WHY ADOPT A STANDARD EARLY WHEN THERE ARE NO ECONOMIC BENEFITS?

THE CASE OF EARLY ADOPTERS AND VOLUNTARY STATE-AUTHORED STANDARDS

John Z. Ni, Steve A. Melnyk, William J. Ritchie, Barbara F. Flynn

INTRODUCTION

Information asymmetry often occurs in situations where two parties are involved and one party has more or better information than the other. This is critical because one party may be dependent on the other party to carry out certain actions or to produce products/services on which the first party is dependent. For example, in outsourcing/supply chain transactions, the buyer, located in one country, is dependent on an overseas supplier to provide goods that meet the performance requirement criteria. As has been noted in business studies such as *Poorly Made in China* (Midler, 2009), suppliers (especially those located overseas) often ship poorly made products, while simultaneously assuring the buyers that their products conform to the performance requirements. Consequently, the buyers often find themselves exposed to critical problems when deficiencies are uncovered.

When faced by such information asymmetries, firms have three possible options available to them. First, they can use buffers, in the form of extra inventory, increased/safety lead times, or multiple suppliers. While this option addresses pressing temporal issues, it also increases costs and does not resolve the underlying causes of information asymmetries. Second, firms can pursue their own inspection and validation processes to mitigate the asymmetries. In addition to being costly and time-consuming, this approach is not always effective. For example, a recent investigation by the New York Times found that the resulting on-site inspection process is

riddled by flaws such as superficial inspections, deceptive tricks played by the party being investigated, and hidden violations of client expectations(Clifford & Greenhouse, 2013). The third option, and the primary focus of this study, is to require that the supplier be certified according to some form of generally accepted and appropriate business standard.

Business standards are administrative innovations that provide a means of addressing information asymmetries (e.g., King, Lenox, & Terlaak, 2005; Montiel, Husted, & Christmann, 2012). Firms become certified because the verified adoption and implementation of the standard signals to others that the firm and its processes conform to the requirements captured within the standard (Connelly, Certo, Ireland, & Reutzel, 2011). Yet, standards are only effective when the standard is appropriate and, due to the absence of mandatory legal requirements, a sufficiently large number of stakeholders and members within the business community have embraced it. Thus, when enough organizations have embraced them, these standards possess a "taken for granted" attribute (O'Neill, Pouder, & Buchholtz, 1998). When this trait is associated with a standard, we can regard it as "quasi-mandatory" – where it is expected that firms will pursue certification in the standard and where the failure to be certified is regarded as unusual and noteworthy. When a standard becomes quasi-mandatory, justification seldom requires a business case; rather, the expense of being certified is seen as simply the costs of doing business.

Yet, the achievement of this "quasi-mandatory" status is the result of a process that is both complex and not well understood. Specifically, most of the research on standards has focused on the adoption decision after a "quasi-mandatory" standard has emerged (e.g., Terlaak, 2007). Further complicating our understanding of this process is the loci of authorship. That is, standards can be either public-authored or private-authored (Ingram & Clay, 2000; Ritchie & Melnyk, 2012; Terlaak, 2007).

The process by which an administrative innovation such as a standard is developed, adopted, and diffused has traditionally been studied with the assumption that the early adopters, who face the high risks (after all, they may have selected and invested in the "wrong" standard), are rewarded by correspondingly higher economic returns. In contrast, the late adopters receive lower economic returns in accordance with lower uncertainties of adoption (due to the fact that the standard has already been accepted and vetted by the business community). Furthermore, late adopters are often motivated primarily by institutional (i.e., customer pressure) rather economic factors (Westphal, Gulati, & Shortell, 1997). This scenario is most evident with private-authored standards (e.g., ISO 9000). However, as noted by Ritchie and Melnyk (2012) and Melnyk, Ritchie, and Calantone (2014), public-authored standards present early adopters with very different economic results. Here, it is the late adopters, not the early adopters, who are the recipients of the highest economic returns.

With public-authored standards, the State often acts as an agent for the public and seeks to introduce a standard that offers major benefits for the public. However, in order to realize the maximum benefits of the standard, widespread adoption by a critical mass of organizations is essential. When organizations view the standard as essentially quasi-mandatory (and behave accordingly), the desired public benefits have the greatest potential for being realized. Examples of such standards include the Department of Environmental Protection's Clean Marina Program and Custom Border Protection's (CBP) Customs-Trade Partnership against Terrorism (C-TPAT).

Past research, while describing the differences in benefits and actions between early and late adopters, has not addressed a simple but critical question: "Why would the early adopters participate in this process if there are no significant, long-term economic benefits?" To address this question, this study adopts, as its theoretical framework, signaling theory (Connelly et al.,

2011; Spence, 1973, 1974, 2002). Using this theoretical lens, this study explores the motivations of early adoption by addressing the following specific questions:

- Does the perceived signal strength of the standard play a role in determining the adoption timing?

- To what degree is adoption timing related to alignment with the firm's motivations for the adoption and perceived benefits?

In addressing these questions, this study contributes to standard's scholarship in four areas. First, we argue that standard authorship and the adopter's motives matter. Specifically, this study introduces the concept that the adoption timing of a standard depends upon the fit between the power/strength of a standard's signal and a firm's motivation for adoption. Second, by examining the motivations for adoption, this study reveals greater insights into the underlying process in which a public voluntary standard evolves into the quasi-mandatory status introduced by Melnyk et al. (2013). Third, we provide a framework that predicts standard adoption timing based upon the alignment between a standard's signal strength and the motivations of the adopter. Finally, while all of the standards literature to-date uses secondary data to indirectly measure the impact of standard adoption on firms, we offer evidence of direct linkages between the ex-ante motivations and ex-post adoption experience based upon direct feedback from managers who implemented the standard.

STANDARDS: THEORETICAL PERSPECTIVES

Standards are a form of Administrative Innovation (AI) whereby a set of rules or guidelines are relied upon to govern processes or systems (Melnyk et al., 2013). As such, standards play an important role in guiding organizational decisions and processes and have been

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applied in a wide variety of contexts ranging from individuals and products to management systems. The source of standards is equally varied in that their genesis arises from individuals (e.g. professional designations through the AICPA), private organizations (e.g. ISO 9000 & ISO 14000), and public entities, such as the State (e.g. the SEC and the Food and Drug Administration's pharmaceutical guidelines).

Entities in the Standards Landscape

The process by which a voluntary certified management standard (CMS), irrespective of whether its authorship is public or private, begins with the creation of a *voluntary* guideline –a standard whose adoption is truly optional. The authors of the guideline ultimately hope that a transition occurs whereby it achieves "quasi-mandatory" status. The quasi-mandatory status is bestowed when a sufficiently large number of firms have adopted the standard so that it assumes a "taken-for-granted" character (O'Neill, Pouder & Bucholtz, 1999).

As previously noted, the process by which CMS attain this coveted status is not well understood. Rather, the research focus has centered on the adoption decision *after* the standard has become accepted. Yet, to understand the nuances of the adoption process, we must begin by identifying the various entities involved in the adoption process and clarifying the roles that they play. Three key entities are of critical importance in the adoption process: (1) firms; (2) the general public (and their agents); and, (3) certifying organizations.

Firms: It is the firms, not the individual consumers that are most interested in certification since it enables them to address the problems created by information asymmetries (Montiel et al., 2012). Firms are involved either as consumers (buyers) or as suppliers of goods and services. Typically, it is the firm as supplier that often seeks certification. As noted by

Westphal et al. (1997), the motivation for suppliers to seek certification can vary. The early adopters of these standards (often pursued before the standards have become widely accepted) have been typically portrayed as being economically driven, that is, they see that the benefits attained by implementing the standards and their associated practices outweigh the costs of pursuing certification (Benner & Velosso, 2008). In contrast, the late adopters are viewed as being compliance driven, where they are responding to external pressures placed on them by customers who are typically other firms.

Understanding the interplay between the firms is critical because it helps us to better understand the difference between a private standard and a public standard. With a private standard, the majority of the benefits are captured by the two parties in the transaction (i.e., the firm as customer and the firm as supplier). This is not to say that the public, elaborated on in the next section, does not receive any benefits. However, the benefits for the general public are minor compared to the economic benefits captured by the two firms in the dyad.

The General Public: The second entity is the general public. The presence of this entity recognizes that there are externalities associated with the actions of the firms involved in the transactions. Thus, the general public does not directly influence the establishment and shaping of standards. Rather, it relies on an agent in the form of a professional society, consulting organization (as in the case of the Cradle-to-Cradle standard), or governmental agencies (i.e. the State). However, the public and its agents, play a critical role in standards when the issues at the heart of the standards involve activities or goals with strong externalities (e.g., sustainability, security, public health, food safety, drug safety). It is this trait, the presence of strong externalities along with authorship by the State, which differentiates a public from a private standard.

Certifying Organizations: The third entity arethe certifying organizations. These organizations are charged with establishing the standards, disseminating information about the standards (and their costs and benefits), and protecting the integrity of these same standards. A certifying organization can take many forms. It can be an external organization such as the International Organization for Standardization (www.iso.org), professional societies (e.g., Supply Chain Council for SCOR or Supply Chain Operational Reference Model), private consulting organizations (e.g., McDonough Braungart Design Chemistry and the Cradle-to-Cradle certification for product design (http://www.mbdc.com/cradle-to-cradle/c2c-framework/), or governmental agencies (e.g., Customs and Border Protection and its national security standard, Customs-Trade Partnership Against Terrorism or C-TPAT).

The Emergence of Public Standards – A Comparison with Private Standards

Past research has focused on private CMS, such as ISO 9000 and TQM (Westphal et al., 1997; Benner & Veloso, 2008; Terlaak & King, 2006), where the buyers and suppliers are the primary participating entities involved in the transaction as well as the primary beneficiaries. This research thread has also identified a distinct temporal pattern of diffusion and standardization associated with private standards. Initially, a standard such as ISO 9000 is not widely diffused or widely accepted. Rather, it can be regarded more properly as a voluntary standard that is organized around a certain desired outcome (e.g., quality, in the case of ISO 9000). The initial adopters see the potential economic advantages offered by this voluntary standard. Economic benefits are derived from a variety of conditions. First, standards provide a basis for the codification of organizational 'best practices', offering firms a practical template from which to base significant process improvements and introduce new systems. Second, standards such as TQM or ISO 9000 have been found to reduce waste, reduce costs, reduce lead

time, and positively affect perceived product reputation (Benner & Veloso, 2008; Corbett, Montes-Sancho, & Kirsch, 2005; Terlaak & King, 2006; Terziovski, Power, & Sohal, 2003). Finally, adoption of standards also increases the range of entry barriers as firms learn to customize organizational activities and increase process opacity (Westphal et al., 1997). As the early adopters accept the standards, they gain the benefits. These benefits become identified and then communicated to the rest of the firms (either in their roles as consumers or suppliers).

The diffusion of knowledge of these benefits often prompts the emergence of broad industry pressures for adoption through bandwagon effects (Terlaak & King, 2006). These higher returns (a combination of the benefits of the program combined with the fact that many other firms have not followed suit) compensate these early adopters for the increased exposure to risk, since they have invested in a development that has not yet been widely accepted.

Eventually, increasing numbers of firms accept that the goals underlying the private CMS positively impact performance and widespread adoption is bolstered by the interplay among the parties in the dyad. Specifically, acceptance occurs at both ends of the dyadic transaction (e.g. for the customers and suppliers). If a supplier fails to pursue the standard, then, as Westphal et al. (1997) noted, there is pressure from the customers (i.e., firms) to adopt these standards since the customers benefit economically from the activities associated with the standard. For example, a health insurer is likely to insist that a hospital adopt a quality standard because this would mean shorter hospital stays, fewer medical complications, fewer law suits, and, ultimately, lower costs – a direct benefit to the insurer. The importance of this sequence of events in the adoption process since without the initial economic incentives creating the impetus for early adoption, there would be no bandwagon or adoption pressures described by *(Terlaak & King, 2006)*.

However, we posit that a very different development and diffusion process occurs for public-authored standards. As previously noted, these standards are characterized by externalities that potentially have a significant impact on the general public. To achieve these benefits without the agent having to undertake the direct responsibility for ensuring the desired result, the agent seeks to have the firms assume this responsibility through the standard. While the firms directly involved in the transaction dyad may receive some economic benefits, these are secondary to the benefits captured by the general public. With a public CMS, the agent representing the general public is also charged with the task of developing and disseminating the standard, assuming the dual roles of agent for the general public *and* the certifying organization responsible for development and deployment of the standard.

In essence, the pressure for adopting these public standards comes not from the promise of economic benefits and the partnering firms in the immediate transactional dyad but rather from this agent. In this case, it is in the best interest of the agent to ensure that the proposed standard become widely accepted as "quasi mandatory" as quickly as possible. If this occurs, firms will typically not develop a business case for adoption. They will simply consider adoption as a cost of doing business (e.g., O'Neill et al., 1998).

The agent seeks to achieve this state through a combination of economic and institutional forces. On one hand, the agent will emphasize the potential economic benefits offered by adoption. However, failure to respond to these pressures can result in the application of institutional pressure in the form of implied coercive forces. For example, in the case of C-TPAT, *Cargo Business News* (http://www.cargobusinessnews.com/Oct_08/straight_talk.html) noted that the failure to become certified can result in increased cargo exams, and additional related costs (e.g., cargo stripping charges, cargo transfer charges). CBP can require that the

firms also provide the information required by C-TPAT certification as a condition for having their cargo released from inspection. Furthermore, CBP has been known to offer unfavorable customer service levels (Tranzact Technologies, 2012).

Being Widely Accepted – The Critical Challenge facing the Public CMS

This discussion exposes an interesting paradox regarding the process leading to the coveted "quasi-mandatory" status. Through the design and implementation of a public CMS, the State is the "agent" for the general public whose interests are safeguarded by the standard. A public standard derives its power from the regulatory authority of the State. By using standards as templates to share the best practices among firms, the State expects firms to strength their capabilities and thereby greatly reduce the potential harm posed to the general public. Thus, we can explain "a priori" why the general public is in favor of the standard and we can see why the certifying organization (the State) is also in favor of the standard.

We can also explain the actions of the late adopters – they are often responding to institutional pressure and favorable economic returns (Ritchie & Melnyk, 2012; Melnyk et al., 2013). For instance, by considering standard adoption as a social process, Melnyk, Ritchie, and Calantone (2013) argue that the laggards' decision to adopt a standard is strongly influenced by the actions and cues taken from early adopters. However, still unidentified are the early adopters' motivations.

Early adopters are a necessary ingredient to the success of CMS, particularly the voluntary State-authored CMS. In contrast to law-based CMS, a voluntary State-authored CMS cannot be enforced by a court system. While a State designs a standard to achieve a specific objective, the implementation is dependent on the actions of others. In light of the increasing

number of standards in the marketplace, the mere fact that the State is the sponsoring organization of the standard does not automatically lead to a wide acceptance among companies. However, the State can focus on certain firms as first mover and use them to set up a "reference target". If correctly targeted and recruited, the actions of early adopters can influence the decisions of other firms. For example, Giachetti and Lampel (2010) found that firms, when faced by a new administrative innovation, were most influenced by the actions of market leaders.

Consequently, in the case of public-authored CMS early adopters are likely to be large firms and market leaders (Melnyk et al., 2013). This is evident in the case of C-TPAT. In December 2001, one month after the announcement of C-TPAT, CBP signed agreements and enrolled the first charter members in C-TPAT. These seven charter members included British Petroleum, DaimlerChrysler, Ford Motor, General Motors, Motorola, Sarah Lee, and Target. Such firms confer credibility to the new public CMS as they often have the necessary slack resources to engage in early adoption. Since these large-sized companies are easier to identify, they form natural focal points for attention. Thus, given the high uncertainty attached to a new standard, such firms are most likely to be the reference targets for others (Melnyk et al., 2013). Yet, this line of argument leaves unanswered the question of why these firms would voluntarily become involved? After all, the economic advantages of early involvement (higher economic returns in exchange for assuming higher risks) are not present (Ritchie & Melnyk, 2012). *In the absence of the aforementioned traditional economic benefits, what then motivates such widespread adoption?*

Since standards are an effective signaling mechanism (Montiel et al., 2012), signaling theory offers a suitable theoretical framework to examine these new standards and the adoption context in greater detail. Specifically, this study advances theory suggesting that signal strength

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varies with the timing of standard adoption and that social motivations prevail in the early adoption decision.

Standards as Signals

Signaling theory (Spence, 1973, 1974, 2002) is based on the information economics perspective which considers the asymmetrical information structure of markets. In general, firms engage in signaling to reduce information asymmetries that exist in transactions with individuals, organizations, or states. But the signals must be both observable and credible in order for firms to derive benefits (Spence, 1974). As such, management scholars have applied signaling theory to help explain how organizations have attempted to create information-rich signals by communicating the quality and prestige of the top management teams (Zimmerman, 2008; Cohen & Dean, 2005, Lester, Certo, Dalton, Dalton, & Cannella, 2006), composition of the boards of directors (Certo et al., 2001), operating performance (Jenkinson & Ljungqvist, 2001), background of the CEO (Zhang & Wiersema, 2009), interorganizational ties (Gulati & Higgins, 2003; Park & Mezias, 2005) and management stability (Perkins & Hendry, 2005). Importantly, signaling strategies are not limited solely to firm-specific activities. There is a growing use of signals that are derived from entities external to the firm. For example, recent research has highlighted the benefits of signaling through certifications in the form of CMS (e.g. King, Lenox, & Terlaak, 2005). In these cases, firms demonstrate legitimacy in a specific situation through attainment of a third-party validation.

Central to our study is the notion that certifications are not created equal. Each has its unique author/sponsoring organization, community of adopters, and associated brand equity. Thus, the signals associated with adoption of different standards cannot be assumed to be homogenous, as some signals have greater signal quality and strength than others (Lampel &

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Shamsie, 2000; Park & Mezias, 2005). We assert then that the signal strength for a given standard is relative. For example, private voluntary standards such as adoption of ISO 9000 offer the greatest benefits for the relational dyad of the adopting firms such as the supplier and the consumer. In these cases strong adoption signals are received and valued primarily by the acting parties in the dyad, with relatively minor externalities impacting the general public. In contrast, by nature of the fact that public standards are authored by the State, they impact not only the firms in the dyad but also the general public and the scope of the standard's impact is significantly greater.

It is noteworthy that with private standards the primary signal receiver is the firm engaged in the dyadic relationship, while with public-authored standards the primary signal receivers are the late adopters and business customers. For instance, in the case of a private voluntary standard such as ISO 9000, the signal receivers are the firms and consumers who use the ISO 9000 certificate to discern high-quality from low-quality suppliers. In contrast, the signaling effects of adopting a public standard are twofold. First, the early adoption of public standards by large firms establishes the legitimacy to the new standard and shapes behaviors of other companies to comply with the same standard. More importantly, these firms use standards as primary instrument to signal desirable organizational attributes to their customers. A C-TPAT certificate assures the customers that the shipments will move predictably across the border and be subject to less exposure to product/shipment security risks.

In addition to variation in signal strength among types of standards, there is also a temporal element to adoption that impacts signal strength. Previous research has concluded that companies adopt standards as a signal to reveal the unobservable quality of the organization (Montiel et al., 2012; Terlaak & King, 2006). Once a voluntary standard establishes its quasi-

mandatory status, most companies choose to adopt a standard in response to bandwagon pressure (Terlaak & King, 2006). However, once bandwagon effects are in full force the value of the signal deteriorates rapidly, as adoption becomes commonplace (Connelly et al., 2011). The diminishing value of a signal has been reported in previous studies. For instance, Janney and Folta (2006) found that the signaling effect of investor reputation dissipates over time. This might be due to the fact that the increasing number of a signal conditions such as receivers' expectations, leading to a certain taken-for-granted nature of standards (George & Jones, 2000). Thus, increases in a receiver's expectations changes the interpretation of signals and reduces the value of a previously discernible signal (Connelly et al., 2011).

In anticipation of the erosion of the signal value that can take place over time, a high-quality firm may be motivated to adopt a standard earlier than a low-quality firm, which results in a separating equilibrium. In such cases, outsiders are better able to accurately distinguish between high- and low-quality firms based upon adoption timing rather than the standard type. Therefore, we argue that the timing of standard adoption carries varying levels of signal strength. This is not a trivial matter (Montiel et al., 2012), as it has significant implications for the level of managerial discretion regarding timing of the adoption decision.

Prior research relating to private standards applied Spence's (1973) model to standard certification arguing that firms with good conduct will use certification as a signal to reveal this information only if the value derived from certification exceeds the cost (King et al., 2005; Montiel et al., 2012). However, this argument cannot be easily extended to public standards since economic motivations are weak. Instead, we argue that a firm's decision to adopt a standard is based on its inherent quality. Quality refers to the underlying, unobservable ability of the signaler to fulfill the needs or demands of an outsider observing the signal (Connelly et al., 2011).

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For example, for a firm who highly values public security, given sufficient resources, and the opportunity to establish a supply chain security system, it will opt to adopt a relevant standard such as C-TPAT with little hesitation.

In contrast, for a firm who associates low important to public security, it will be more likely to defer its decision to adopt the standard. This is especially true when companies face competing initiatives and priorities. We acknowledge that it is possible that inferior firms have incentive to "cheat" by bribing auditors to obtain certification, as Montiel et al. (2012) reported in private standards. However, because of the formidable scrutiny by the general public and stringent certification processes that are audited by the State, risk of false signaling in public standard is likely minimal

In essence, we find at work an interesting condition where we propose that when compared with public-authored standards, private standards (e.g. ISO 9000, ISO 14000, TQM, Etc.) will have relatively weak initial signal precedence, yet strong economic motivations for adoption. In this case, the adoption decision is focused on more narrowly defined firm-level considerations such as costs, benefits, and customer demands in the dyad. By contrast, public standards have high precedence for early adoption yet weak economic motivations. The relationship between adoption timing and standard precedence is summarized in Figure 1. Thus, to test how these conditions impact adoption of standards, we propose that in cases where the 'signal precedence' is strong, early adopters react to social/altruistic motivations.

Insert Figure 1 about here

Hypotheses

H1: Powerful signal strength associated with voluntary, State-authored standards results in early adoption motivations that center on indirect benefits in the interest of the public good, without regard for direct economic benefits.

In contrast to the motivations of the early adopters, late adopters will display very different goals for adoption. The adoption laggards will ultimately be the beneficiaries of four key conditions. First, late adopters will benefit from the experiences of the successful, larger early adopters (Melnyk et al., 2013). The observations of the experiences of the early adopters will serve as a template for laggards to learn from in terms of reducing the costs of implementation of the standard. Second, there will be less uncertainty regarding the challenges of adoption. Third, a support structure for adoption vis-à-vis consultants and third-party support mechanisms will have time to develop. Finally, laggards have the benefit of visiting exemplar adoptions of the standard, leading to significantly shortened learning curves. Given these benefits we posit that the motivations for adoption by laggards will differ from the early adopters such that:

H2: Powerful signal strength associated with voluntary, State-initiated standards results in late adoption motivations that center on direct economic benefits in the interest of the firm, without regard for public good.

METHODS

Sample

We obtained the data in this study from the 2007 C-TPAT Partners Cost Benefit Survey. Commissioned by CBP, the University of Virginia (UVA) surveyed more than 1,700 C-TPAT members, including importers, carriers, service providers and foreign manufacturers, regarding

their views of the benefits and costs associated with membership in the program. The objectives for the survey were to learn what motivates a company to become a C-TAPT partner and how the program benefits relate to the cost of participation. Given the nature of our study, this survey provides suitable data for testing our hypotheses.

Similar to Melnyk, Ritchie, and Calentone (2013), we focus the analysis on importers for two reasons. First, although importers have been regarded as a key driver in international trade, there is a dearth of research on importer-related topics. Second, any delay in the movement of products across the border adversely affects importers. Ultimately, it can be argued that adoption of C-TPAT certification offers the potential for direct linkage to importer performance.

To test our hypotheses, we divided the entire sample into two groups based on the time of C-TPAT adoption: firms that adopted the C-TPAT program within three years since the standard inception ($n = 136$) and firms that adopted the C-TPAT after three years ($n = 115$).

Methodology

Measures

The first step in the construct analysis is to formally specify a measurement model that captures the expected relationships between the indicators and the focal construct and/or sub-dimensions they are intended to represent (MacKenzie, Podsakoff, & Podsakoff, 2011). We focus on the following measurements related to the motivations and overall experience of the C-TPAT members.

I.   Economic Benefits

Direct Economic benefit. was measured using a three-item scale, evaluating how important the member firms view the reduction in time and cost of CBP inspections. The survey questionnaire asked: (1) 'Reduce U.S. Customs and Border Protection (CBP) inspection rate,' (2) 'Reduce time and cost of getting cargo processed and released by U. S. Customs and Border Protection (CBP),' and (3) 'Reduce time in U. S. Customs and Border Protection (CBP) secondary cargo inspection lines'.

Marketing benefit. was measured with a three-item scale, evaluating the importance of intangible marketing benefits accrued to C-TPAT member firms. These scales state (1) 'Protects or builds company's brand image,' (2) 'Makes your company more competitive,' (3)' Enhances your company's marketing opportunities'.

Industry-level benefit. was measured by the following scales: (1) 'Protects your industry,' (2)' Facilitates globalization,' (3)' Enhances standards within your industry'. These questions evaluate how important to the firm C-TPAT standard promotes the overall security performance of the industry.

Supply chain visibility. A security program such as C-TPAT often require increase information sharing and supply chain visibility (Voss & Williams, 2013). We measure the importance of this construct with two-item scales, including (1)' Improve ability to monitor and track orders within the supply chain,' (2) 'Increase supply chain visibility'.

CBP Administrative Support. In the C-TPAT program, CBP provides a multitude of support to help participant to meet the standard requirements. These include assigning CBP supply chain specialist, sharing best practices and organizing, cooperatively developing solutions to address potential security vulnerabilities and organizing C-TPAT Supply Chain Security conferences.

These potential administrative benefits are measured with two-item scales: (1)' Assignment of a C-TPAT Supply Chain Security Specialist to help your company validate and enhance security throughout your supply chain,' (2)' Self-policing and self-monitoring of security activities through the Importer Self-Assessment program'.

II.   Social Benefits

Security benefit. we use four-item scales to assess the relative importance the firms attach to the improvement of the security performance as the result of adopting C-TPAT. These scales include (1)' Reduce cargo theft and pilferage,' (2)' Improve asset utilization,' (3)' Improve security for workforce,' (4)' Reduce insurance rates'.

All the above motivation measures were assessed with a 5-point Likert: 'extremely unimportant'=0, 'somewhat unimportant=1', 'does not consider a potential benefit=2', 'somewhat important=3', 'extremely important=4'.

Overall Experience with C-TPAT. This variable was measured with a single four-point scale item. The questionnaire item asked the member firms to indicate whether 'The benefits outweigh the costs' (=4), 'The benefits and the costs are about the same'(=3), 'The costs outweigh the benefits'(=2) or 'It's too early to tell' (=1)

The Measurement Model

How well the measurement model fits the observed data is accomplished by examining the psychometric properties of the scale, both at the item and construct level. To accomplish this we first determined (1) the appropriateness of the confirmatory factor analysis solution for the motivation and experience measures (i.e., the estimation procedure converges and none of the

variances are negative); (b) the individual hypothesized relationships between motivation and experience factors and that their measures are statistically significant; and (c) the overall relationships between the items and that their underlying factors are adequately accounted for the sample data (MacKenzie et al., 2011). A solution is proper if the estimation procedure converges and none of the variance estimates are negative. A nonsignificant (p > .10) chi-square statistic is indicative of a good fit because it means that the covariances predicted by the model are not significantly different than the sample covariances. However, because chi-square statistic is known to be sensitive to sample size, it is necessary to rely on other goodness of fit indices to evaluate the extent to which the relationships hypothesized in the measurement model are consistent with the sample data (MacKenzie et al., 2011). Hu and Bentler (1999) suggest that a combination of the CFI, RMSEA, and SRMR are the best alternative goodness of fit indices to supplement the chi-squared test. According to these authors, a CFI value that is > .95, a SRMR value that is < .08, and a RMSEA value that is <.06 are indicators that there is a good fit between the hypothesized model and the observed data.

After examining the overall model fit, the second step was to assess the validity and reliability of the set of indicators at the construct level. Convergent validity was assessed by calculating the average variance in the indicators that is accounted for by the focal construct. Discriminant validity was tested by examining whether the indicators of the focal construct are distinguishable from the indicators of other constructs. Fornell and Larcker (1981) suggest using the average variance extracted (AVE) to assess both convergent and discriminant validity. The AVE was calculated by averaging the squared completely standardized factor loadings for the focal indicators. An AVE greater than .50 is desirable because it suggests that the latent construct accounts for a majority of the variance in its indicators on average (MacKenzie et al., 2011). To

establish discriminant validity, Fornell and Larcker (1981) recommend examining whether the AVE for each construct is greater than the square of the correlation between the constructs. Fornell and Larcker (1981) also provide a composite index of construct reliability based on the ratio of the variance accounted for by the latent construct to the total variance in the measures.

In the final step, we assessed the validity and reliability of the individual indicators by determining whether the relationship between each indicator and its hypothesized latent construct is large and statistically significant (MacKenzie et al., 2011). In a typical model like ours where each item is hypothesized to load on only one construct, the degree of validity of each item was examined by the square of the item's completely standardized loading. A value greater than .50 suggests an adequate level of validity (Fornell & Larcker, 1981). Item's reliability was assessed by examining the squared multiple correlation for the item (Bollen, 1989). Typically a value greater than .50 is desired because it suggests that the majority of the variance in the indicator is due to the latent construct (MacKenzie et al., 2011).

The Structural Model

In order to validate Hypotheses H1 and H2, we subjected the data to a test of invariance of structural parameters across two groups (early adopters vs. late adopters). Such tests of group invariance typically begin with scrutiny of the measurement model. Once we identified which observed measures were group invariant, we constrained these parameters equal while conducting subsequent tests of invariance of the structural parameters (Byrne, Shavelson, & Muthén, 1989). At first, we considered an unconstrained "baseline" model (M1), which is estimated for each group separately. If the same pattern of zero and non-zero factor loadings is observed across groups in M1, it indicates configural invariance. In Model 2 (M2), factor

loadings were constrained to be equivalent across groups (Byrne et al., 1989). Items that were found metric invariant by comparing M2 and M1 were then assessed for structural invariance using Model 3 (M3) in which the measurement and structural parameters were constrained to be equal. .

We observed the measurement and structural invariance by examining the difference between a more restricted model (i.e., invariance constraints in place) and a less restricted model (i.e., a model in which those constraints are not in place) (Vandenberg & Lance, 2000). For instance, M3 was compared against M2, or M2 against M1. In this study, we used the chi-square difference procedure for evaluating model differences, which has been most frequently used in invariance tests (Vandenberg & Lance, 2000).

RESULTS

Testing of the Measurement Model

To examine the measurement model fit, the construct- and item-level validity and reliability, a confirmatory factory analysis was performed using LISREL 8.7. The results presented in Table 1 indicate that despite a significant chi-square value ($\chi^2 = 171.776, p < .01$), goodness-of-fit indices for the confirmatory factor model exceeded Hu and Bentler (1999)'s suggested cutoff of .95 for the Comparative Fit Index ($CFI = 0.989$), .06 for the Root Mean Square Error of Approximation ($RMSEA = 0.0414$), and .08 for the Standardized Root Mean Square Residual ($SRMR = 0.0365$). To further test the fitness of the model, we compared our proposed measurement model against two alternative models: an "uncorrelated" factor model in which no relationship is allowed between the constructs, and a single factor model in which all items loaded on the same factor. As shown in Table 1, the hypothesized measurement model was

superior to the "uncorrelated" factor model ($\Delta\chi^2 = 484.678, df = 23$), and the single factor

model ($\Delta\chi^2 = 834.668, df = 20$). Furthermore, the hypothesized six-factor model fit the data

significantly better than a two-factor model in which the items from economic, marketing and

industry-level benefit loaded on one factor and the rest loaded on another ($\Delta\chi^2 = 779.482, df = 18$), a three-factor model in which the items from economic, marketing benefit loaded on one

factor, the items from industry-level benefit and CBP administrative support on the second

factor, and items from supply chain visibility and security benefits loaded on the third factor

($\Delta\chi^2 = 380.119, df = 15$). Taken together, these results suggest that the hypothesized model

achieve a good fit to the data.

Insert Table 1 about here

Table 2 reports the AVE values and correlations among latent constructs. Construct inter-

correlations are reported below the diagonal, Fornell and Larcker's (1981) composite reliability

indices are reported on the diagonal, and squared correlations are reported above the diagonal.

The composite reliability index of each construct is acceptable with all values equal to or above

.70 (Nunnally & Bernstein, 1994). These results indicate that the constructs possess high levels

of convergent validity given that the AVE values are well above Fornell and Larcker's (1981)

suggested cutoff of .50. Furthermore, the AVE values exceed the squared construct inter-

correlations in every construct, thereby indicating a high degree of discriminant validity.

Insert Table 2 and 3 about here

Furthermore, the results reported in Table 3 show that the squared multiple correlation for

the items exceed .50 value suggested by Fornell and Larcker (1981). Each factor loadings is also

strong and significant, with all p values less than .01. Overall, we conclude that all the items

exhibit high level of reliability and validity.

Testing of the Structure Model

Insert Figure 2 about here

With $\chi^2(115, N = 251) = 171.776, \frac{\chi^2}{df} = 1.49, CFI = 0.989, IFI = 0.989, NFI =$

$0.967, RMSEA = 0.041, RMSEA\ confidence\ interval\ (0.0259\ ;\ 0.0551)$, the full model

provided a good fit to the data. As shown in Figure 2, the path from Industry-level Benefit to

Overall Experience with C-TPAT is positive ($\gamma = 0.304$) and significant at 0.05 level, indicating

that indirect benefits, such as protecting the whole industry and facilitating globalization, accrue

to C-TPAT adopters. The significantly negative path from Supply Chain Visibility to Overall

Experience ($\gamma = -0.255, p < 0.05$) suggests that adopting C-TPAT program does not help

companies gain any benefit of improving supply chain visibility. On the contrary, the investment

in this area significantly outweighs any potential return. In addition, Economic Benefit ($\gamma =$

0.143) and Security Benefit($\gamma = 0.201$) were positively related to the overall C-TPAT

experience. However, given that their significance level is low ($p < 0.1$), we are unable to draw

any definitive conclusion about the effects of these two constructs.

To ascertain the structural parameter differences across two groups (early vs. late adopters), we

conducted several tests of measurement and structure invariance. As reported in Table 4, the

baseline model (M1) exhibits acceptable fit ($\chi^2(232) = 394.08, \frac{\chi^2}{df} = 1.70, CFI =$

$0.967, NNFI = 0.957, RMSEA = 0.0657$). The same pattern of non-zero and zero factor

loadings was observed in the two groups. Taken together, these results demonstrate full

configural variance. The second model, M2, involved constraining the factor loadings to be

invariant across two groups, yielding an insignificant change in model fit ($\chi^2(243) =$

$405.31, \Delta\chi^2 = 11.23, \Delta df = 11, p = 0.42$) and indicating full metric variance. The third model,

M3, involved imposing structural parameter invariance. The significant change in model fit

between M3 and M2 ($\chi^2(249) = 518.17, \Delta\chi^2 = 112.86, \Delta df = 6, p < 0.0001$) suggests

unequivalence in structure parameters across group. Subsequently, a search procedure was

implemented in order to identify which path coefficients were significantly different across two

groups. In this procedure, two models were compared at a time – M2 and a particular path

coefficient of interest is constrained to be equal. It was found that the link between Supply Chain

Visibility to Overall Experience is different across two groups($\Delta\chi^2 = 10.43, \Delta df = 1, p =$

0.001). The within group standardized solution for this path is -0.346 among early adopters and -

2.929 among late adopters. This result suggests that, although higher than potential benefits in

both groups, the cost of increasing supply chain visibility and firm abilities to monitor orders is

significantly greater for later adopters than early adopters. We also found the path coefficient for

the link between Economic Benefit and Overall Experience is different across two groups, with

$\Delta\chi^2 = 12.965, \Delta df = 1, p < 0.001$. The within group standardized solution of this coefficient

is 0.014 among early adopters, which is lower than the 2.867 among late adopters. This indicates

that C-TPAT program yields greater direct economic benefits, such as significant reduction in

CBP inspection rate and cargo processing time/cost, to late adopters than to early adopters.

Insert Figure 3 and 4 about here

To further validate this finding, we tested our theoretical model among early and late adopters separately. As shown in Figure 3, only the path from security benefits is positively significant to early adopters. The negative path coefficient between firm-level security benefit suggests that these companies have incurred higher cost related to improving supply chain visibility, indicating the investment in achieving compliance in this area brought few benefit to the firms. In contrast, Figure 4 shows that late adopters have received greater benefits from C-TPAT adoption, if they are seeking both the firm-level direct economic benefit and industry-level indirect benefit. Thus, in terms of direct economic benefits, those firms who adopted the C-TPAT at later time seem to be the biggest beneficiaries of the program. Taken together, the above results provide strong statistical evidence to our hypothesis 1 and 2.

CONCLUSIONS

In support of recent research on voluntary public standards (Melnyk et al., 2013), we have found that the adoption patterns of voluntary public standards are very different than voluntary private standards. We have extended this research by supporting the notion that early adopters have specific social motivations for adoption versus the economic motivations of laggards. That early adopters are motivated more by social incentives than economic benefits suggests that motivations for adoption of standards may be driven by broader field of information asymmetries than the simple dyad of supplier—buyer. As such, an implication of our findings is that there are manifold layers of asymmetries facing firms. These asymmetries extend to civil society, cultural norms, and the State. Thus, adoption of voluntary, public standards are an effective means of addressing the concerns of these stakeholder groups that are often difficult to codify

Based upon our findings, we can also infer that there may be a certain hierarchy associated with standards and their ability to address certain asymmetries. Findings in this study also bring to light the notion that perceived signal strength of the standard may be a key component in the adoption decision. We have suggested that in the case of voluntary public standards, the level of precedence may be particularly high compared with voluntary private standards, due to fact that the State is proxy for the desires of society as well as the author of the standard. In these cases it appears that strong signal strength trumps economic considerations. Further, the fact that a small collective of the largest firms in the marketplace were the early adopters of the standard examined in this study also corroborates this idea in that large firms are often searching for effective signaling mechanisms (Carter, 2006). What better mechanism to send a signal to broader society than through a State-authored standard?

This study also contributes to the broader management standards literature by presenting a framework that integrates both private and public adoption theories. Specifically, Figure 1 one provides a useful contrast between these two types of standards in terms of signal strength, motivations, and adoption timing based upon data from adopting managers. To-date, management research has relied upon post-hoc data and financial outcomes for analysis of adoption timing and motivations. For example, Benner and Veloso (2008) used return on assets and return on sales while Terlaak and King (2006) measured the changes in production volume to study the impact of ISO 9000 certification. As acknowledged by Heras, Dick, and Casadesus (2002), this approach is potentially plagued by the problem of "reverse causation". That is, it could be argued that firms with superior financial performance and higher production growth opted to adopt ISO 9000 standard early. The current analysis is informed by practicing managers, avoiding the potential pitfalls of relying on secondary financial data.

This study has shed new light on the standards adoption process by clarifying the specific motivations that drive early adoption. In addition to identifying the strong social motivations of early adopters and economic motivations of laggard, we have also elaborated on the notion that standards have differing levels of precedence, particularly when comparing private-authored with state-authored standards. These findings raise additional questions for future research such as understanding varying levels of standard precedence between State-authored standards. More research is also needed to understand the diffusion process behind State-authored standards. This study has focused attention on the development and diffusion of public CMSs. As previously noted, we can expect such standards to grow in popularity in the near future. Increasingly, we are encountering areas of public concern that must be addressed (e.g., governance, public food safety, security, sustainability) but for which the government, the primary change agent in the past, no longer has the resources to pursue. Furthermore, many of these areas are ones characterized by high levels of urgency, which means that the standards development mechanisms described by Ingram and Silverman (2002) are no longer appropriate. Consequently, we can expect that a greater reliance on public CMS that are implemented in manners similar to that of C-TPAT.

If that is the case, then we would expect to see the diffusion patterns exhibited by such standards to differ from those patterns exhibited for private CMS. For example, with a private CMS, we would expect a longer period until the CMS attained a sufficient number of adoptions to be considered "quasi-mandatory." In contrast, we would expect this interval to be much shorter with a public CMS. After all, with a public CMS, the goal of the agent is to ensure widespread acceptance of the proposed standard. Addressing this concern would require

undertaking some form of diffusion analysis – something that is currently being done for such private standards as ISO 9000 (e.g., Franceshini, Galetto & Cecconi, 2006).

Second, there is the issue of harmonization, or ensuring that the standards are applied the same irrespective of the country in which the standard is applied. This behavior is especially important if we are dealing with issues involving an international supply chain. In the case of private standards, this harmonization is done through the certifying organization (e.g. ISO for ISO 9000). Yet, a different mechanism is required for the public CMS. Initial indications are that the mechanism for the public CMS is the Mutual Recognition Agreement (MRA) or an agreement between agencies. For C-TPAT, the following MRAs have been implemented:

- New Zealand Customs Services – Secure Export Scheme Program (SES), June 2007.

- Jordan Customs Department – Golden List Program (GLP), June 2007.

- Canadian Border Services Agency – Partners in Protection (PIP), June 2008.

- Japan Customs and Tariff Bureau – Authorized Economic Operator Program (AEO), June 2009.

- Korean Customs Service – Authorized Economic Operator Program (AEO), June 2010.

- European Union – Authorized Economic Operator Program (AEO), May 2012.

- Taiwan – General of Customs, Taiwan Ministry of Finance's Authorized Economic Operator Program, November 2012.

Additional study into the effectiveness of the MRA relative to the international certification organization is needed.

Finally, there is the issue of persistence. Standards succeed because they persist over time. That is, firms recognize the advantages offered by standards and consequently they persist

in using the standards since these standards offer both economic advantages (in the case of

private CMS) and a mechanism for dealing with information asymmetries. Yet, when dealing

with a public CMS, especially one that was initiated by a crisis (such as the terrorist attacks on

9/11/2001), there is an issue of whether the public standard exhibits the same staying power

observed with private standards such as ISO 9000 (e.g., Franceschini et al., 2006).

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TABLE 1
MODEL FIT STATISTICS FOR CONFIRMATORY FACTOR ANALYSIS MODELS

Model	df	Chi-Square	CFI	RMSEA	SRMR
Hypothesized model	115	171.776	.989	.04	.04
Uncorrelated factor model	138	656.454	.897	.14	.28
Two factor model	133	951.258	.838	.18	.11
Three factor model	130	551.895	.916	.12	.10
Single factor model	135	1,006.444	. 827	.18	.11

Note. The chi-square value from each model is significant at the $p < .01$. CFI = comparative fit index; RMSEA = Root Mean Square Error of Approximation; SRMR = standardized root-mean residual. All chi-square values are significant at the $p < .01$ level of significance.

TABLE 2
LATENT CONSTRUCT CORRELATIONS, AND AVE VALUES

Variable	*AVE*	FDB	FIB	IIB	FSB	SCV	CAS	OEC
Economic benefit (EB)	.560	(.760)	.125	.126	.201	.228	.115	.043
Marketing benefit (MB)	.696	.353	(.873)	.543	.219	.194	.193	.030
Industry-level benefit (IB)	.681	.355	.737	(.865)	.277	.213	.287	.091
Security benefit (SB)	.658	.448	.468	.526	(.884)	.475	.222	.056
Supply chain visibility (SCV)	.773	.478	.44	.462	.689	(.871)	.253	.007
CBP Administrative Support (CAS)	.573	.339	.439	.536	.471	.503	(.700)	.047
Overall Experience with C-TPAT (OEC)	1	.207	.173	.301	.236	.085	.217	-

Note. Fornell and Larcker (1981)'s composite reliabilities indices are reported in parentheses on the diagonal. Construct inter-correlations are reported below the diagonal. Squared construct inter-correlations are reported above the diagonal.

TABLE 3

SUMMARY OF CONFIRMATORY FACTOR ANALYSIS RESULTS

Constructs/Items	Factor Loadings	Squared MC
Economic benefit		
1. Reduce U.S. Customs and Border Protection (CBP) inspection rate.	.730	.533
2. Reduce time and cost of getting cargo processed and released by U. S. Customs and Border Protection (CBP).	.780	.608
3. Reduce time in U. S. Customs and Border Protection (CBP) secondary cargo inspection lines.	.733	.538
Marketing benefit		
1. Protects or builds company's brand image.	.809	.654
2. Makes your company more competitive.	.818	.670
3. Enhances your company's marketing opportunities.	.875	.765
Industry-level benefit		
1. Protects your industry	.865	.748
2. Facilitates globalization	.819	.670
3. Enhances standards within your industry	.790	.624
Security benefit		
1. Reduce cargo theft and pilferage	.792	.627
2. Improve asset utilization	.882	.778
3. Improve security for workforce	.842	.708
4. Reduce insurance rates	.719	.518
Supply chain visibility		
1. Improve ability to monitor and track orders within the supply chain	.910	.828
2. Increase supply chain visibility	.847	.717
CBP Administrative Support		
1. Assignment of a C-TPAT Supply Chain Security Specialist to help your company validate and enhance security throughout your supply chain	.720	.518
2. Self-policing and self-monitoring of security activities through the Importer Self-Assessment program	.792	.628

Note. All factor loadings are completely standardized lambda loadings and are significant at $p < .01$.

TABLE 4

INVARIANCE TEAS ACROSS EARLY AND LATE ADOPTERS

Models	df	χ^2	CFI	$NNFI$	RMSEA	$\Delta\chi^2$	Δdf	Sig. Level
M1: Base Model	232	394.08	0.967	0.957	0.0657			
M2: Equal Factor Loading	243	405.308	0.967	0.959	0.0632	11.228	11	0.424
M3: Equal Structural Parameter	249	518.166	0.946	0.934	0.0889	112.858	6	5.135E-22
M2a: Equal Factor Loading & EB→OEC	244	418.273	0.965	0.956	0.065	12.965	1	0.000
M2b: Equal Factor Loading & MB→OEC	244	406.471	0.967	0.959	0.0637	1.163	1	0.281
M2c: Equal Factor Loading & IB→OEC	244	405.317	0.968	0.959	0.0628	0.009	1	0.924
M2d: Equal Factor Loading & SB→OEC	244	405.618	0.968	0.959	0.0629	0.310	1	0.578
M2e: Equal Factor Loading & SCV→OEC	244	415.742	0.966	0.957	0.0666	10.434	1	0.001
M2f: Equal Factor Loading & CAS→OEC	244	405.406	0.968	0.959	0.0629	0.098	1	0.754

FIGURE 1

STANDARD ADOPTION MODEL

	Early Adopter	**Late Adopter**
Powerful Initial Signal Precedence	State-Authored Standard Indirect, benefits for public good prevail, without regard for economic benefits	State-Authored Standard Direct, firm-level, Economic Motivations Prevail
Low Initial Signal Precedence	Private Authored Standards Economic Motivations Prevail	Private Authored Standards 'social' motivations prevail (Rationale: the adopter is responding to bandwagon pressures)

FIGURE 2

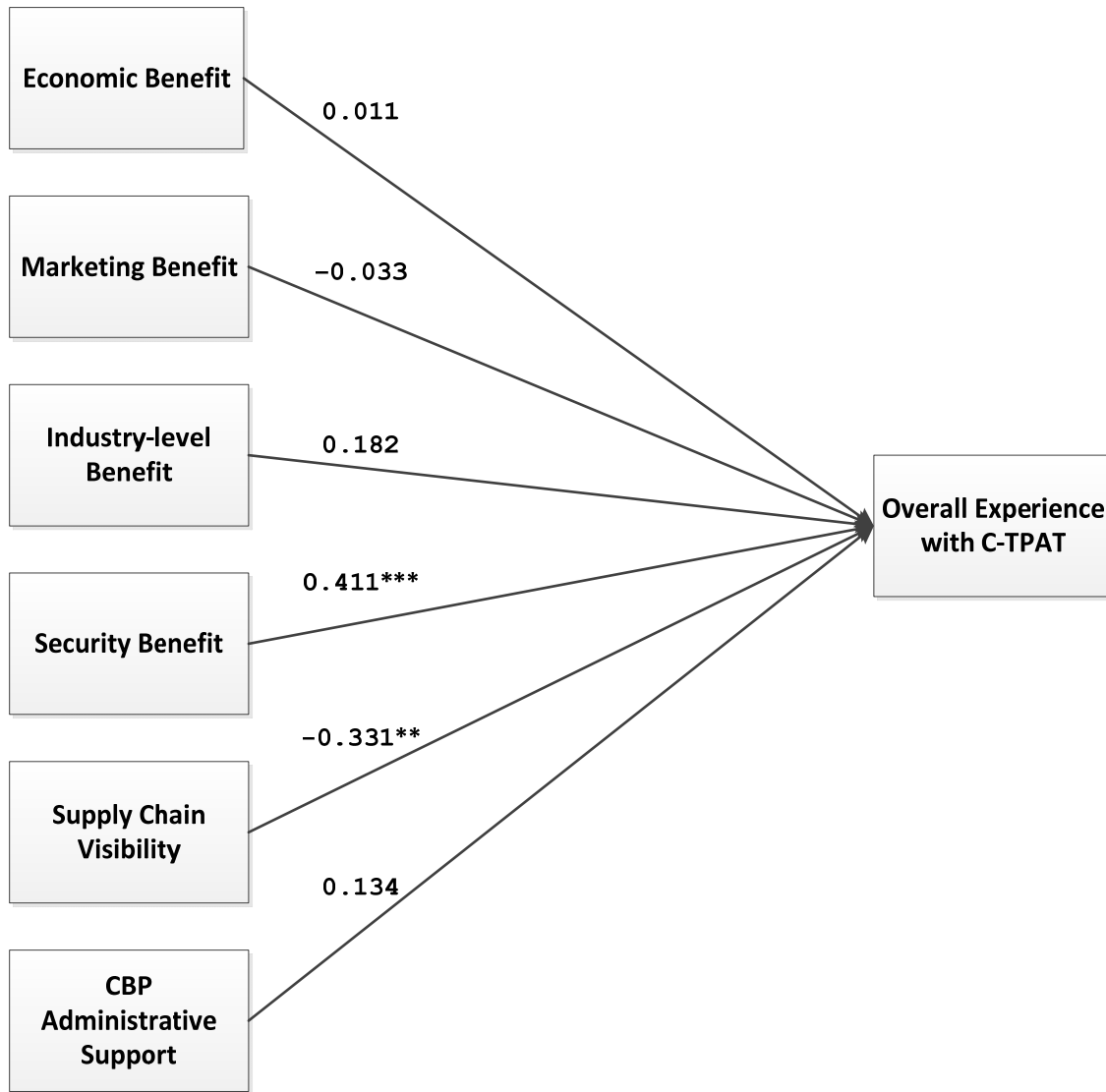**SEM ANALYSIS RESULTS-FULL MODEL**
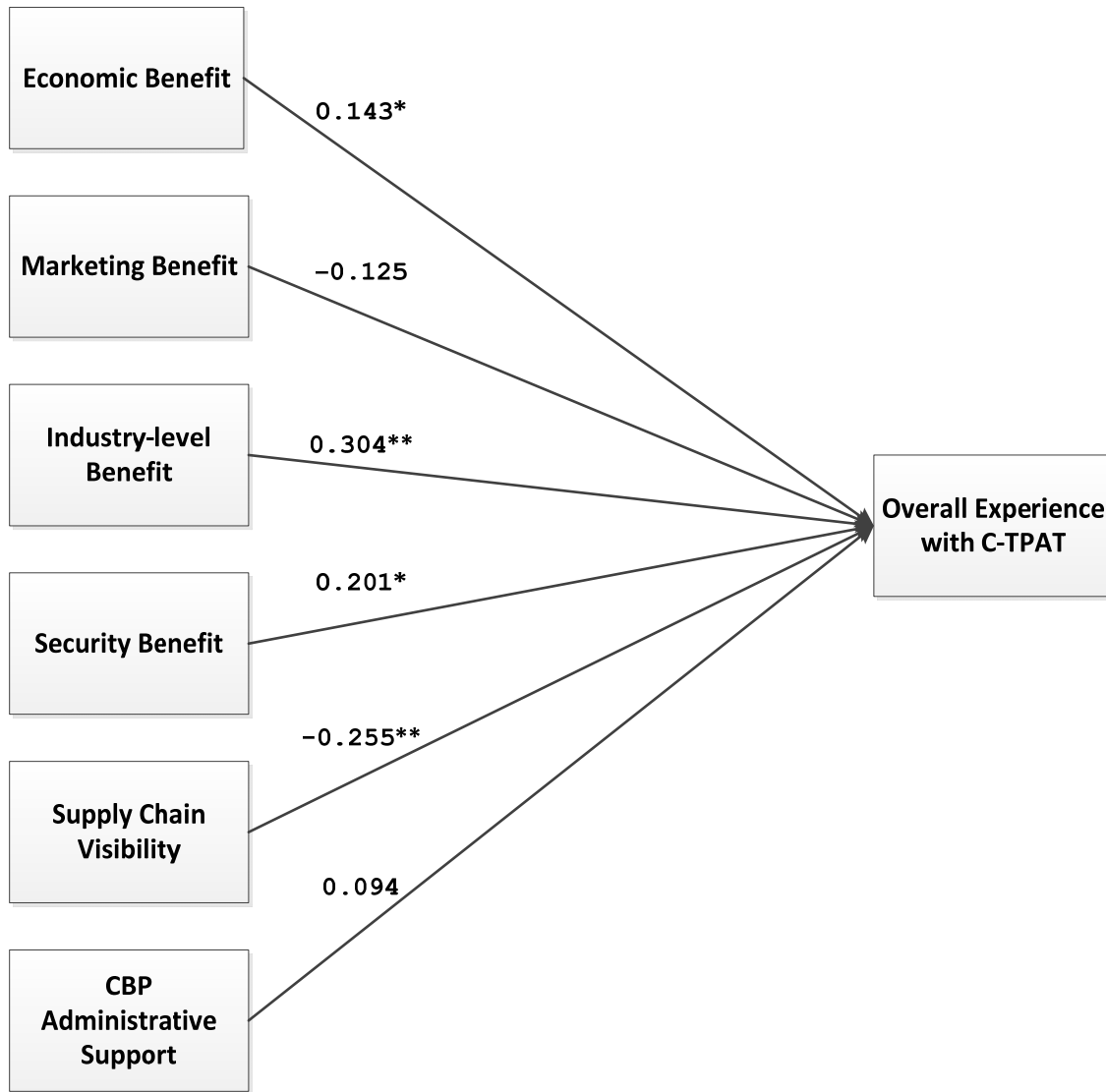
Note:

1. All path coefficients are standardized solutions.
2. *p < 0.10
3. **p < 0.05

FIGURE 3

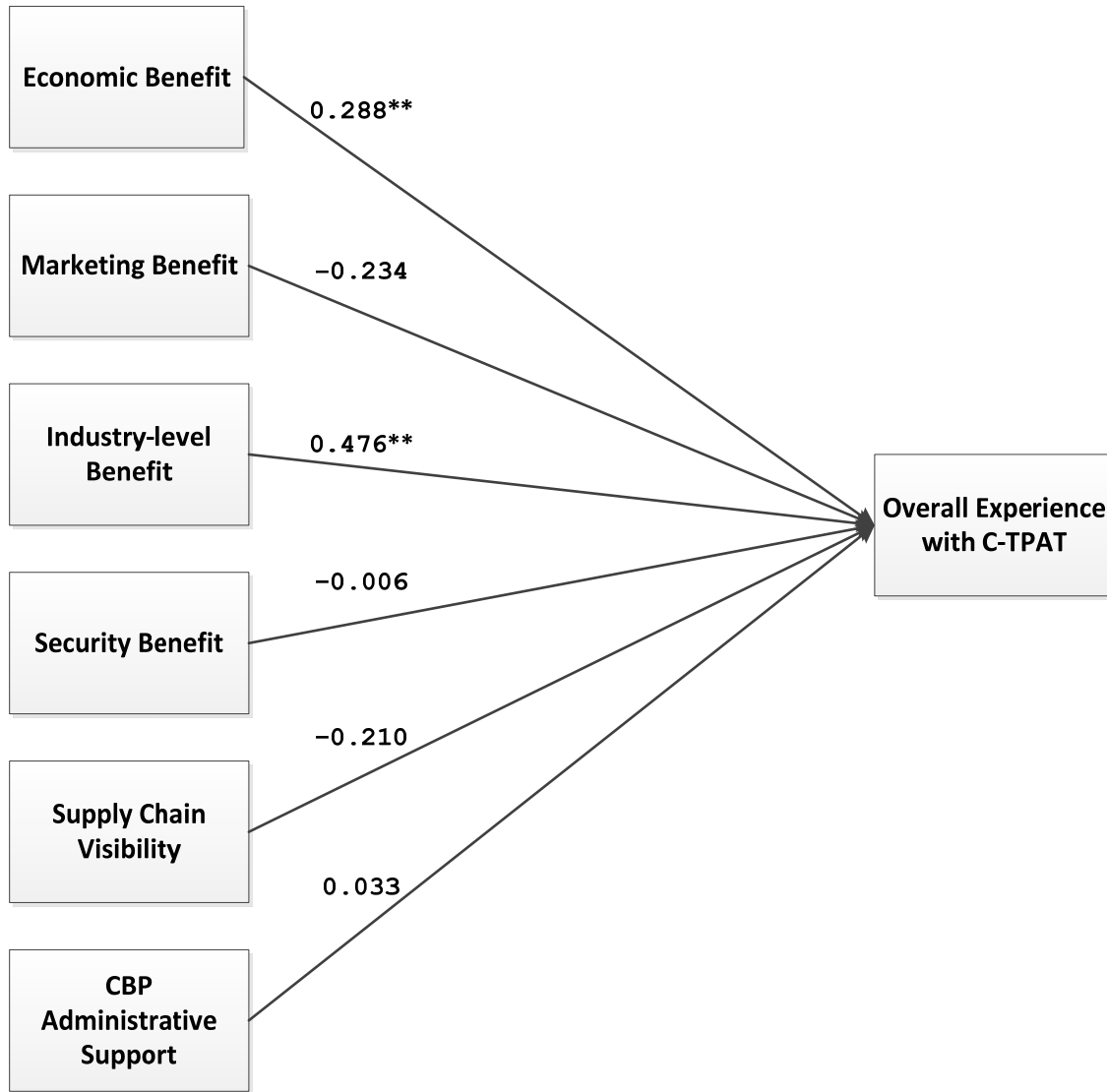**SEM ANALYSIS RESULTS-FULL MODEL (EARLY ADOPTERS ONLY)**

Note:

1. All path coefficients are standardized solutions.
2. *p* < 0.10
3. **p* < 0.05
4. ***p* < 0.01

FIGURE 4

SEM ANALYSIS RESULTS-FULL MODEL (LATE ADOPTERS ONLY)

Note:

1. All path coefficients are standardized solutions.
2. *$p < 0.10$
3. **$p < 0.05$