Investigating Postadoption Utilization: An Examination Into the Role of Interorganizational and Technology Trust

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***Abstract*—Grounded in the technology acceptance model (TAM), this study examines the influence of technology trust and interorganizational trust on postadoption utilization. This study extends the innovation diffusion literature by drawing upon past diffusion research and considering trust-based determinants in facilitating technology usage. Field interviews were conducted to develop an understanding of the user population and the unique challenges the individuals experienced while working with the new system. The results of the interviews enabled the author to identify which variables to investigate further through the use of a survey data collection protocol. In the present study, 273 first-tier supply chain members of the second-largest U.S. automotive service-parts logistics operation, who were recently introduced to a new supply chain management technology, were surveyed. Using a structural equation model, nine hypotheses were tested. As hypothesized, an individual's technology trust and interorganizational trust have an effect on perceived ease of use and perceived usefulness, which further influence postadoption technology utilization behavior. The results suggest that even in supply chains where usage is mandated, the presence of technology and interorganizational trust can increase individual utilization of new technologies. Implications of this study along with suggestions for future research are provided.**

***Index Terms*—Organizational trust and technology trust, postadoption behavior, structural equation modeling, supply chains, technology acceptance model (TAM), technology adoption, utilization.**

I. Introduction

THE USE of information technologies (ITs) by organizational members, referred to as IT utilization, is one of the most frequently applied concepts to evaluate system success [118]. In recent studies (e.g., [5], [50], [74], [78], [90], and [102]), postadoption utilization has been investigated as the outcome variable of interest. Many studies [68], [90] suggest that individuals within organizations do not use the full range of functional capabilities found within new innovations. Rather, individuals take advantage of selected features necessary to complete work activities and rarely operate at higher levels of technological proficiency. This limited utilization creates potential issues for organizations that implement technologies as a means to achieve a competitive advantage. Additionally, the expected benefits for organizations employing these technological solutions are often unrealized. As organizations exhibit greater reliance on technologies to achieve competitive advantage, increased efficient and effective utilization of technological functionality may be one opportunity for achieving these goals.

The challenges associated with encouraging the use of a new technology are compounded when introduced into supply chains, because trust between organizations is a critical factor for information sharing and technology acceptance [20]. Information sharing among supply chain partners may require the release of proprietary strategic, financial, and/or operational information to other supply chain affiliates who may have been and/or will be competitors [81]. In order for information sharing to be effective, the existence of interorganizational trust is essential [15]. Information sharing and trust among supplier organizations influences supply chain collaboration and represents the physical and operational alignment between supply chain affiliates [100]. Trust and quality of information are critical to decision-making effectiveness [106].

Interfirm trust deters the threat of opportunism and lowers decision-making uncertainty in organizational buying decisions [14], [69]. Supply chain relationships are enhanced as members recognize the value and importance of increased interorganizational trust and commitment on the strategic and economic potential of the relationship [7]. Larson and Kulchitsky [84] found that closer relationships between buyer and supplier firms are associated with better delivery performance by suppliers. Successful long-term supply chain relationships are maximizing performance, reducing costs of repetitive transactions, and improving customer satisfaction through the effective use of ITs [77].

Trust is critical to the success of strategic alliance formation [120] and is often considered necessary to maintain strategic partnerships [124] since one-third of strategic alliances fail due to a lack of trust among trading partners [120]. Interorganizational trust is a phenomenon that is required between partners who are dependent on each other for operational supply chain functionality. The issue of trust is more important in supply chain relationships because supply chains often involve a higher degree of interdependency between competitors [82]. Morgan and Hunt [99] suggest that when commitment and trust exist in supply chain relationships, efficiency, productivity, and effectiveness of interactions are enhanced.

Supply chain relationships have been restructured through the use of technology to improve total supply chain performance

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[77]. Aspects of supply chain performance include accurate, up-to-date information on orders, inventory, and production widely known as the need for greater supply chain visibility [138]. Collaboration and visibility are often discussed simultaneously in supply chain activities and it is suggested that trust leads to better business relationships [107]. Managing inventory movement is costly [83] and requires technologies to reduce expenses and manage operational activity [135]. Information technology solutions, such as the collaborative visibility network (CVN), are implemented by supply chains to provide detailed line-item identification of inbound materials to manufacturing facilities [135]. Technology trust of a system solution is, therefore, dependent upon interorganizational trust to support and enhance the supply chain function.

CVN, the technology investigated in this study, enables part-level visibility to supply chains as goods are moved from supplier to distribution center. CVN benefits all supply chain members through: 1) establishing visibility; 2) enabling changes to manufacturing schedules; 3) gaining improved inventory control; 4) reducing carrying costs; 5) increasing customer satisfaction through improved order fulfillment; and 6) reducing out-of-stock scenarios [97]. General Motors, Ford, Saturn, and Ford Europe use Internet-based applications to coordinate activities, enhance interorganizational communication, and to develop better integration among supply chain affiliates [119]. In order for these solutions to provide business value, all supply chain members must accurately input data in a timely and precise fashion. The inaccuracy or absence of data can affect multiple supply chain partners who depend upon the data for operational decision-making.

This dependence upon others to function consistently and responsibly in their data processing behavior influences the level of technology trust in the referenced CVN system. Interorganizational trust is necessary for supply chain members to willingly input data even when the new business process requires more time than previous manual procedures. Technology trust is influenced by the degree of interorganizational trust, which further affects technology utilization. The level of trust supply chain members place in the IT used to coordinate activities and enhance communication among their partnerships can influence the success of their long-term interactions [89]. As such, understanding the degree to which technology trust and interorganizational trust influence a member's decision to continue using an IT is of value to automotive support organizations that depend on supply chain partners fully using a technology. Understanding the complex relationship between supply chain partners by differentiating trust in technology from interorganizational trust is necessary in order to predict outcome behavior.

This research is worth investigating because of the recognized importance of trust among supply chain partners (e.g., [28], [48], [57], [108], and [126]). In order for supply chains to function effectively, trust is required among supply chain members [70], [81]. A lack of trust among these partners often leads to ineffective and inefficient performance [28] and is the greatest obstacle to advanced collaboration [108]. Because supply chain management (SCM) processes are inherently uncertain and risky, interorganizational trust between partners is where the risks prevail [126].

The investigation of the influence of trust on perceived usefulness and ease of use can be justified by the work of Keat and Mohan [75] who compared a series of studies that modeled various forms of trust as antecedents of perceived usefulness and ease of use. In particular, Dahlberg *et al*. [33] considered disposition to trust and perceived trust as determinants of perceived usefulness. Pavlou [103] investigated trust as antecedents of perceived ease of use and perceived usefulness in the context of user acceptance of B2C e-commerce. Because of its investigation of trust as antecedents of perceived ease of use and usefulness, the Pavlou [103] study provides a basis for investigating the influence of trust on perceived usefulness and perceived ease of use within a supply chain context.

This research makes two contributions to industry managers and information technology practitioners by: 1) determining the effect of trust antecedents (technology trust and interorganizational trust) and cognitive antecedents (perceived ease of use and perceived usefulness) on postadoption utilization; and, 2) offering insights to automotive industry supply chains to facilitate continued technology utilization.

This study makes three contributions to the information systems literature through: 1) developing a conceptual model to help understand individual-level determinants of postadoption behavior; 2) providing measures to evaluate technology trust and postadoption utilization; and, 3) investigating the role of technology and interorganizational trust on the technology acceptance model (TAM) constructs and postadoption utilization.

The proposed model is grounded in the TAM [35], [36]. It is empirically tested through structural equation modeling and practical implications are drawn from the results. A discussion of the methodology employed in this research is offered. Data analysis and factors affecting the structural equation model are provided in a discussion and implications for practitioners and academics. The study's limitations are outlined and suggestions for future research are presented.

II. Literature Review and Research Application

Davis developed the TAM [35], [36] to explain and predict an individual's acceptance behavior toward a new technology, regardless of the user population and the type of technology being introduced. Davis [35] based TAM on the theory of reasoned action (TRA) [6], [49] and asserted that adoption decisions are predicated on an individual's affective reaction toward using an innovation. According to TAM, an individual's acceptance decision is premised on two beliefs: 1) perceived ease of use, the individual's perception concerning the amount of effort required to use the new system; and, 2) perceived usefulness, the individual's perception concerning the degree to which using the technology will improve his job performance [35], [36]. Since TAM explains computer usage behavior and offers insights regarding how user acceptance is influenced by system characteristics, scholars consider TAM to be an important theory of technology acceptance [54].

According to TAM, perceived ease of use, which functions as an indicator of the cognitive effort needed to learn and use a new system, influences acceptance through its effect on perceived usefulness [35]. This relationship between perceived ease of use and perceived usefulness and their effect on an individual's intention to adopt a technology were studied within the information systems field (e.g., [2], [66], and [130]). Davis [35] asserts that all other external variables, such as system-specific characteristics or individual attitudinal factors, are mediated by these two beliefs, perceived ease of use and perceived usefulness. Numerous studies (e.g., [1], [4], [37], [98], [117], and [139]) have found perceived ease of use to be important in technology adoption. Gefen and Straub [55] suggest that perceived usefulness, rather than perceived ease of use, may influence the individual's usage intention toward a specific technology. An individual's perceived ease of use influenced by his perceived usefulness toward the usage decision is substantiated by a number of studies (e.g., [25], [26], [55], [60], [73], [129], and [132]). Legris *et al.* [85] indicate that perceived ease of use and perceived usefulness explain approximately 40% of why an individual uses a new technology.

Venkatesh and Davis [129] recently updated TAM to include a number of antecedents to perceived usefulness and ease of use including subjective norms, experience, and output quality. This revised model, known as TAM2, was found to account for 40–60% of the variance in usefulness perceptions and 34–52% of the variance in usage intentions. Venkatesh and Davis [129] found that social influence activities (subjective norms, voluntariness, and image) along with cognitive activities (job relevance, output quality, result demonstrability, and perceived ease of use) influence user acceptance of technology. Chan and Lu [21] used TAM2 as a theoretical basis for their study and considered the influence of five external variables on perceived ease of use and perceived usefulness, and their effect on an individual's intention to adopt and continue using Internet banking. Legris *et al.* [85] conducted a review of studies using TAM and TAM2 as a theoretical basis and determined that additional factors to explain usage behaviors remain latent from the TAM models.

Researchers [128], [131] have attempted to integrate various technology acceptance models to explain technology acceptance and diffusion in different user populations. Venkatesh *et al.* [131] summarize eight technology acceptance models and synthesize the models into a unified view called the unified theory of acceptance and use of technology (UTAUT). The purpose of the Venkatesh *et al.* [131]'s work was to integrate a series of diverse and competing models developed to assess technology acceptance in different organizational contexts. Determinants of acceptance from each of the eight models contributed to the development of a unified model. For the purposes of the current study, the original technology acceptance model enables the investigation of different forms of trust on actual utilization behaviors.

Researchers have empirically validated TAM in a variety of settings. Prior studies have examined TAM antecedents including users' perceived trust (e.g., [33], [53], and [54]), prior similar experiences (e.g., [63] and [129]), computer experience (e.g., [64]), computer self-efficacy (e.g., [23], [60], and [65]), perceived risk (e.g., [136]), personal innovativeness (e.g., [2]), perceived information quality (e.g., [122]), cognitive absorption (e.g., [117]), flow experiences (e.g., [61]), tool experience (e.g., [43]), perceived enjoyment (e.g., [137]), relevance of information need (e.g., [121]), social factors (e.g., [61]), and support achieved through training (e.g., [73]).

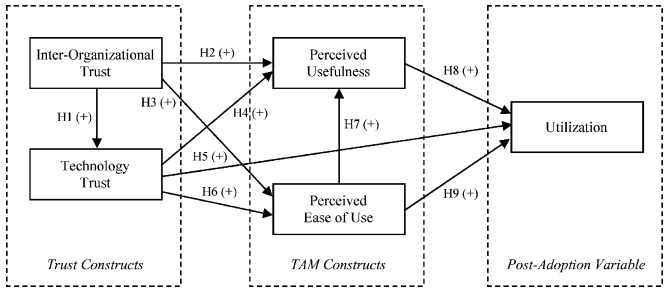

Fig. 1. Proposed model.

Researchers investigating technology adoption using the original TAM as a theoretical foundation have focused primarily on an individual's intention to adopt as the dependent variable (e.g., [22], [24], [25], [59], and [62]) rather than using dependent measures of actual usage behavior. Intention to adopt represents the intent to behave in the future rather than an actual behavior in the present [105]. Actual usage behavior was studied in the form of postadoption beliefs (e.g., [74] and [102]) and computer utilization (e.g., [79] and [127]). A fundamental premise to the proposed research model is that using a behavioral postadoption approach to investigate actual technology utilization represents a more robust measure of technology usage and acceptance than an individual's intention to behave in the future.

III. Model Development and Hypotheses

Fig. 1 summarizes the research model incorporating the hypothesized relationships for the antecedents of technology utilization. The model suggests that technology trust and interorganizational trust have an effect on perceived ease of use and perceived usefulness, and, therefore, on the continued utilization of a technology. Based on TAM, it is suggested that an individual's utilization of a new technology in a socially dependent environment will be influenced by the degree of technology trust and interorganizational trust, perceived ease of use, and perceived usefulness of the technology.

A. Trust Constructs

Trust between individuals, or interpersonal trust, has been studied extensively by scholars in the organizational theory (e.g., [86], [94], [95], and [96]), psychology (e.g., [113]–[116]), management (e.g., [80]), political science (e.g., [10]), and sociology (e.g., [143]). Likewise, interorganizational trust, which is the extent to which one party has confidence in an exchange partner's reliability and integrity [45] has been investigated in a number of different contexts (e.g., [93], [133], and [142]).

The differences between interpersonal and interorganizational trust can be characterized through four propositions: 1) interorganizational trust is difficult to measure, difficult to observe, and subject to higher error in interpretation; (2) interorganizational trust is often latent and has variance even within the trustee and trustor organizations; 3) when testing for interorganizational trust, factors identified as related to trust will vary from one member to another within an organization; and 4) interorganizational trust is multidimensional. The implications of these phenomena are that it is often impossible to generate a statistically reliable index, particularly when data are gathered through individual self-report. Interorganizational trust is an operationalized construct that helps in the understanding of complex dependent relationships and, therefore, is included as a construct within this study in order to provide the opportunity to juxtapose interorganizational trust with technology trust.

Interorganizational trust is the extent to which one party has confidence in an exchange partner's reliability and integrity [45] and forms the foundation for effective interactions among supply chain members. Interorganizational trust between supply chain members is important in order for technological solutions to provide value to all affiliates. A lack of trust among trading partners often creates a condition where every transaction has to be reviewed, scrutinized, and verified, thereby increasing the transaction costs to an unacceptably high level [81].

The level of trust placed in a technology used to coordinate activities and enhance communication among supply chain partners can influence the success of their long-term interactions with one another [89]. Technology trust is an individual's willingness to be vulnerable to a technology based on expectations of technology predictability, reliability, and utility and influenced by an individual's predilection to trust technology [87]. As such, interorganizational trust will directly influence an individual's trust in the technology. Therefore:

H1. Interorganizational trust of supply chain members will positively affect an individual's trust in a new technology.

Perceived usefulness is the degree to which an individual believes that a particular technology will enhance his job performance [35], [36]. Shih [121] found that an individual's perceived usefulness positively influenced his perceptions regarding Internet performance. This suggests that perceived usefulness of a technology relates to improved job performance. Interorganizational trust, the trust an individual places on affiliate organizations, can be generalized to technology trust by association. As an individual within the supply chain uses a new system, he associates the usefulness for his improved job performance and the improvement of the entire operation, which involves affiliate organizations. Therefore, interorganizational trust will directly influence an individual's perception of the technology's usefulness. Therefore:

H2. Interorganizational trust of supply chain members will positively affect an individual's perception that a technology is useful.

Like perceived usefulness, the individual's perception of a technology's ease of use is oftentimes associated with the general level of trust that is placed on affiliate organizations. The ease of use and perceived usefulness of a new innovation are related to interorganizational trust through dependency and cooperative function. Users are dependent on their associative partners in order to accomplish the overall mission—in supply chain operations, the delivery of a part to the proper end-user on time, on cost, with efficiency and with accuracy. Hence, interorganizational trust is related to the user's perception of a technology's ease of use and as such:

H3. Interorganizational trust of supply chain members will positively affect an individual's perception that a technology is easy to use.

Existing literature provides evidence of positive relationships between various types of trust (e.g., [9], [51]–[54], [87], [89], and [104]) and an individual's intention to adopt a technology [54], [55]. An individual's trust evaluation of a technology is based on the amalgamation of affective and cognitive inputs [88]. Since perceived usefulness refers to the degree to which an individual believes that a particular technology will enhance her job performance [35], the individual's trust assessment will likely affect his/her perception. Likewise, since perceived ease of use represents the degree to which an individual believes that a particular technology is simple to use [35], trust in the technology should influence an individual's perception that a technology is useful. Ultimately, trust assessments will affect an individual's willingness to engage in utilization behaviors where utilization refers to the extent to which users take advantage of the most important operational features of the technology [90]. Therefore:

H4. Technology trust will positively affect an individual's perception that the technology is useful.

Each time an individual uses a technology, a trust assessment is made about the system [38]. If the information technology is operational when needed, a positive assessment of system performance is noted. Individuals may consider frequent or inconvenient system downtimes as negative experiences that may result in a diminished level of trust in the technology. Since trust assessments are often based upon a single incident [38], they will affect an individual's willingness to engage in utilization behaviors. Past experiences with the technology, both positive and negative, influence an individual's assessment of that system. The accumulation of these trust assessments will affect the individual's willingness to use the new technology, where utilization refers to the extent to which users take advantage of the most important operational features of the system [90]. Therefore, it is suggested that:

H5. Technology trust will positively affect an individual's willingness to use the new technology.

Each interaction with a technology will influence an individual's perception of the system [38] such that expected

interactions will lead to positive evaluations of the technology [87]. The accumulation of all experiences with an individual or technology leads to a current trust evaluation [88]. Trust permits individuals to have some degree of predictability of the technology's functionality, which allows the user to establish and test expectations regarding as to how the system will operate [40], [41]. In order for an individual to trust, he must be able to evaluate the "predictability" of the individual or object that he is trusting and the situation must have "motivational relevance" [41]. Predictability and expectations are common constructs in the operationalization of trust since predictability suggests consistency of function that can be assessed. Motivational relevance is based on the importance an individual places in the trust event, an individual's expectations of occurrence, and the motivational relevance of the event [41]. Therefore, according to Deutsch [41], if an individual expects an event to occur (the technology to function consistently) and the event has motivational relevance (the need to complete tasks), then the concept of trust applies. As such, positive experiences with a technology will increase an individual's trust in technology. As the individual's trust in the technology increases, perceptions that the technology is easy to use will also increase. Therefore:

H6. Technology trust will positively affect an individual's perception that the technology is easy to use.

B. TAM Constructs

Perceived usefulness was found to be a significant mediating variable between perceived ease of use and the behavioral intention to adopt a technology [34], [35]. Many studies (e.g., [36] and [66]) found that perceived usefulness is a better predictor of behavioral intention to adopt than perceived ease of use. Gefen and Straub [55] suggest that perceived usefulness, rather than perceived ease of use, may influence the individual's usage intention toward a specific technology. The effect of an individual's perceived ease of use influenced by the perceived usefulness toward the usage decision is substantiated by a number of studies (e.g., [25], [26], [55], [60], [73], [129], [132], and [141]). Venkatesh and Davis [129] found that users' perceptions regarding the ease of use will positively influence the user's behavioral intentions to adopt the technology. Therefore, according to TAM, the following relationship is hypothesized:

H7. An individual's perception that a technology is easy to use ispositively related to the perception that the technology is useful.

The degree of perceived utility for a single technology may differ depending upon the utilization context. For example, research has shown that computer-mediated communication devices, such as email, produce less rich interpersonal communication than face-to-face interactions [32]. The selection of email as a communication medium is an alternative, but the use of this technology within the context of rich information exchange has been shown ([32], [109], and [110]) to be less useful in the completion of the specific task. The perceived usefulness of email, to facilitate rich communications, does not match the nature of the task needed for completion. Therefore, although email technology is useful for exchanging data and information, the utility of this technology is diminished in this context if an outcome of a rich (high affective and cognitive) information exchange is sought. As such, this suggests that:

H8. The degree to which an individual perceives the technology as useful ispositively related to willingness to use the technology.

The relationship between ease of use and willingness to use is based on the margin of technical difficulty of a new system and the amount or degree of difference that exists between the old and new technologies. Dishaw and Strong [43] empirically found that individuals accept innovations that enable them to easily complete daily tasks. The degree to which these same individuals will use the new system will depend upon the extent to which individuals believe the technology is performing the tasks as per its design [43]. In an IT adoption, where the new system operates with similarity of function and structure, individuals are more likely to try and use the technology because of the associated perceived ease of use [90]. Ease of use is an individual's perception or judgment that is directly proportional to a willingness to try. Therefore:

H9. The degree to which an individual perceives the technology as easy touse is positively related to a willingness to use the technology.

IV. Methodology

The methodology section provides a summary of the data collection protocols involved in a two-stage data collection process of members of the second-largest U.S. automotive supply chain. Section IV-A contains a detailed synopsis of the Stage 1 data collection process in which the researcher conducted face-to-face interviews with members of the supply chain. The purpose of the interviews was to understand the user population, to provide a foundation for the data collection instrument design and development, and to serve as a validation mechanism during the analysis stage. The interviews provided a description of the population as a means to precheck for any anomalies, specific to the CVN technology users that would have an effect on the way the study was designed.

Section IV-B contains a discussion of the Stage 2 data collection process that consisted of a field survey to empirically test the research hypotheses presented in this manuscript. A précis of the measurement items used in the field survey is introduced along with descriptions of the operationalization of constructs, scales used, and sources where items and scales were previously used. The purpose and functionality of the technology studied as part of this research is explained along with a discussion of the implementation process associated with the introduction of

TABLE I
RESEARCH CONSTRUCTS

Construct	Construct Definition	Reliability Alpha (Number of Items)	Scale Source
Perceived Ease of Use	The degree to which an individual believes that a particular technology is effortless to use	.94 (6) .87 (4)	[35] [4]
Perceived Usefulness	The degree to which an individual believes that a particular technology will enhance his job performance	.98 (6) .95 (8)	[35] [4]
Technology Trust	The extent to which an individual is willing to place trust in the information technology	New items	New Items
Inter-Organizational Trust	The extent to which one party has confidence in an exchange partner's reliability and integrity	.94 (8)	[45]
Utilization	The extent to which users take advantage of the most important operational features of the technology	.64 (5)	[90]

the technology. The survey administration process is explained as the concluding element of the methodology section.

A. Stage 1 Data Collection—Interviews

The researcher conducted 59 interviews with members of the second-largest U.S. automotive supply chain over a 4-month period in several geographic regions in the Northeast, Midwest, and Southeast of the United States and Ontario, Canada. Nine employees of the automotive company, 47 individuals working for supplier organizations, and three members of the fourth-party logistics (4 PL) firm were interviewed. Twenty-nine men and 30 women were contacted in the following locations: four in Georgia, four in Indiana, two in Kentucky, 21 in Michigan, five in North Carolina, five in Ohio, ten in Tennessee, three in Wisconsin, and five in Ontario, Canada. Interviewees were selected based on their role in the buying center [111], [134].

Interviews were conducted until theoretical saturation occurred, which involves the gathering of data until repetitions are encountered [46], [140]. Within-case analysis was applied during interview examination consistent with recommendations by Eisenhardt [46]. Interview data were reviewed and reduced to identify consistent and repeated themes that were then ranked in order of frequency of occurrence. These factors were mapped to the existing literature involving innovation diffusion and technology adoption in the fields of information systems, marketing, supply chain management, logistics, and psychology. Factors affecting continued usage behaviors were derived from the interviews and specific factors were selected for further investigation using a survey approach and quantitative analysis.

B. Stage 2 Data Collection—Field Survey

1) Measurements: The appendix shows all the measurement items used in this study. All items were based on previously tested scales employed within the information systems literature as shown in Table I. Table I presents the original sources for each construct used in this study along with a definition of the construct, the number of items used in the original source to assess each construct, the original coefficient α produced in the source study, and the reference for each original scale source. For each item, a seven-point Likert scale was used with response options ranging from strongly disagree to strongly agree. These scales were used to evaluate individual user's perceptions of the technology. As such, the unit of analysis for this study is the individual supply chain member who may also function as the surrogate for the supply chain organization since in most affiliate organizations, there is only one individual within the affiliated firm responsible for working with this system.

The following scales and modifications were applied in order to meet a standard of face validity for these constructs. In all instances, item wording was modified to include the technology under investigation, which is consistent with Agarwal and Prasad [3].

a) Perceived ease of use: The six-item perceived ease of use scale ($\alpha = 0.94$) was adapted from the Davis [35]'s study, which developed this construct as a determinant of user technology acceptance. The original scale has been validated by other information services (IS) research resulting in similar levels of reliability (e.g., $\alpha = 0.96$ [90]; $\alpha = 0.93$ [102]; $\alpha = 0.92$ [129]).

b) Perceived usefulness: The eight-item perceived usefulness scale ($\alpha = 0.98$) was adapted from the Davis [30]'s study investigating determinants of user IT acceptance and has been confirmed within IS research (e.g., $\alpha = 0.99$ [90]; $\alpha = 0.95$ [4]; $\alpha = 0.93 = 0.93$ [130]).

c) Technology trust: The technology trust scale was premised on Lippert's [87] eight-item scale ($\alpha = 0.69$), later refined by Lippert and Forman [89] and Lippert *et al.* [91]. The scale used in the current study is a new four-item scale used to assess the individual's trust in the information technology.

d) Interorganizational trust: Interorganizational trust was assessed by an eight-item scale ($\alpha = 0.94$) developed by Doney and Cannon [45] to measure the impact of supplier organization and salesperson trust on a buying firm's current supplier choice and future purchase intentions. In the current study, the language was modified from the firm to the customer since the Doney and Cannon [45] scales evaluated the salesperson's trust in the supplier firm.

e) Utilization: Utilization refers to the extent to which users take advantage of the most important operational features of the technology and was tapped based on a refined version of the Lippert and Forman [90] six-item scale. The refinements to the utilization construct emerged based on the interviews conducted during the Stage 1 data collection process. Utilization is a measure of the degree to which an individual uses key features in CVN including the express option, the exception management feature, the workload planning capability, the sequence of the unloading process, and the use of the suppliers' scorecard to manage logistical performance.

2) Context of Technology Under Investigation: The technology explored in this study, CVN, is an Internet-based technology designed to facilitate a number of logistics functions including scheduling and confirmation of shipments to the second-largest automotive company's U.S. distribution centers. As part of the process change necessary to use CVN, suppliers are required to input shipping dimensions and weights for each product to facilitate the development of cubic dimensions. These measures

are used by the 4PL to optimize the cubic space of shipping vehicles and to streamline routing. Additionally, cubic dimensions enable the 4PL to select the best transportation routes in order to increase trailer utilization and reduce congestion at the distribution centers.

3) Implementation Process: CVN is a relatively new technology that was rolled out through a phased conversion to all members of the supply chain. The technology was introduced to the supply chain organizations by a letter from the customer organization announcing the inclusion of the technology to facilitate the distribution process. Suppliers had approximately 2 months to prepare for the new system. During this preparation phase, supply chain affiliates were instructed to review a Website containing instructions on how to use the CVN. Because the technology was implemented across supply chain organizations, basic technological standards varied greatly among the supplier firms. Some affiliates had not previously automated their information processing activities and, therefore, needed to implement requisite technologies in order to gain Internet access. For these organizations, the additional pressure of acquiring these basic technological systems added to the challenge of working with the CVN system.

Another group of supplier organizations had very sophisticated technologies for which their users had received extensive training. The variability in technology, experience with these systems, speed of Internet access, and past training with computers, in general, provided an additional layer of complexity to the implementation process. In some instances, the change to use CVN required not only process modifications but also the use of technologies to accomplish the tasks. Some organizations had technologically sophisticated cultures while others used antiquated systems or structures to accomplish the supply chain functions.

4) Survey Administration: The 4PL Chief Information Officer sent a letter to the automotive company's entire first-tier supply chain membership indicating that a survey was forthcoming in 1 week and asked for their cooperation. A census was conduced to ensure that all qualified members of the population (authorized CVN users) received a survey. In total, 3000 surveys were distributed; 562 were returned for incorrect addresses. The original contact list obtained from the 4PL contained numerous address errors impacting the number of returned questionnaires. After removing incomplete surveys from the 341 returned questionnaires, 273 usable surveys were included in this study yielding a response rate of approximately 11.2%. U.S. companies received 2705 surveys and 295 surveys were mailed to Canadian companies that are first-tier suppliers to this specific automotive company. An equivalent rate of response was found for both U.S. (11.1%) and Canadian (11.9%) companies.

V. Data Analysis

A. Characteristics of Sample

Gender, age, education level, locale (U.S. or Canada), and zip codes were collected. Zip codes were collapsed into a binary nominal structure and labeled as rural or urban based on criteria from the U.S. Department of Commerce 2000 National Census [39].

TABLE II
DEMOGRAPHICS ($N = 273$)

Demographic	Frequency	Percentage
Gender		
• Men	96	35.2%
• Women	177	64.8%
Age (years of age)		
• 20-29	33	12.1%
• 20-39	90	33.0%
• 40-49	101	37.0%
• 50-59	45	16.5%
• Over 60	3	1.1%
• Missing	1	0.4%
Education		
• High School Diploma	52	19.0%
• Some College	121	44.3%
• College Degree	92	33.7%
• Other	8	2.9%
Locale		
• U.S.	249	91.2%
• Canada	24	8.8%
Geographic Area in U.S. (N=249)		
• Rural	64	25.7%
• Urban	185	74.3%

TABLE III
MEANS, STANDARD DEVIATIONS, AND RELIABILITIES ($N = 273$)

	Mean	S.D.	Reliabilities
Perceived Ease of Use	4.91	1.57	.96
Perceived Usefulness	3.71	1.90	.98
Technology Trust	4.58	1.55	.95
Inter-Organizational Trust	4.51	1.24	.94
Utilization	1.47	0.92	.84

Respondents varied in gender (female, 64.8%; male, 35.2%); age (20–29 years, 12.1%; 30–39 years, 33.0%; 40–49 years, 37.0%; 50–59 years, 16.5%; and over 60, 1.1%), and education (high school diplomas, 19.0%; some college, 44.3%; college degree, 33.7%; other, 2.9%). Twenty-four of the respondents were from Canadian companies and 249 were from U.S. companies. Of the 249 U.S. companies, 25.7% were rural and 74.3% were urban. The demographic information is summarized in Table II.

B. Reliability and Validity

Table III presents the results of the reliability testing using Cronbach's α coefficients [29], [30] for the constructs of the current study. The measures of reliability for all the constructs are well above the acceptable threshold of 0.70 set by Nunnally [101] and are considered strong measures with α's ranging between 0.84 and 0.98 (see [13] and [92]). The UTL1 item was dropped from the utilization construct and analysis due to cross-loading resulting in a five-item scale with $\alpha = 0.84$. Table III displays the variable means, standard deviations, and reliabilities for the constructs.

A factor analysis was conducted to determine if the constructs were distinct and unique. A principal components factor analysis with a varimax rotation was performed on the 31 items used to measure perceived ease of use, perceived usefulness, technology trust, interorganizational trust, and utilization. Table IV shows that there is minimal cross-loading and that each item loads on a

TABLE IV
FACTOR ANALYSIS OF STUDY CONSTRUCTS

	Factor 1 Perceived Usefulness	Factor 2 Inter-Organizational Trust	Factor 3 Perceived Ease of Use	Factor 4 Technology Trust	Factor 5 Utilization
PU1	**0.803**	0.144	0.355	0.215	0.136
PU2	**0.875**	0.207	0.228	0.168	0.117
PU3	**0.886**	0.175	0.211	0.177	0.122
PU4	**0.893**	0.188	0.201	0.178	0.106
PU5	**0.902**	0.192	0.207	0.144	0.108
PU6	**0.890**	0.204	0.218	0.187	0.107
PU7	**0.874**	0.166	0.268	0.192	0.108
PU8	**0.814**	0.182	0.310	0.266	0.131
IOT1	0.172	**0.731**	0.154	0.312	0.032
IOT2	0.171	**0.847**	0.044	0.216	0.008
IOT3	0.154	**0.783**	0.003	0.252	-0.034
IOT4	0.175	**0.828**	0.173	0.048	0.094
IOT5	0.159	**0.850**	0.180	-0.003	0.111
IOT6	0.132	**0.870**	0.156	0.001	0.075
IOT7	0.151	**0.865**	0.055	0.183	0.021
IOT8	0.089	**0.707**	0.038	-0.062	0.072
PEOU1	0.200	0.133	**0.864**	0.166	0.033
PEOU2	0.212	0.105	**0.881**	0.155	-0.003
PEOU3	0.436	0.170	**0.730**	0.179	0.066
PEOU4	0.233	0.109	**0.887**	0.166	0.009
PEOU5	0.304	0.129	**0.821**	0.241	0.064
PEOU6	0.381	0.120	**0.823**	0.223	0.051
TT1	0.248	0.208	0.287	**0.770**	0.078
TT2	0.337	0.142	0.282	**0.807**	0.110
TT3	0.368	0.207	0.315	**0.789**	0.083
TT4	0.357	0.213	0.290	**0.796**	0.087
UTL2	0.151	0.092	0.025	-0.006	**0.712**
UTL3	0.026	0.040	0.028	0.093	**0.825**
UTL4	0.104	0.116	0.024	0.069	**0.773**
UTL5	0.084	0.122	-0.003	-0.021	**0.819**
UTL6	0.126	-0.109	0.061	0.098	**0.695**
% of variance explained	44.74%	13.06%	9.59%	7.21%	5.15%

unique factor. Additionally, 79.75% of the variance is explained. As such, construct validity is supported.

C. Analysis of Convergent and Discriminant Validity

Convergent and discriminant validity were assessed using the multitrait-multimethod (MTMM) analysis developed by Campbell and Fiske [19]. Convergent validity assesses the interitem correlations of measures in order to interpret concept similarity [58]. The convergent validity of the measures was assessed and the interitem correlations were found to highly correlate and produced significance beyond the $p < 0.001$ level.

Following the protocols outlined in Doll and Torkzadeh [44], the smallest within-variable correlations contained in the study are: utilization = 0.37; interorganizational trust = 0.46; perceived ease of use = 0.69; technology trust = 0.77; and, perceived usefulness = 0.81. Based on these results, the scales demonstrate high correlations among the items measuring a particular construct and, therefore, support convergent validity.

Discriminant validity assesses the degree to which two theoretically similar constructs are distinct [58]. With discriminant validity, the total scale correlation between conceptually distinct measures should be low. The three protocols outlined by Campbell and Fiske [19] and Elbert [47] for establishing discriminant validity were followed. The results of the three tests are contained in Table V. The first discriminant validity criterion was to ascertain the level of general method variance contained within the matrix [47]. Values within the validity diagonal should be higher than the values contained within the heterotrait-heteromethod triangles [19], [47]. Table V shows that the first discriminant validity criterion has been met.

TABLE V
SUMMARY OF DISCRIMINANT VALIDITY

Discriminant Validity Criteria		Respondents
First Test	Convergent validities exceed heterotrait-heteromethod values	100.0%
Second Test	Convergent validities exceed heterotrait-monomethod values	86.9%
Third Test	Kendall's Coefficient of Concordance, W	.412

* Note: Cell values indicate percentage of cases meeting the criterion
** $p < .05$: Suggests that at least some agreement in coefficient patterns

The second discriminant validity criterion was to ascertain if the validity diagonal coefficients are greater than the heterotrait-monomethod coefficients [19], [47]. In this study, the second criterion was satisfied in 86.9% of the cases, a strong indication that method variance was not an issue. Table V shows that the second criterion has been met.

The third discriminant validity criterion was to ascertain if the same pattern of trait interrelationships is found in both the heterotrait-heteromethod coefficients and the heterotrait-monomethod coefficients. Consistent with Elbert [47], Kendall's coefficient of concordance W [123] was used to determine the magnitude of agreement among all the coefficients in the MTMM. Kendall's W was found to be 0.412 at $p < 0.0001$, which suggests that there is some similarity in the coefficient patterns. Hence, the third criterion was also met. Given the results of the three criteria assessments, discriminant validity is supported.

D. Research Model Results

A structural equation modeling approach with maximum likelihood estimation was used to evaluate the research questions. The structural equation model using a series of hypotheses identifies how the variables are generated and related [27] and provides an assessment of predictive validity [18], [125]. LISREL was selected for this type of data analysis since the model fit to the data is evaluated through the significance of the individual causal paths.

E. Hypothesized Structural Model

The research model was tested with an item-level structural equation model (SEM). Fit indices indicated that the model fits the data well. Significantly, $\chi^2 = 0.321$, nonnormed fit index (NNFI) = 1.018, incremental fit index (IFI) = 1.002, comparative fit index (CFI) = 1.000, root-mean-square error of approximation (RMSEA) = 0.00, standardized root-mean residual (SRMR) = 0.007. Fig. 2 shows the structural model. Since the chi-square test statistic is sensitive to multivariate normality when sufficiently large sample sizes are used and produces unstable results when there is a violation of this basic statistical assumption [12], the use of other fit indices is warranted [56], [67]. Thus, in addition to the statistical evaluation of fit using chi-square, CFI, NNFI, and IFI over 0.90 are considered as criteria of good fit [76]. These three indices improve the fit of the hypothesized model over the null model, in which all observed variables are specified as uncorrelated. These thresholds have been found to be sufficient criteria even in small-sample

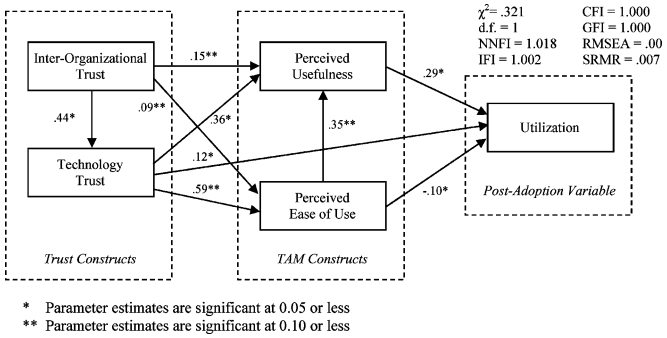

Fig. 2. Results of full structural model ($N = 273$).

situations (e.g., [11], [67], and [72]). Browne and Cudeck [16] suggest that an RMSEA of 0.05 or less indicates a close fit. The SRMRs less than 0.05 indicate a good fit to the data [42]. All SEM analyses were performed with covariance metrics as suggested by [31] and [71].

Four of the nine hypotheses were supported at the 0.05 level while the remaining five exhibited partial support at the 0.10 level. This study reports findings at the $p < 0.10$ level consistent with the assertion of Rosnow and Rosenthal [116] that p values exceeding 0.05 contain valuable information and are worthy of reporting. Therefore, findings significant at the $p < 0.10$ or better threshold are reported as partially significant.

Hypothesis 1 was partially supported at $p < 0.10$ ($\beta_{\text{Interorganizational trust}\rightarrow\text{Technology Trust}} = 0.44$), which suggests that interorganizational trust demonstrates a partial influence on an individual's trust in the CVN technology. This suggests that the extent to which one party has confidence in an exchange partner's reliability and integrity provides only some influence on the exchange partner's willingness to place trust in the information technology.

Hypotheses 2 and 3 were supported at $p < 0.05$ ($\beta_{\text{Interorganizationaltrust}\rightarrow\text{Perceived Usefulness}} = 0.15$ $\beta_{\text{Interorganizational trust}\rightarrow\text{Perceived Ease of Use}} = 0.09$). This suggests that the degree to which one exchange partner has faith and trust in another will positively influence an individual's perceptions that the technology is useful (Hypothesis 2) and easy to use (Hypothesis 3). In this context, trust in another individual of importance can influence perceptions regarding a technology's attributes.

Hypotheses 4 and 5 were partially supported at $p < 0.10$ ($\beta_{\text{Technology Trust}\rightarrow\text{Perceived Usefulness}} = 0.36$ $\beta_{\text{Technology Trust}\rightarrow\text{Utilization}} = 0.12$). These findings show that trust in the inanimate technology has the potential to influence individual's perceptions that the technology will enhance job performance. Additionally, the findings suggest that an individual's trust in the technology may influence the extent to which he takes advantage of the most important operational features of the system by using them to complete daily tasks.

Support is exhibited for Hypothesis 6 at $p < 0.05$ ($\beta_{\text{Technology Trust}\rightarrow\text{Perceived Ease of Use}} = 0.59$) indicating that if the individual trusts the technology, he will perceive the technology to be easy to use. As expected, Hypothesis 7 is confirmed at $p < 0.05$ ($\beta_{\text{Perceived Ease of Use}\rightarrow\text{Perceived Usefulness}} = 0.59$) indicating that perceived ease of use influences an individual's perception that the technology is useful.

Hypothesis 8 demonstrated partial support at $p < 0.10$ ($\beta_{\text{Perceived Usefulness}\rightarrow\text{Utilization}} = 0.29$) suggesting that if an individual recognized the utility of the software, he is more likely to use the most important features of that system. The one counterintuitive result from this study is the finding that perceived ease of use exhibits an inverse relationship with utilization ($\beta_{\text{Perceived Ease of Use}\rightarrow\text{Utilization}} = -0.10$, $p < 0.10$). This finding suggests supply chain members within this study felt that if the IT was easy to use, then they did not use the most important features. Although the finding demonstrated only partial support for this negative relationship, the result was not expected. Table VI displays the path coefficients and t -values for the hypotheses tested.

This study found that interorganizational trust was significantly and positively related to technology trust and perceived usefulness. Trust in supply chain partners influences an individual's trust in technology and perceptions that the new technology is useful for specific job tasks. Technology trust affects an individual's perception that the technology is easy to use and useful for task completion. Trust in the technology appears to directly affect an individual's technology utilization. Within a supply chain context, perceived ease of use was found to influence perceived usefulness and provides further support of this relationship consistent with past TAM research. Perceived usefulness influenced an individual's utilization of the IT.

However, a negative relationship was found between perceived ease of use and technology utilization producing a counterintuitive finding. One potential explanation for this counterintuitive result is the proposition that individuals investigated in this study perceive that if a process is more difficult, then the process is actually superior to a process that is easier to employ. These data suggest that within the automotive supply chain investigated, the perceived complexity of the technology may influence the suppliers' willingness to use the system. This counterintuitive finding might also be associated with the respondent's limited utilization of the features. On average, respondents reported less than optimal usage statistics for this technology. The fact that the respondents have limited experience with the system may explain why they do not make the connection between how easy the system is to use and the degree to which they use the CVN. What this means for managers is that they need to focus attention on the specific benefits of the technology and how the use of specialized functions can generate these individual-level benefits. In general, the results confirmed that trust, both interorganizational and technology, are relevant constructs to consider in explaining and predicting the degree to which an individual uses a new technology.

VI. Conclusion

A. Discussion and Model Confirmation

This study provides empirical support to confirm trust determinants that influence automotive supply chain member's

TABLE VI
RESULTS OF THE PROPOSED MODEL

Causal Paths	Hypothesis	Standardized Structural Coefficient	t-value	Assessment
Inter-organizational trust → technology trust	H1	.44	7.204*	Supported
Inter-organizational trust → perceived usefulness	H2	.15	2.955**	Supported
Inter-organizational trust → perceived ease of use	H3	.09	1.634**	Supported
Technology trust → perceived usefulness	H4	.36	5.768*	Supported
Technology trust → utilization	H5	.12	1.210*	Supported
Technology trust → perceived ease of use	H6	.59	10.400**	Supported
Perceived ease of use → perceived usefulness	H7	.35	5.945**	Supported
Perceived usefulness → utilization	H8	.29	3.170*	Supported
Perceived ease of use → utilization	H9	-.10	-1.079*	Not Supported
* Parameter estimates are significant at 0.10 or less	** Parameter estimates are significant at 0.05 or less			

decisions to continue using a specialized IT. Predicated on the TAM [35], [36] as theoretical grounding, this study proposed a model to investigate the relationship of selective trust phenomena as external variables to TAM.

Overall, the findings of this research study are significant and meaningful. Eight of the nine hypotheses are supported at the $p < 0.10$ significance level. One hypothesis was found to have an inverse significant relationship at the $p < 0.10$ level. One interesting finding is that the two trust constructs, interorganizational and technology, affect an individual's perception that the new technology is easy to use and useful for the completion of job tasks. The study revealed several important relationships that exist between trust (interorganizational trust and technology trust) and TAM (perceived usefulness and perceived ease of use) antecedents influencing an individual's willingness to use the innovation.

B. Findings Related to Trust Constructs

The current study investigated the effects of interorganizational and technology trust on the TAM antecedents and the utilization of a new supply chain technology. Interorganizational trust is particularly relevant for the study application because of the complex business relationships that exist within supply chains, involving multiple organizations that are mutually dependent on a logistic operation and process. This is particularly relevant since interorganizational trust is necessary if supply chain affiliates are to effectively share information [15] such as the operational data that are entered into the CVN technology. This is important for management in that the building of trust between supply chain affiliates appears to have additional benefits related to information exchange. As suggested by Lippert [88], trust is an important operating force in any enterprise and the explicit efforts to establish, nurture, and maintain a trust culture can make a considerable difference in business success. This suggests that organizations should establish and maintain a culture of trust [88]. Lewicki and Bunker [86] offer specific strategies for trust-building in organizational settings. Managers should familiarize themselves with these strategies to help build, foster, and nurture interorganizational trust among supply chain affiliates.

Interorganizational trust was found to be an important variable for technology utilization through a dependent relationship, and as manifest through the already supported TAM constructs of perceived usefulness and perceived ease of use. Interorganizational trust was found to have three direct links. First, the basic notion of trust as a faith and dependency on complex elements that are rarely under an individual's control are manifest through predictability, reliability, and expectation. Second, the notion of trust as a reinforcing construct, i.e., as our general trust increases, it extends to other trust relationships, is tested. Finally, the reinforcing nature of trust is oftentimes identified and measured as a proclivity toward positive trust or a general propensity to trust [86]. Interorganizational trust directly links to perceived usefulness, perceived ease of use, and technology trust. The results indicate that the higher the degree of interorganizational trust, the greater the positive perception of technology usefulness, ease of use, and willingness to trust the innovation.

These findings indicate that the existence of high levels of interorganizational trust influence an individual's trust in the technology, his/her perceptions that the technology is easy to use, and that the technology is useful. From a practical perspective, when an affiliate organization keeps its promises and is honest with other supplier organizations, the effect of interorganizational trust is maintained. This implies that consistency of behavior in interorganizational dealings provides a basis for exhibiting a genuine concern that the operations are successful. This support, in the form of trust, has a strong effect on supplier perceptions. Therefore, management should be cognizant of the effect of interorganizational trust on technology utilization.

Technology trust is the extent to which an individual is willing to place trust in the information technology [87], [91]. The results from this study indicate that trust in technology has a direct influence or linkage to perceived usefulness, perceived ease of use, and technology utilization. As previously noted, the totality of an individual's experiences with a technology leads to the current trust evaluation of the system [87]. The presence of technology trust suggests that individuals can predict the technology's functionality, which enables them to establish and test expectations regarding how the system will operate. The significance of this result is that technology trust has an accumulating

effect on actual technology use. The results confirm that as trust in technology increases, not only do perceptions of ease and usefulness increase, but, most importantly, the behavioral (beyond intent) action of actual utilization also increases.

In order to support affiliate's trust perceptions toward the new system, management should openly communicate the individual-, organizational-, and supply chain-level benefits of the innovation. The verbal affirmations offered by management provide one potential mechanism for establishing and maintaining trust in the new technology. Additionally, since trust is enhanced through consistent functionality [86], affiliates should be notified immediately regarding any potential issues, problems, or operational variances that occur as a result of the technological transition.

Butler [17] offers eight trust-building behaviors that individuals use to build trust in other individuals within organizational settings. These behaviors include *consistency of behavior* (reliability, predictability, and good judgment), *promise fulfillment* (following through on one's word), *fairness in interactions* (unprejudiced means without preconceived opinions or judgments), *discreetness* (keeping confidences), *receptivity* (accepting of ideas), *availability* (being physically present when needed), and *openness* (freely sharing ideas and information). As a trust-building strategy, management can develop training programs to consciously introduce these concepts into organizational practices as a mechanism for building both interorganizational and technology trust. Since an individual's actual behaviors play a critical role in signaling whether he should be trusted, the use of these trust-building activities can be effective in enhancing interorganizational relationships.

C. Findings Related to TAM Constructs

This study provides further validation of the TAM within the population of a U.S. automotive supply chain employing a specialized SCM technology. The findings confirm that an individual's perception of the technology's ease of use has an influence on the individual's assessment of the technology's usefulness. Additionally, a technology that is considered to be useful was shown to be used by the supply chain members within this study. This suggests that utilization behavior can be positively influenced by management's willingness to consider initiatives aimed at promoting the usefulness of the new technology. Since actual utilization is a measurable outcome, the practical implication of increasing overall technology utilization within the supply chain, has the potential to generate productivity gains across the supply chain. This finding affects the investigation of TAM in future studies by establishing the connection between perception and actual usage behavior, through confirmation of actual use.

VII. Implications

A. Academic Implications

This research offers several contributions to the IT literature. First, a conceptual model was empirically tested to understand the influence of individual-level determinants of postadoption behavior. This study found that trust antecedents (interorganizational trust and technology trust) and the TAM antecedents (perceived usefulness and perceived ease of use) exhibited an effect on technology utilization. This suggests that the inclusion of trust in the investigation of postadoption behavior is relevant and appropriate in future examinations.

Second, a measure to evaluate the specialized functionality used by supply chain members was employed within this study and found to exhibit strong internal consistency. This suggests that the utilization measure may be valuable in future investigations that evaluate an individual's usage behavior of similar supply chain technologies.

Third, this study examined factors impacting postadoption behavior of supply chain organizations using the TAM. As a consequence of this research, the application of TAM in the context of supply chains was found to be appropriate.

Fourth, the CVN technology is currently used by several different automotive supply chains in the United States, Canada, and Europe as well as supply chains in the construction, electronics, heavy equipment manufacturing, and television manufacturing industries. Therefore, this research can be generalized to supply chains that use CVN for similar purposes and application. However, additional studies that replicate this investigation are warranted to ensure that the generalization assertion holds in these different industries or for other SCM technologies.

B. Practical Implications

This research makes two contributions to industry managers and IT technologists. First, this study found that interorganizational and technology trust appear to affect supply chain members' continued technology use through the TAM constructs. This implies that industry managers should assess interorganizational relationships to determine if high levels of trust exist. Identifying opportunities for supply chain affiliates to engage in positive trust activities can help foster and promote interorganizational trust. Opportunities to build technology trust also appear to be important to supply chain affiliates in persuading members to use the system. The development of practical strategies for building trust within organizations and toward technologies should be developed by industry managers to support trust-building activities [88].

Second, supply chain organizations should be encouraged to develop initiatives to foster greater continued technology usage through the application of trust initiatives. These trust initiatives will need to emerge and be supported by top management in order for the full effect of these initiatives to be achieved. Seminars and focus group discussions offer possible mechanisms for determining areas where trust is low or latent. The benefits derived from these discussions could be a greater understanding of pertinent issues influencing individual supply chain members. Management can use these insights to identify the current state of the organization's trust culture and thereby ascertain where trust could be enhanced.

VIII. Limitations

Several limitations in this study are recognized in terms of process or method as well as generalizability. This study is delimited to the first-tier suppliers of the second-largest U.S. automotive manufacturer, thus restricting generalizability to companies in that industry. The inclusion of only first-tier suppliers could affect the study's external validity with regard to second- or third-tier CVN users within this supply chain context. Since this research only investigates the behaviors of members of a single supply chain, care should be exercised when extrapolating the results until the study is replicated across different populations.

As common with many field studies that use TAM as theoretical grounding, this study acknowledges the presence of common method bias, since responses to the survey items (both independent and dependent variables) are provided by the same respondent [8]. The survey was sent to all authorized users of the CVN within the supply chain. As such, the survey respondents are all the individuals in each supplier organization that use the new CVN technology. In most instances, there is only one individual within each organization who uses the system and who has knowledge of the CVN. One of the original possibilities was to capture actual usage statistics for each user. These statistics could have been employed instead of the individual's self-reported utilization assessments. However, due to confidentiality concerns expressed by executives during the pretesting of the survey, this option became unfeasible.

Concurrently, this study accepts the presence of key informant bias since the only respondents capable of providing the necessary data were the key informants who constituted the survey population. The current study does not report the perceptions of anyone else in the business since key informants were the only respondents with experience in using the system.

Cross-sectional studies such as this may not fully capture the complexity or periodicity of the adoption and usage processes since beliefs, attitudes, and decisions are dynamic. Therefore, the results of this study should be viewed as only preliminary evidence regarding the varying criteria that influence technology utilization. Longitudinal studies that examine how beliefs and attitudes of the user evolve temporally would provide a more rigorous test of how the determinants of behavioral intention and attitudes are modified over time [74].

IX. Future Research

There are a number of possible options for future research based on the current study. First, the construct of utilization could be further investigated through the use of quantifiable measures generated from the CVN usage statistics. The inclusion of these quantifiable measures could help resolve common method bias issues inherent in this type of data collection procedure.

Second, a longitudinal study could be undertaken to assess individual's utilization behaviors at different points of time as experience with the system increases. The longitudinal approach could assess individual's trust in the technology at regular intervals in order to determine if corporate interventions might help facilitate trust development. From a longitudinal perspective, the perceptions formed immediately following an interaction affect the individual's beliefs about the technology and the interfirm operations. A longitudinal research project could be undertaken by: 1) surveying individuals at several predetermined periods, e.g., 3-month-, 6-month-, and 9-month postadoption; 2) assessing the degree to which user's opinions change over time and with experience using the technology; and 3) matching the participant's perceptions with his/her prior experiences to determine what influences were most relevant in effecting any change in perception over time. These assessments could be used to evaluate the individual's trust in the technology and the degree to which he/she is using the system.

Third, experiments could be conducted to evaluate the effects of trust enhancements on respondent's perceptions of the technology. Organizational managers could develop specialized training programs geared to facilitate trust-building between supply chain members. These training programs could be evaluated in the form of pre- and postassessments of the respondent's perceptions of the technology and the level of trust in his/her supply chain partners.

Fourth, future investigations could consider the effect of perceived ease of use and perceived usefulness on trust in technology. The investigation of these causal relationships may support other research questions within this domain. Alternative model specifications could be crafted and tested for directionality as an avenue for future research.

Fifth, future research might examine the degree of risk an individual is willing to experience and the effect of this level on their trust assessment. Research by Deutsch [40] suggests that in order for an individual to trust, the situation must have motivational relevance. This future research could follow the logic of Deutsch [40] to assess an individual's motivational relevance and the degree to which this impacts his/her level of trust.

Sixth, evaluating the individual's predisposition to trust may also affect the individual's willingness to use a technology. The trust an individual has in the technology will also be influenced by other external variables. Consideration should be given to identifying other variables likely to affect an individual's trust in the technology.

Seventh, users could be classified based on Rogers' [112] taxonomy of adopters as innovators, early adopters, early majority, late majority, and laggards. Individuals classified within each of these categories might be compared to determine which individuals are more in need of organizational interventions related to building trust. These insights could help inform future managerial initiatives to enhance and support individual acceptance of new technologies.

Future research based on this study can follow a number of paths of investigation to better understand the effects of trust antecedents on postadoption behavior. Technology acceptance and continued utilization are affected by a diverse set of antecedents that require additional investigation in order to fully understand these phenomena. Continued research to strengthen the understanding of these relationships is both proposed and warranted.

APPENDIX
SCALE ITEM AND DESCRIPTIVE STATISTICS BY CONSTRUCT

Perceived Ease of Use

Var	Mean	S.D.	Item Wording
PEU1	5.01	1.72	Learning to use CVN is easy for me
PEU2	5.30	1.63	It is easy for me to remember how to perform tasks using CVN
PEU3	4.45	1.89	I believe that it is easy to get CVN to do what I want it to do
PEU4	4.95	1.64	It is easy for me to become skillful at using CVN
PEU5	4.87	1.68	My interaction with CVN is clear and understandable
PEU6	4.89	1.73	Overall, I believe that CVN is easy to use

Perceived Usefulness

Var	Mean	S.D.	Item Wording
PU1	3.99	2.04	Using CVN enables me to accomplish tasks more quickly
PU2	3.76	2.02	Using CVN improves my job performance
PU3	3.63	1.94	Using CVN gives me greater control over my work
PU4	3.58	1.95	Using CVN improves the quality of work I do
PU5	3.48	1.95	Using CVN improves my productivity
PU6	3.64	1.98	Using CVN enhances my effectiveness on the job
PU7	3.70	2.03	Using CVN makes it easier to do my job
PU8	3.87	2.10	Overall, I find using CVN useful in my job

Technology Trust

Var	Mean	S.D.	Item Wording
TT1	4.59	1.60	I think that CVN is predictable
TT2	4.51	1.72	I can rely on CVN to be working when I need it
TT3	4.58	1.67	I have faith that CVN will function as I expect it
TT4	4.63	1.63	I have a high degree of confidence that CVN will be working when I need it

Inter-Organizational Trust

Var	Mean	S.D.	Item Wording
IOT1	4.86	1.41	Our customer keeps promises it makes to our firm
IOT2	4.69	1.38	Our customer is always honest with us
IOT3	5.04	1.33	We believe the information that our customer provides us
IOT4	4.49	1.51	Our customer is genuinely concerned that our business succeeds
IOT5	4.10	1.63	When making important decision, our customer considers our welfare as well as its own
IOT6	4.21	1.62	We trust our customer keeps our best interests in mind
IOT7	4.72	1.35	Our customer is trustworthy
IOT8	3.99	1.59	It is not necessary to be cautious with our customer

Utilization

To what extent do you use CVN to:

Var	Mean	S.D.	Item Wording
UTL2	1.43	1.12	Use the Express Option
UTL3	1.44	1.05	Use the exception management feature
UTL4	1.56	1.42	Use the search function to manage workload planning
UTL5	1.31	0.96	Use the search function to prioritize the unloading process
UTL6	1.60	1.39	Use the suppliers scorecard to manage logistical performance

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