceived Ease of Use, All Survey Items

Variable	*b*	SE *B*	*B*	*p*
Constant	1.38	.61		.028*
PEOUO1	.41	.19	.39	.036*
PEOUO2	-.17	.28	-.16	.543
PEOUO3	-.24	.22	-.23	.284
PEOUO4	.45	.24	.36	.070
PEOUO5	-.15	.24	-.13	.534
PEOUO6	.53	.29	.48	.075
R^2	.44			
F	8.03			

Note. PEOUO = perceived ease of use organization; $N = 70$; $R^2 = .44$, ($p < .05$).

Table H4

Regression Analysis: Organization Perceived Usefulness, All Survey Items

Variable	*b*	SE *B*	*B*	*p*
Constant	1.25	.55		.027*
PUO1	-.03	.19	-.03	.871
PUO2	.15	.19	.14	.427
PUO3	-.55	.30	-.46	.077
PUO4	.22	.28	.19	.430
PUO5	.57	.31	.51	.069
PUO6	.46	.22	.39	.044*
R^2	.53			
F	12.03			

Note. PUO = perceived usefulness organization; $N = 70$; $R^2 = .53$ ($p < .05$).

Table H5

Regression Analysis: Individual Perceived Ease of Use, Individual Perceived Usefulness, All Survey Items

Variable	*b*	SE *B*	*B*	*p*
Constant	-.78	.76		.309
PEOUI1	.43	.19	.33	.025*
PEOUI2	-.10	.14	-.10	.480
PEOUI3	-.21	.15	-.20	.161
PEOUI4	.35	.19	.26	.074
PEOUI5	-.32	.21	-.24	.129
PEOUI6	-.32	.18	.28	.082
PUI1	.25	.18	.21	.173
PUI2	.37	.29	.30	.211
PUI3	-.20	.23	-.16	.394
PUI4	-.04	.33	-.04	.893
PUI5	-.16	.21	-.13	.452
PUI6	.53	.20	.47	.011*
R^2	.67			
F	9.13			

Note. PEOUI = perceived ease of use individual; PUI = perceived usefulness individual; $N = 70$; $R^2 = .67$ ($p < .05$).

Table H6

Regression Analysis: Organization Perceived Ease of Use, and Organization Perceived Usefulness, All Survey Items

Variable	*b*	SE *B*	*B*	*p*
Constant	1.06	.61		.089
PEOUO1	-.10	.20	-.08	.627
PEOUO2	.15	.20	.14	.464
PEOUO3	-.72	.30	-.61	.031*
PEOUO4	.26	.29	.22	.375
PEOUO5	.58	.32	.51	.076
PEOUO6	.39	.25	.33	.124
PUO1	.33	.18	.32	.070
PUO2	.04	.26	.04	.870
PUO3	-.38	.22	-.37	.086
PUO4	.14	.25	.11	.597
PUO5	-.16	.23	-.14	.492
PUO6	.34	.28	.31	.226
R^2	.59			
F	6.70			

Note. PEOUO = perceived ease of use organization; PUO = perceived usefulness organization; $N = 70$; $p < .05$.