# Q-TAM: A quality technology acceptance model for predicting organizational buyers' continuance intentions for e-procurement services

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## ABSTRACT

This research provides important extensions to the Technology Acceptance Model (TAM) with system quality considerations (Q-TAM) in the context of e-procurement services. Utilizing data from organizational buyers and founding our expectations in the resource-based view, coupled with the dynamic capabilities perspective, we study the impact of information flow quality and logistics fulfillment quality on organizational buyers' perception of e-procurement services, and the ensuing intentions to continue using these services. As such, this study addresses user satisfaction as an attribute to understand organizational buyers' continuance intentions of e-procurement systems in a mandated usage setting. Furthermore, the mediating roles of individuals' perception in the relationship between system characteristics and satisfaction are investigated. We distinct our work with prior literature on e-procurement by focusing on organizational buyers' continued usage intentions, rather than investigating the e-procurement adoption issues at the firm level. Also, our research is positioned in a unique context since it investigates a system that is generally mandatory in nature. While a system may have been implemented successfully and its use may have been mandated, it may actually not be used to its fullest extent, leaving significant potential unrealized. Overall, with our theoretical development and the empirical test of Q-TAM, we provide important insights into organizational buyers' intentions to continue the use of e-procurement services.

## 1. Introduction

The use of e-procurement systems has gained importance due to its beneficial impact on individual- and organizational-level productivity and efficiency (Ramkumar et al., 2016; Vaidyanathan and Devaraj, 2008). As such, information systems (IS) and operations management (OM) researchers have investigated the implementation and adoption of e-procurement systems for the past decade (Ramkumar and Jenamani, 2012; Schoenherr and Tummala, 2007). However, most prior studies have focused on factors that examine users' *initial acceptance and adoption*, with only some studies exploring the long-term continuance of the adopted enterprise systems (Bhattacherjee, 2001). This is surprising, since the eventual success of a newly implemented enterprise information system is dependent on its continued usage, rather than the initial acceptance (it might very well be that after initial acceptance, the system is used infrequently or ineffectively, due to for example unfulfilled expectations). This was confirmed in personal communications of the authors with purchasing executives, who

revealed that while companies are oftentimes very successful in implementing e-procurement services, continued use by internal constituents is frequently disappointing. We therefore specifically tailor our research to investigate organizational buyers' *continuance intentions* for e-procurement systems.

In order to provide additional focus within this context, we concentrate on *e-procurement services*, which we define as online supply management solutions that are offered in a software-as-a-service (SaaS) environment. We focus on this type of e-procurement since it is becoming increasingly popular due to the scalability and flexibility of such hosted solutions (Ramkumar and Jenamani, 2012). Relying on tenets inherent in the resource-based view (RBV), coupled with the dynamic capabilities perspective, we theorize organizational buyers' perceived ease of use, perceived usefulness and perceived value of e-procurement services to influence their continuance intentions, extending research on the Technology Acceptance Model (TAM). Perceived ease of use refers to the belief of effortlessness being associated with the use of technology, and perceived usefulness is indicative of the

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subjective expectation that the technology will increase job performance. We extend these two central TAM variables by a third, taking into account the perceived value of e-procurement services, which is reflective of organizational buyers' perception of e-procurement services. Perceived value is the cognitive trade-off between perception of benefits and costs (Chekurov et al., 2018; Wang and Hazen, 2016).

In a mandatory environment, concentrating on organizational buyers' continuance intention of e-procurement may seem superfluous, since individuals usually have no choice beyond continuing to use these systems. However, organizational buyers' continuance intention of e-procurement depends on what "continuance", or for that matter "discontinuance", means in a mandated setting (Sørebø and Eikebrokk, 2008). In voluntary settings, continuance intentions simply refer to the users willingness or lack thereof to continue using the system (Bhattacherjee, 2001). However, within mandated settings, lack of user willingness does not necessarily lead to interrupted usage (Brown et al., 2002; Sørebø and Eikebrokk, 2008), but more likely to dissatisfaction with the e-procurement system and further underutilization, decreased productivity and/or inefficiency. As "using the system" in voluntary settings is related to "doing the job" in a mandated environment, organizational buyers' dissatisfaction with the e-procurement system may lead to absenteeism and turnover, manifestations that are often associated with job dissatisfaction (Bhattacherjee, 2001; Brown et al., 2002; Sørebø and Eikebrokk, 2008). As the antecedents behind the users' willingness to continue using the system are different in both voluntary and mandatory settings, we believe that organizational buyers' continuance intention of e-procurement is an important research issue in a mandatory environment.

Like other mandated settings, since organizational buyers must use the e-procurement system to perform their job functions with no choice in terms of stopping to use the system midway, we contend that "continuance intention" is not the appropriate dependent variable as far as our context is concerned. Instead, based on prior literature of users' continued usage intention of mandated technologies (Bhattacherjee, 2001; Sørebø and Eikebrokk, 2008), we believe that organizational buyers' 'satisfaction' with e-procurement systems is the appropriate dependent variable in this context, and thus develop our model accordingly.

We suggest that user-level determinants of buyers' satisfaction are influenced by the quality of the e-procurement services provided, which we position as resources under the RBV (Barney, 1991). This is consistent with prior studies, which positioned information systems as resources (Tarafdar and Gordon, 2007; Wade and Hulland, 2004). We specifically focus on the service's information flow quality (assessed by online information quality and order procedures, both relevant in the pre-order experience) and logistics fulfillment quality (assessed by fulfilled order accuracy and fulfilled order timeliness, both relevant in the post-order experience) (cf. Mentzer et al., 2001). It is reasonable to suggest that such aspects should serve as contributors to organizational buyers' perception of e-procurement services, thus functioning as a valuable resource for increasing such.

To our knowledge, there has been no published research that integrates the TAM framework with such system quality aspects, making this, coupled with the above-described relevance and importance of this setting, an area in need of further investigation. The importance is given by the likely impact of system quality on organizational buyers' perception of the system and the achieved performance. The objective of this article is therefore to evaluate an integrated quality technology acceptance model (Q-TAM) to *comprehend the organizational buyers' continued usage intentions of e-procurement services after adoption.* The theoretical development and empirical test of Q-TAM contributes to the supply chain, logistics, information systems and quality literature by highlighting the important role played by quality in driving the continued use of e-procurement services. Insights derived from this model will help top management to understand organizational buyers' continuance intentions of e-procurement services.

Within this setting, our contributions are three-fold. First, we focus on organizational buyers' *continuance intentions* for e-procurement services, which is quite different to initial implementation and adoption considerations that have frequently been studied. We further differentiate our research in that we investigate an environment where the system use is generally mandatory, adding a unique context to our investigation. These settings offer an intriguing frame to study continuance intentions, since while a system may have been implemented successfully and its use may have been mandated, it may actually not be used to its fullest extent (maybe also due to resentment based on the mandatory nature), leaving significant potential unrealized. Second, we scrutinize fundamental TAM constructs and theorize about their influence on organizational buyers' continuance intentions for e-procurement services, effectively applying an established model to the novel and increasingly popular context of e-procurement services. And third, we extent this framework with system quality dimensions, aiming to explicate how these influence organizational buyers' perceived ease of use, perceived usefulness and perceived value of e-procurement services. In addition, we test the mediating roles of the central perception constructs in the relationship between system quality characteristics and satisfaction. Overall, with our theoretical development and the empirical test of Q-TAM, we provide important insights into organizational buyers' intentions to continue the use of e-procurement services.

## 2. Literature review

E-procurement services are online supply management solutions offered in a SaaS environment. With the ability to significantly enhance transaction-processing capabilities, e-procurement services are implemented to replace manual procurement activities. Online ordering processes of e-procurement technologies encompass for example the submission of requests for quote, transmission of purchase orders to suppliers, and follow-ups on order status (Ramkumar 2016; Toktaş-Palut et al., 2014). Such hosted solutions have numerous advantages, especially when compared to stand-alone or owned software implemented on the company's servers (Concha et al., 2010; Guttman et al., 2005). As such, SaaS environments are easily scalable and offer a seamless integration with internal enterprise resource planning systems; software and data incompatibility issues are thus also of no concern. In addition, with suppliers interacting with the software hosted on the provider's servers, there is an additional layer of security shielding the company from any maleficence. Due to the SaaS nature, services can also be accessed from anywhere, also from mobile devices, enhancing the accessibility and dynamic decision-making capabilities for both buyer and supplier (Schoenherr, 2016).

Prior literature stressed the voluntary acceptance of technologies, where continued usage depends upon the users' willingness to do so. However, in most instances, a minimal use of these services is mandated, with advanced and more sophisticated use being voluntary (Kremers and Van Dissel, 2000). Within such a mandated environment, a lack of willingness to use the system does not necessarily lead to interrupted usage, but rather to dissatisfaction with the system and all the other negative consequences described above. Investigating users' continuance intentions (satisfaction) within such mandated environments is thus probably more important than in a voluntary environment due to the potential negative consequences in a mandated environment. Even though, prior research has investigated user acceptance in delegated environments (Adamson and Shine, 2003; Brown et al., 2002), as well as continued user acceptance in voluntary environments (Sun and Bhattacherjee, 2011), little effort has been made to examine *continued user acceptance of e-procurement services in mandated environments.*

Organizations adopt e-procurement systems due to the multitude of benefits offered by them, including better data management (e.g., spend analysis) and integration with other in-house systems, which in turn enables faster cycle time, enhanced tracking capabilities, improved error elimination, and higher quality purchasing decisions

(Gunasekaran and Ngai, 2008; Gunasekaran et al., 2009; Ramkumar and Jenamani 2012, 2015a; Toktaş-Palut et al., 2014). These organizational benefits are however only retained if organizational buyers continue to use these systems. Among a variety of models in the IS literature utilized to predict organizational users' acceptance, continuance and success of enterprise systems (Amoako-Gyampah and Salam, 2004), the TAM is one of the more widely applied ones (e.g., Davis et al., 1989).

With its roots in Ajzen and Fishbein's (1980) Theory of Reasoned Action for predicting technology acceptance and usage, TAM has been successful in predicting user-level acceptance and continuance. TAM has for instance been used in adoption studies of various enterprise technologies, including enterprise resource planning (Amoako-Gyampah and Salam, 2004), e-customer relationship management (Wu and Wu, 2005), e-procurement (Ramkumar and Jenamani, 2015b), and mobile devices and applications (Schoenherr, 2016). Additional information and communication technologies acceptance/continuance issues were covered within the context of e-banking (Adamson and Shine, 2003), e-government services (Carter and Bélanger, 2005), rural mobile telephony (Gupta and Jain, 2014), word processors (Jackson et al., 1997), the World Wide Web (Lederer et al., 2000), and the wireless internet (Lu et al., 2003). These studies have shown strong support for the soundness of TAM, inspiring us to apply this framework within our context.

Specifically, we follow this stream of research and extend TAM into Q-TAM, focusing on users' continuance intentions based on the system quality of e-procurement services. Quality dimensions characterizing a system are "salient features … that can help individuals develop favorable (or unfavorable) perceptions regarding the usefulness or ease of use of a system" (Venkatesh and Bala, 2008, p. 276). While the supply chain management literature stresses more on e-procurement adoption at firm level (Gunasekaran et al., 2009; Teo and Lai, 2009), there is a dearth of research that integrates the critical role of quality in determining organizational buyers' continuance intentions for e-procurement services (Vaidyanathan and Devaraj, 2008); research into this domain has thus been called for (Venkatesh and Bala, 2008).

Our model is theoretically grounded in the RBV (Barney, 1991), with both information flow quality and logistics fulfillment quality representing valuable resources emanating from an e-procurement system. These resources, we suggest, are able to effectuate perception and eventual continuance intention. The underlying tenet of the RBV is that resources – when they can be classified as valuable, rare, inimitable and non-substitutable – can serve as the foundation for firm benefits (Wernerfelt, 1984; Barney, 1991; Day, 1994). Early research employing the RBV concentrated on the heterogeneity of resources (e.g., Wernerfelt, 1984; Barney, 1991), with later work focusing on their configuration (e.g., Eisenhardt and Martin, 2000; Teece, 2007). Under this perspective, owning heterogeneous resources by itself may not be sufficient to enable differentiation; instead, the way these resources are developed, configured and exploited is likely to lead to significant advantages (Allred et al., 2011; Blome et al., 2013). The recognition of these dynamics led to the dynamic capabilities perspective (Teece, 2007). While the dimensions of information flow quality and logistics fulfillment quality in the present study may not be able to be classified as truly dynamic, they certainly can be considered as being reflective of resources under the RBV, enabling the eventual development of more dynamic capabilities. As such, they can be viewed as slow changing capabilities (cf. Mentzer et al., 2001; Tanskanen et al., 2015). Further, since e-procurement systems do not necessarily lead to advantages merely by themselves, but by their appropriate application, both information flow quality and logistics fulfillment quality can be regarded as reflections of such, thus substantiating our theoretical perspective.

Overall, favorable system characteristics, such as high online information quality, sound order procedures, high fulfilled order accuracy and high fulfilled order timeliness, can be regarded as contributors to organizational buyers' perception of e-procurement services. These benefits are achieved by the firm harnessing their technological system resources (via e-procurement services) to generate a value-creating procurement process, which is generally enhanced when switching to e-procurement systems (Vaidyanathan and Devaraj, 2008). This comports well with the RBV and its emphasis on the properties of valuable, rare, inimitable and non-substitutable. These characteristics can be prescribed to information flow quality and logistics fulfillment quality, as generated by e-procurement services, able to yield beneficial results (organizational buyers' perception of e-procurement services and the ensuing continuance intentions, in our context). Within this setting, system quality aspects can be regarded as resources enabling favorable outcomes.

## 3. Research model and hypotheses

Our research model explicating the continuance intentions for e-procurement services is founded in variables central to TAM (*Perceived Ease of Use, Perceived Usefulness*), complemented with the dimensions of *Perceived Value* and *Satisfaction*, all applied to the context of e-procurement services. We consider organizational buyers' satisfaction in using the e-procurement to be the most adequate construct for explaining 'continuance intentions' when the usage is mandated. We extend this base model by the consideration of *system quality* relating to characteristics in both pre- and post-order activities/experiences. Characteristics that may contribute to system quality in the pre-order stage include online information quality and the existence of robust order procedures, both elements of information flow quality. Characteristics in the post-order stage include fulfilled order accuracy and fulfilled order timeliness, both elements of logistics fulfillment quality. We suggest that these dimensions are crucial in determining organizational buyers' perception of e-procurement services and their ensuing satisfaction with the system. The overall research model is presented in Fig. 1.

### 3.1. The role of online information and order procedures

While relevant online information refers to useful data provided by suppliers on their products and services in the e-procurement system, favorable order procedures refer to the efficiency and effectiveness of the processes underlying e-procurement services (Bienstock et al., 1996; Mentzer et al., 2001). Both useful online information and facilitating order procedures can be considered as valuable properties emanating from the e-procurement system. In addition, since online information and order procedures do not necessarily have to be supporting organizational endeavors at all times, if they do, they can be considered as rare. Further, since they do not automatically emanate from any e-procurement system (the system must be implemented right and fit the organizational requirements), they can be considered as in-imitable. And lastly, it may be rather difficulty to replicate the same benefits with other approaches, rendering them non-substitutable. Therefore, both online information and order procedures, as enabled by an e-procurement system, can be regarded as critical resources under the RBV.

Specifically, for online information, past research has stressed that the quality of such information is more important than its quantity, and that good quality information can go a long way in enabling better decision making (Heikkilä, 2002). This can be accomplished for example via advanced search and comparison services offered by third party e-procurement service providers (Mentzer et al., 2001). With these features, coupled with the availability and adequacy of information provided via such e-procurement services (e.g., visibility into the location and the inventory of products), apt sourcing decisions can be easily taken by the buyer (Cash and Konsynski, 1985; Dai and Kauffman, 2002; Koch and Cebulla, 2002). Especially the adequacy of quality information can severely reduce the cost of co-ordination, data gathering, and analysis (Clark and Lee, 2000; Truman, 2000). We therefore position the availability and adequacy of online information
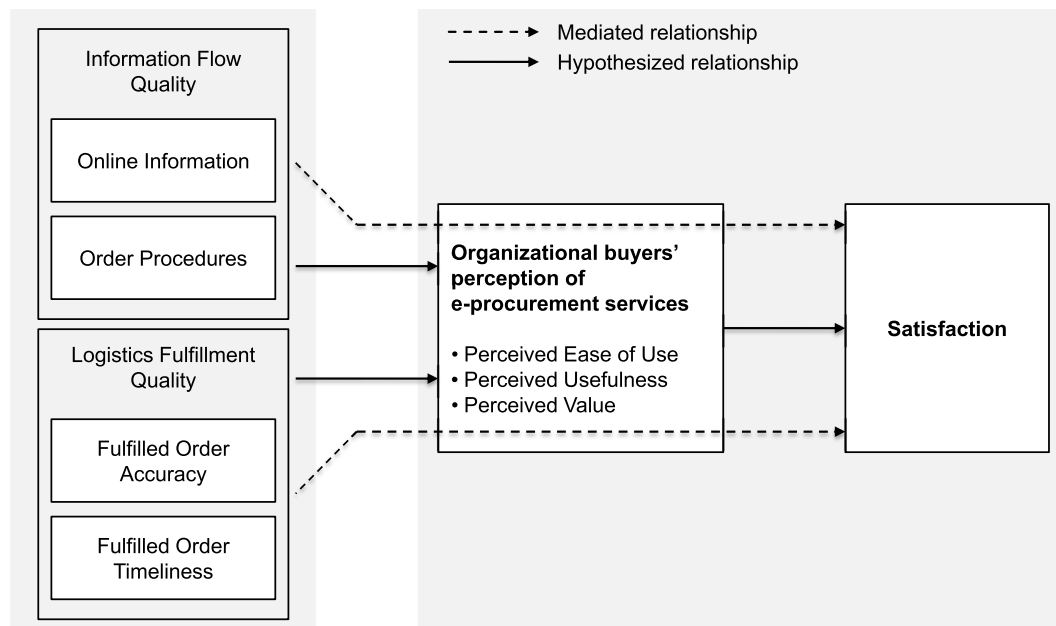
**Fig. 1.** Research model.

in the e-procurement system as critical system resources that should influence organizational buyers' perception of e-procurement services.

Furthermore, when information is available and adequate, as assessed by the buyer, she should be able to perceive the e-procurement services in a favorable light. Particularly due to the ready availability of sufficient information, this system capability should contribute to the perceived ease of use associated with e-procurement services. Along similar lines, online information quality should foster the perceived usefulness of e-procurement services among organizational buyers, based on the expectation that this easy-to-process, relevant information will be valuable in improving one's job performance. Further, the better the provided online information is to understand and put to use, the greater the perceived value emanating from these services. Based on these contemplations founded in TAM and the RBV, coupled with the dynamic capabilities perspective, we hypothesize the following:

**H1.** Online information quality is positively related to organizational buyers' (a) perceived ease of use, (b) perceived usefulness, and (c) perceived value of e-procurement services.

In order to realize the full competitive potential of implemented e-procurement systems, firms should organize their business processes efficiently and effectively (Barney and Wright, 1998). Following notions by Thirumalai and Sinha (2005), we suggest that having such sound order procedures are indicative of resources that should enhance organizational buyers' perception of e-procurement services. With such system properties, requisitioning is done in a streamlined fashion, without any unnecessary steps and approvals needed. This should foster the buyers' view of the e-procurement services, as evidenced in their perceived ease of use, perceived usefulness and perceived value.

Similar as above, we suggest that when online processes are efficient and effective, this can represent a resource that will yield a favorable perception of e-procurement services among organizational buyers. Sound and straightforward processes should thus facilitate the ease with which individual buyers are using the system. It should also increase the anticipated value from the services for their own benefit (i.e., their job performance), as assessed by perceived usefulness. In addition, greater value is expected to be associated with e-procurement services if the order procedures are solid and understandable; this will create confidence in the system. We therefore hypothesize the following:

**H2.** Robust order procedures are positively related to organizational

buyers' (a) perceived ease of use, (b) perceived usefulness, and (c) perceived value of e-procurement services.

### 3.2. The role of fulfilled order accuracy and fulfilled order timeliness

While fulfilled order accuracy refers to the shipment containing the specified items in the correct quantity and quality (Mentzer et al., 2001; Tokman et al., 2012), fulfilled order timeliness refers to the degree to which items are delivered on the promised date, the time elapsed between placing and receiving an order, and the lack (or short duration) of backorders (Mentzer et al., 2001; Tokman et al., 2012). We position both of these properties as important resources facilitating organizational buyers' everyday job, thus enhancing the perception of the e-procurement system that enables these capabilities. Similar as above, both fulfilled order accuracy and fulfilled order timeliness can be viewed as valuable properties that derive from the e-procurement system. Further, since the accomplishment of these is certainly not always a given, and since they do not automatically result from any e-procurement system, they can be considered as rare and in-imitable. Accomplishing great results on fulfilled order accuracy and fulfilled order timeliness may also not be able to be easily replicated via other means, they can be viewed as non-substitutable. As such, fulfilled order accuracy and fulfilled order timeliness can be considered as important resources under the RBV, with these system outcome characteristics enabling greater perception of the e-procurement system by organizational buyers.

Specifically, electronic fulfillment consists of the management of many integrated business processes, including order receipt, transaction management, warehouse management, transportation coordination, customer response management, and reverse logistics management (Vaidyanathan and Devaraj, 2008). Numerous mistakes can happen during these steps, so an integrated value system is needed for effective coordination and collaboration (Toktaş-Palut et al., 2014), heightening the importance for the assurance of fulfilled order accuracy. As such, "order accuracy is a dimension of quality at receipt" (Vaidyanathan and Devaraj, 2008, p. 415). We suggest that the greater the fulfilled order accuracy, the more favorable the organizational buyers' perception of e-procurement services, thus further speaking in favor of this property as a resource. Even though suppliers control the order accuracy as per the buyers' information, its impact on the buyers' perceived satisfaction is

critical (Vaidyanathan and Devaraj, 2008). Some of the key features of e-procurement as opposed to traditional purchasing practices are quicker and more accurate order processing, enhanced order tracking, better information management, and improved buyer satisfaction (Boyer and Hult, 2006). E-procurement is able to achieve these features through online catalog information and eradicate the ineffectiveness of traditional procurement practices (Vaidyanathan and Devaraj, 2008). If all of this works well (which is not a given), then fulfilled order accuracy can be considered a resources stemming from the e-procurement system. The prominence of e-procurement to order quality (accuracy) is that it augments value to the buyer and increases his/her perception towards the system. Order accuracy in turn creates loyal buyers.

Specifically, when fulfilled order accuracy is high, as assessed by the buyer, he or she should be able to perceive e-procurement services to be easier to use, primarily due to the associated system efficiencies. Again, this connection – while certainly intended – is not necessarily given, positioning fulfilled order accuracy as a resource enabled by the e-procurement system. Along similar lines, the organizational buyers' perceived usefulness should also improve, since enhanced fulfilled order accuracy can be a central determinant of the buyers' performance evaluation. In addition, greater fulfilled order accuracy should generate a greater perceived value of e-procurement services, due to the likely significant performance improvements visible when switching to e-procurement systems. Building on these foundations, we hypothesize the following:

**H3.** Fulfilled order accuracy is positively related to organizational buyers' (a) perceived ease of use, (b) perceived usefulness, and (c) perceived value of e-procurement services.

In addition, fulfilled order timeliness can be positioned as a resource emanating from the quality of e-procurement services (Daugherty and Pittman, 1995; Fleisch and Powell, 2001). E-procurement solutions offer enhanced integration based on refined processes, and ensure that all relevant parties are informed about activities pertinent to their actions. Thus, effective decision-making can ensue, which results in enhanced coordination, and, ultimately, fulfilled order timeliness. Since many businesses are competing on the dimension of time as it is prerequisite for just-in-time approaches, fulfilled order timeliness should be able to serve as a critical resource able to effectuate perceptions of quality. A reputation for timely deliveries is a key differentiator for suppliers (Vaidyanathan and Devaraj, 2008).

Linking fulfilled order timeliness to organizational buyers' perception of e-procurement services, we suggest that with greater performance on the timeliness dimension, the perceived ease of use, the perceived usefulness and the perceived value of e-procurement services among organizational buyers will increase as well. Specifically, fulfilled order timeliness can be positioned as a resource enabled by the e-procurement system, which thus should enhance the ease of use with which the system is perceived. This is especially the case when compared to traditional, manual or offline procedures. Due to system efficiencies, fulfillment order timeliness is likely to be improved, leading to greater perceived ease of use. Similarly, fulfilled order timeliness should increase the perceived usefulness of e-procurement services among organizational buyers, based on the likely greater job performance of organizational buyers (as evidenced by greater fulfilled order timeliness). Further, the greater the fulfilled order timeliness, the greater the perceived value emanating from these services. Based on these contemplations founded in RBV, coupled with the dynamic capabilities perspective, we hypothesize the following:

**H4.** Fulfilled order timeliness is positively related to organizational buyers' (a) perceived ease of use, (b) perceived usefulness, and (c) perceived value of e-procurement services.

### 3.3. Continuance intentions for e-procurement services

We assess organizational buyers' perception of e-procurement services by their perceived ease of use and perceived usefulness associated with e-procurement services, two variables central to TAM. The former is defined as the "degree to which an organizational buyer believes that using e-procurement would be free of effort" (Ramkumar and Jenamani, 2015b, p. 274), while the latter is defined as the "degree to which an organizational buyer believes that using e-procurement would enhance his or her job performance" (Ramkumar and Jenamani, 2015b, p. 274). In addition, we extend TAM by the consideration of the services' perceived value. While the TAM might consider an organization's strategy in technology adoption, it does not seem to take economic considerations into account (e.g., the perceived value of the technology). For instance, purchasing literature reveals that an individuals' willingness to buy is directly influenced by the perceived value of the product or service (Obal, 2013). Extending this to the technology adoption context, Chekurov et al. (2018) found that perceived value, a cognitive trade-off between perceptions of benefits and costs, directly impacts adoption rates. Parallels can be seen in the consumer behavior literature (Turel et al., 2010; Wang and Hazen, 2016). We therefore consider perceived ease of use, perceived usefulness, and perceived value as assessments of organizational buyers' perception of e-procurement services.

Relying on extant TAM research and theoretical rationales derived from the RBV, coupled with the dynamic capabilities perspective, we propose that perceived ease of use, perceived usefulness, and perceived value are positively related to organizational buyers' continuance intentions for e-procurement services. We extend prior TAM research in that we are considering a buyer's *continuance* intentions, and not his or her intentions to adopt the technology. The relevance is particularly given in our context of a mandated environment. We suggest that if e-procurement services are perceived to be easier to use, the users' intentions for their continued use should be greater. This makes sense, since if a system is intuitive and straightforward to use, it will likely be enjoyable to take advantage of it, and further use should ensue. Similarly, if the service is perceived to enhance one's job performance (reflected in perceived usefulness), this should serve as a motivating rationale for the continued use of the services. As such, extrinsic rewards serve as a primary motivator.

Within this context, this perceived ease of use and their usefulness of e-procurement systems can be positioned as resources, contributing to organizational buyers' satisfaction in continuing the e-procurement system. As such, both dimensions are clearly valuable, since they are likely facilitating the buyer's job. These system properties are however not automatic from any system implementation, thus they can be considered as rare. Further, designing the e-procurement system in such a way that these benefits emanate may not be easy, offering support for these system properties to be in-imitable. In addition, similar level of perceived ease of use and usefulness may not be accomplished via other means, rendering these system properties as non-substitutable. By extension, similar rationales apply for the overall perceived value of e-procurement services, which relates to overall firm-related performance enhancements. Based on these notions, we hypothesize the following:

**H5.** (a) Perceived ease of use, (b) perceived usefulness, and (c) perceived value of e-procurement services are positively related to organizational buyers' satisfaction in continuing the use of e-procurement services.

### 3.4. Mediation effects

Underlying the foregoing hypotheses is a sequence-of-effects pattern, which is indicative of the presence of mediating aspects. As such, we suggest that having adequate online information available, as well as having efficient and effective processes, is not sufficient to drive

**Table 1**
Construct operationalization.

| Latent Construct | Definition | Primary Sources |
|---|---|---|
| Online Information (OI) | Quality information that is available and adequate provided by suppliers | Vaidyanathan and Devaraj (2008) |
| Order Procedures (OP) | Order procedures from the buyers that are effective and efficient | Vaidyanathan and Devaraj (2008) |
| Fulfilled Order Accuracy (FOA) | Refers to how closely shipments from suppliers match buyers' order upon arrival | Vaidyanathan and Devaraj (2008) |
| Fulfilled Order Timeliness (FOT) | Refers to whether orders arrive at the buyer location when promised; timeliness also refers to the time length between order placement and receipt | Vaidyanathan and Devaraj (2008) |
| Perceived Ease of Use (PEOU) | Degree to which an organizational buyer believes that using e-procurement is effortless | Davis et al. (1989); Venkatesh and Bala (2008) |
| Perceived Usefulness (PU) | Degree to which an organizational buyer believes that using e-procurement enhances his/her individual performance | Davis et al. (1989); Venkatesh and Bala (2008) |
| Perceived Value (PV) | Degree to which the organizational buyer believes that using e-procurement enhances the impact on procurement performance like cost reduction, internal efficiency, managerial effectiveness and coordination | Teo and Lai (2009) |
| Satisfaction (SAT) | Users' affect with (feelings about) prior e-procurement use | Bhattacherjee (2001) |

organizational buyers' continued usage of e-procurement services. Rather, these system resources (availability of adequate information, and efficient and effective processes) need to be judged as beneficial by organizational buyers in order to generate a positive outcome, i.e. these resources need to be enhanced and their value needs to be recognized. This is the case with buyers perceiving e-procurement services to be easier to use, more useful, and more valuable. These properties are likely to be reflective of better decision-making capabilities generated for the buyers (Cash and Konsynski, 1985; Dai and Kauffman, 2002; Koch and Cebulla, 2002). For example, the adequacy of quality information can significantly enhance decision-making (Clark and Lee, 2000; Truman, 2000), which in turn can lead to effective buyer-supplier relationships. Once such positive impacts have been achieved via e-procurement services, continuance intentions can ensue. We therefore hypothesize the following:

**H6.** The organizational buyers' perception of e-procurement services [(a) perceived ease of use, (b) perceived usefulness, and (c) perceived value] mediates the influence of online information on the satisfaction of e-procurement services.

**H7.** The organizational buyers' perception of e-procurement services [(a) perceived ease of use, (b) perceived usefulness, and (c) perceived value] mediates the influence of order procedures on the satisfaction of e-procurement services.

Related arguments can be made for the mediating role of perceived ease of use, perceived usefulness, and perceived value, in the link between logistics fulfillment quality (fulfilled order accuracy and timeliness) and continuance intentions. While the mere presence of such system resources yielding greater fulfilled order accuracy and timeliness can certainly impact user satisfaction, we suggest that the impact is significantly mediated by organizational buyers' perception of e-procurement services. Specifically, only when these favorable system capabilities also generate personal performance benefits for organizational buyers, will their impact on user satisfaction be greatest. Therefore, we hypothesize the following:

**H8.** The organizational buyers' perception of e-procurement services [(a) perceived ease of use, (b) perceived usefulness, and (c) perceived value] mediates the influence of suppliers' fulfilled order accuracy on the satisfaction of e-procurement services.

**H9.** The organizational buyers' perception of e-procurement services [(a) perceived ease of use, (b) perceived usefulness, and (c) perceived value] mediates the influence of suppliers' fulfilled order timeliness on the satisfaction of e-procurement services.

## 4. Research method and data

Primary data to test our hypotheses were collected via an e-mail

survey of organizational buyers who are users of e-procurement services in their organizations (Ramkumar and Jenamani, 2015b). The questions were developed based on the research model as shown in Fig. 1, with all items being adapted from extant literature; this contributed to the validity and reliability of the measurement model. In addition, we followed a multistep procedure to obtain professional reviews of the survey instrument (which included the specific instructions given to respondents, item wordings, and constructs). First, four faculty members with extensive experience in survey questionnaire development scrutinized and improved the survey instrument. In the next stage, four industry experts in the procurement domain inspected the document and provided further comments to enhance the clarity of the questions and instructions. Finally, a total of 30 managers, including purchasing and materials managers, participated in a pilot survey. At each stage, we used the feedback gathered to revise and improve the questionnaire. We thus feel that the questionnaire is sound and able to tap into the domain investigated well.

Final measurement items for each construct in the model are based on a 7-point Likert scale. Table 1 presents the constructs and the primary sources of the measurement items, with Table A1 providing the full questionnaire. All constructs were measured reflectively.

We developed a targeted sampling frame with the objective to tap into organizational buyers' continuance intentions for e-procurement services. Specifically, we obtained a list of companies from the "Directory of Top 1000 Corporate Companies of India 2013–14", published by the Delhi Information Bureau. A random set of 650 chief executive officers was selected, to which the questionnaire was sent. If they were the most informed person about mandated e-procurement services in their organization, they were requested to complete the survey. Alternatively, they were requested to redirect the questionnaire to the most informed individual responsible for e-procurement in their organization.

In order to ensure the representativeness of the sample for our analysis, screening questions were included to ensure that the respondent organization had initiated and adopted an e-procurement system, and that this system was offered by a third party in a SaaS environment (as opposed to an in-house development). Only if respondents met these criteria, they were allowed to proceed in the survey; potential respondents that were screened out included for instance those that used e-procurement systems that were built in house. This approach of controlling for the type of e-procurement system adopted by the buyer organization is in line with prior work on technology assimilation (Basole and Nowak, 2016).

Out of the 650 e-mails sent out, a total of 77 e-mails were returned as undeliverable. From the remaining 573 individuals we received a total of 84 responses in a first wave, and an additional 69 responses in a second wave. We eliminated a total of 21 responses due to missing data, yielding a total of 132 qualified and useable responses. This represents an effective response rate of 23%, which is comparable to response

**Table 2**
Sample characteristics.

| Categories | *n* | Percent |
|---|---|---|
| Industry type | | |
| Manufacturing sector | 77 | 58.3 |
| Service sector | 55 | 41.6 |
| Ownership | | |
| Private | 42 | 31.8 |
| Public | 52 | 39.4 |
| Multi national | 38 | 28.8 |
| Number of employees | | |
| < 1000 | 2 | 1.5 |
| 1000–5000 | 22 | 16.7 |
| 5000–10000 | 59 | 44.7 |
| More than 10000 | 49 | 37.1 |
| Respondent titles | | |
| Director/vice president (operations/IT) | 23 | 17.4 |
| General manager (logistics/supply chain/operations/IT) | 32 | 24.2 |
| Purchasing/procurement manager | 17 | 12.9 |
| Logistics/supply chain manager | 15 | 11.4 |
| Materials manager | 14 | 10.6 |
| IT manager | 12 | 9.1 |
| Corporate buyer/senior buyer/other buyer variants | 19 | 14.4 |
| Total | 132 | 100.00 |

**Table 3**
Measurement quality indicators.

| Construct | Indicator | Loading | T-Statistic | Cronbach Alpha | Composite Reliability | AVE |
|---|---|---|---|---|---|---|
| FOA | FOA1 | 0.873* | 29.764 | 0.833 | 0.900 | 0.750 |
| | FOA2 | 0.848* | 31.179 | | | |
| | FOA3 | 0.877* | 33.316 | | | |
| FOT | FOT1 | 0.893* | 35.456 | 0.829 | 0.898 | 0.746 |
| | FOT2 | 0.849* | 28.325 | | | |
| | FOT3 | 0.848* | 25.890 | | | |
| OI | OI1 | 0.883* | 34.016 | 0.748 | 0.888 | 0.798 |
| | OI2 | 0.903* | 53.961 | | | |
| OP | OP1 | 0.896* | 39.033 | 0.798 | 0.907 | 0.831 |
| | OP2 | 0.926* | 74.662 | | | |
| PEOU | PEOU1 | 0.894* | 33.712 | 0.816 | 0.891 | 0.732 |
| | PEOU2 | 0.821* | 25.053 | | | |
| | PEOU3 | 0.850* | 27.134 | | | |
| PU | PU1 | 0.865* | 27.873 | 0.816 | 0.890 | 0.731 |
| | PU2 | 0.864* | 31.923 | | | |
| | PU3 | 0.835* | 26.205 | | | |
| PV | PV1 | 0.879* | 42.116 | 0.855 | 0.902 | 0.698 |
| | PV2 | 0.809* | 24.596 | | | |
| | PV3 | 0.841* | 23.196 | | | |
| | PV4 | 0.810* | 27.394 | | | |
| SAT | SAT1 | 0.721* | 12.652 | 0.673 | 0.802 | 0.504 |
| | SAT2 | 0.675* | 9.084 | | | |
| | SAT3 | 0.742* | 13.340 | | | |
| | SAT4 | 0.699* | 13.154 | | | |

*Note*: AVE = Average Variance Extracted; *\*p* < 0.01.

rates reported in other survey studies of similar type and scale. Table 2 presents the sample demographic characteristics. Our respondents include directors/vice presidents (17.4%), general managers (24.2%), purchasing/procurement managers (12.9%), logistics/supply chain managers (11.4%), materials managers (10.6%), information technology managers (9.1%) and corporate buyers or other buyer variants (14.4%) from purchasing/procurement, materials, and supply chain departments. The average age of our respondents was 36, with 77% of them being male. Overall, 86% of the respondents reported having used e-procurement services for more than 1 year, and a total of 78% reported using e-procurement services for more than 5 h per week. Especially this characteristic is indicative of the sample being representative for our analysis. Respondents were well distributed across industry groups (manufacturing: 58.3%; services: 41.66%) and ownership types (private: 31.82%; public: 39.39%; joint venture/multinational: 28.79%). Most of the organizations (44.7%) had a workforce of between 5000 and 10000 employees.

The sample data characteristics were found to be normally-distributed and the number of missing values was very low (less than 5%). We assessed nonresponse bias using Chi-Square and t-tests, which however yielded only non-significant differences in terms of demographic information between early and late respondents. In addition, since this test of nonresponse bias has been criticized (Kumar et al., 2018), we compared the organizational size of the responding firms with non-respondents using Chi-Square and t-tests (Wagner and Kemmerling, 2010), which yielded non-significant differences between the two. This suggests that non-response bias is not of serious concern.

## 5. Data analysis and results

We used SmartPLS 3.0 (Ringle et al., 2015), which is a partial least square based structural equation modeling (PLS-SEM) package that uses a component-based approach for estimation purposes. This approach is useful for complex models with small sample sizes (given in our case), and employs less strict distributional assumptions for data analysis (Chin, 2010; Hair et al., 2018; Sarstedt et al., 2017). In exploratory conditions, where theory is less established (also given in our case), PLS-SEM is used to develop theories rather than to confirm or to reject theories, and has become a widely accepted multivariate analysis approach (Richter et al., 2016; Rigdon, 2016; Sarstedt et al., 2017). What makes the method particularly appealing is that improvements and methodological advances are constantly being developed (Richter et al.,

2016), some of which we have also implemented in this article. PLS-SEM has successfully been applied in recent supply chain research (e.g., Agarwal et al., 2018; Katiyar et al., 2018; Wagner et al., 2018).

### 5.1. Measurement model evaluation

Content validity of our constructs was ensured by adapting previously validated and published measurement items, followed by an item-by-item review by experts (Straub et al., 2004). Construct validity was assessed by testing for convergent validity and discriminant validity (see Tables 2 and 3). Specifically, we examined convergent validity based on three criteria: (1) construct reliabilities should exceed 0.7, (2) values for the Average Variance Extracted (AVE) should exceed 0.5, and (3) all indicator factor loadings should be significant and exceed 0.5. As it can be seen from Table 3, all construct reliabilities exceeded 0.7 except SAT2 (0.675) and SAT4 (0.699), AVE values are above the recommended value of 0.50, and all item loadings for each reflective construct are statistically significant at $p < 0.01$ ($t > 2.576$) and greater than 0.5, indicating good convergent validity (Gupta and Jain, 2014). Discriminant validity was confirmed by the heterotrait-monotrait (HTMT) ratio of the correlations being less than 0.85 (Henseler et al., 2015) (Table 4), and by each item loading much higher on its assigned construct than on the other constructs. Variance inflation factors were all less than ten, indicating the absence of multicollinearity (Hair et al., 2011).

We aimed to reduce common method variance by ensuring confidentiality to the respondents, emphasizing that there are no right or

**Table 4**
Heterotrait-monotrait ratio of correlations (Discriminant Validity).

| Constructs | FOA | FOT | OI | OP | PEOU | PU | PV |
|---|---|---|---|---|---|---|---|
| FOT | 0.535 | | | | | | |
| OI | 0.584 | 0.485 | | | | | |
| OP | 0.523 | 0.540 | 0.629 | | | | |
| PEOU | 0.433 | 0.461 | 0.596 | 0.671 | | | |
| PU | 0.672 | 0.683 | 0.661 | 0.632 | 0.566 | | |
| PV | 0.698 | 0.717 | 0.638 | 0.702 | 0.565 | 0.688 | |
| SAT | 0.622 | 0.601 | 0.680 | 0.680 | 0.596 | 0.811 | 0.796 |

wrong answers, requesting that each question be answered as honestly as possible, and providing no incentive for participating in the study. In addition, we conducted two *post-hoc* tests: (1) the Harman's single factor test (Harman, 1976; Podsakoff et al., 2003), and (2) Liang et al. (2007) common method bias test for PLS-SEM. The factor analysis as part of Harman's single factor test indicates the existence of eight factors, with the first factor accounting for only 26% of the variance, suggesting that common method variance is not a serious concern. Liang et al. (2007) test confirmed this assessment, showing that the substantive variances by the indicators (0.838) are significantly larger than the average method-based variances (0.631). Given the small magnitude of the method variance, we contend that common method variance is unlikely to be of serious concern.

### 5.2. Hypothesis testing

The sample size was deemed as sufficient in our case, since it is greater than ten times the largest number of structural paths arrowed towards a specific construct in the structural model (Hair et al., 2017), and since a *post-hoc* power analysis (Gupta and Jain, 2014) yielded the power of the parameters to be above 0.80. The majority of the path coefficients were greater than 0.1, suggesting that the model adequately fits the data (Chin, 2010). Fig. 2 presents the estimates obtained from the PLS-SEM analysis, with the results also summarized in Table 5. The $R^2$ of 0.481 indicates that the model explains a significant amount of variance for organizational buyers' satisfaction in continuing e-pro-curement services, especially when compared to studies with similar dependent variables (e.g., Hsieh and Wang, 2007; Sun and Bhattacherjee, 2011). The $R^2$ for the extended TAM constructs are in a reasonable range (perceived ease of use: 36%; perceived usefulness: 50%; perceived value: 57%). Bootstrapping with 5000 replication samples and the percentile approach were run to test the statistical significance of the path coefficients. Overall, the structural model demonstrates a good fit to the underlying structure in the dataset.

**Table 5**
Results of the structural model.

| Hypotheses | | Coefficient | T-Statistic | $p$ | Coefficient at 95% Confidence Intervals | |
|---|---|---|---|---|---|---|
| | | | | | 5% | 95% |
| H1a | OI → PEOU | 0.221 | 2.213 | ** | 0.052 | 0.381 |
| H1b | OI → PU | 0.196 | 2.522 | ** | 0.069 | 0.319 |
| H1c | OI → PV | 0.141 | 1.961 | ** | 0.018 | 0.262 |
| H2a | OP → PEOU | 0.368 | 4.104 | *** | 0.221 | 0.511 |
| H2b | OP → PU | 0.179 | 1.965 | ** | 0.034 | 0.324 |
| H2c | OP → PV | 0.255 | 3.402 | *** | 0.135 | 0.374 |
| H3a | FOA → PEOU | 0.048 | 0.514 | n.s. | −0.101 | 0.211 |
| H3b | FOA → PU | 0.257 | 2.634 | *** | 0.093 | 0.414 |
| H3c | FOA → PV | 0.272 | 3.14 | *** | 0.129 | 0.416 |
| H4a | FOT → PEOU | 0.111 | 1.33 | n.s. | −0.026 | 0.246 |
| H4b | FOT → PU | 0.297 | 3.543 | *** | 0.157 | 0.433 |
| H4c | FOT → PV | 0.318 | 4.251 | *** | 0.201 | 0.442 |
| H5a | PEOU → SAT | 0.115 | 1.634 | n.s. | −0.068 | 0.218 |
| H5b | PU → SAT | 0.350 | 3.387 | *** | 0.125 | 0.515 |
| H5c | PV → SAT | 0.347 | 3.430 | *** | 0.091 | 0.461 |

$^{***}p < 0.01$, $^{**}p < 0.05$, n.s. (not significant).

### 5.2.1. Direct effects

The results indicate that information flow quality aspects of e-procurement services are important antecedents to organizational buyers' perception of e-procurement services. As expected, the relationships between online information and perceived ease of use (H1a) ($\beta = 0.221$, $p < 0.05$), between online information and perceived usefulness (H1b) ($\beta = 0.196$, $p < 0.05$), and between online information
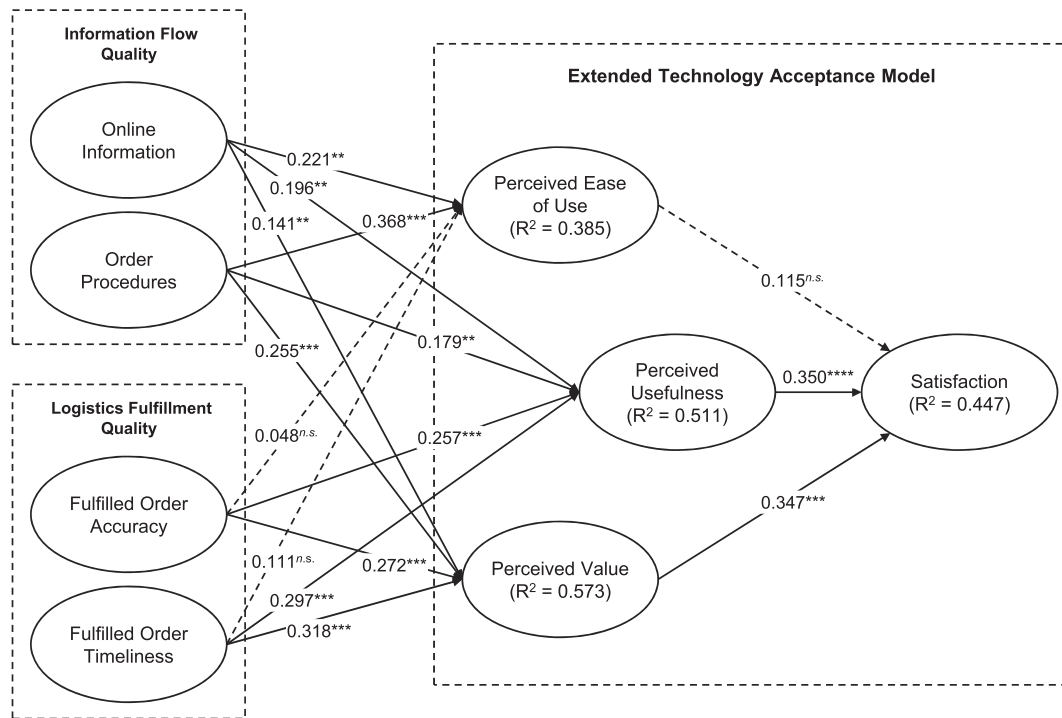


**Fig. 2.** Results of the Partial Least Square Analysis. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$, $^{n.s.}$ not significant.

and perceived value (H1c) ($\beta$ = 0.141, $p < 0.05$), are all supported. Sound order procedures have a similar effect: the link between order procedures and perceived ease of use (H2a) ($\beta$ = 0.368, $p < 0.01$), between order procedures and perceived usefulness (H2b) ($\beta$ = 0.179, $p < 0.05$), and between order procedures and perceived value (H2c), ($\beta$ = 0.255, $p < 0.01$), are all statistically significant. These results confirm that information flow quality (as assessed by online information and online procedures) has a significant impact on organizational buyers' perception of e-procurement services.

The results indicate that logistics fulfillment quality aspects of e-procurement systems are also important antecedents to organizational buyers' perception of e-procurement services. As hypothesized, the link between fulfilled order accuracy and perceived usefulness (H3b) ($\beta$ = 0.257, $p < 0.01$), and between fulfilled order accuracy and perceived value (H3c) ($\beta$ = 0.272, $p < 0.01$), are significant. However, the link between fulfilled order accuracy and perceived ease of use was non-significant ($\beta$ = 0.048, $p > 0.05$), failing to support H3a. Similarly, fulfilled order timeliness is significantly associated with perceived usefulness (H4b) ($\beta$ = 0.297, $p < 0.01$), and perceived value (H4c) ($\beta$ = 0.318, $p < 0.01$), but not with perceived ease of use (H4a) ($\beta$ = 0.111, $p > 0.05$). Overall, logistics fulfillment quality seems to be impacting perceived usefulness and perceived value, but not perceived ease of use.

The model further suggests a strong association of both perceived usefulness and perceived value with organizational buyers' continuance intentions of e-procurement services. This confirms both H5b ($\beta$ = 0.350, $p < 0.01$), and H5c ($\beta$ = 0.347, $p < 0.01$). However, the relationship between perceived ease of use and continuance intentions of e-procurement services (H5a) failed to be supported ($\beta$ = 0.115, $p > 0.05$).

Overall, the high $R^2$ (0.481) for the primary dependent variable (continuance intentions) indicated strong explanatory power of the model. Indeed, only 3 out of 15 hypotheses are not supported by the data, and most of the core hypotheses are strongly supported at the $p < 0.01$ level. This demonstrates the overall good fit of the structural model to the data.

### 5.2.2. Mediating effects

We followed the bootstrapping method proposed by Preacher and Hayes (2008) for mediation tests (cf. Nitzl et al., 2016). The mediation hypotheses are supported if the following conditions are satisfied (cf. Hair et al., 2017, p. 223): (1) the direct effect, without including the mediator variable in the PLS path model, is significant; (2) the indirect effect, when including the mediator variable in the PLS path model, is significant; and (3) the variance accounted for (VAF) is greater than 60% in the case of full mediation, and greater or equal to 20% in the case of partial mediation. If VAF < 20%, there is no mediation. VAF represents the ratio of the indirect-to-total effect (Nitzl et al., 2016).

As can be seen in Table 6, all four path coefficients are significantly related to satisfaction, in the absence of the mediators, fulfilling the first condition. Table 7 reports the results for the second condition, with the indirect effect size being determined by multiplying the direct effect of the independent variable on the mediator with the direct effect of the mediator on the dependent variable. The standard deviation of these computed indirect effect sizes across the subsamples is also provided in

**Table 6**
Significance analysis of path coefficients without mediator.

| Path | Path Coefficient | T-Statistic |
| --- | --- | --- |
| OI → SAT | 0.212** | 2.319 |
| OP → SAT | 0.235*** | 2.651 |
| FOA → SAT | 0.188* | 1.946 |
| FOT → SAT | 0.185** | 2.188 |

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 7. The empirical t value of the indirect effect was determined by dividing the original value with the bootstrapping standard error. As part of the third step, we need to determine the strength of the mediation via the VAF, which equals the indirect effect divided by the total effect, information on which is also presented in Table 7. Of note is that perceived ease of use does not seem to be function as a mediator, leaving H6a, H7a, H8a and H9a unsupported. Given the substantial literature support on employee acceptance of complex enterprise information systems and inter-organizational systems (Amoako-Gyampah and Salam, 2004; Sun and Bhattacherjee, 2011), we suspect that this insignificant effect may be attributed to the mandatory nature of e-procurement systems within the context considered (due to the significant costs involved in implementing the systems).

### 5.2.3. Post-hoc analysis

To explore the stability of the findings and to better understand the mechanisms inherent in our model, we conducted a number of *post-hoc* analyses. First, we constructed an alternate model in which (1) perceived ease of use is linked to perceived usefulness, (2) perceived ease of use is linked to perceived value, and (3) perceived usefulness is linked to perceived value. The results of this alternative model indicate that these links are not statistically significant (see Fig. 3). In addition, the links from (1) online information to perceived value and (2) order procedures to perceived ease of use are not statistically significant. In addition, there is no change in the $R^2$ value of SAT.

We also compared the modified model (Fig. 3) with the original model in terms of $R^2$ change for the final four dependent variables – perceived ease of use, perceived usefulness, perceived value, and continuance intention. For the $R^2$ comparison, we used Cohen's $f^2$ for calculating effect size as

$$f^2 = (R^2_{included} - R^2_{excluded})/(1 - R^2_{included})$$

The value of $f^2$ captures whether the impact of a particular independent construct on a dependent construct is substantive. For the modified model, No change in $R^2$ was observed for perceived ease of use, for perceived usefulness it increased from 0.504 to 0.512 ($f^2$ = 0.016), and for perceived value it increased from 0.573 to 0.580 ($f^2$ = 0.016). No change in $R^2$ was observed for continuance intentions.

Second, we constructed an alternate model with links from control variables, such as gender, job profile, ownership, organizational size (operationalized as number of employees), and industry type, to the organizational buyers' continuance intentions for e-procurement services. In this modified model, the $R^2$ value for continuance intentions increased from 0.481 to 0.496 ($f^2$ = 0.028). Overall, the $f^2$ value results suggest that the two modified models tested in this *post-hoc* analysis do not have significantly better predictive power compared to the original model.

In addition, in assessing the predictive accuracy ($R^2$) of the model, researchers should also evaluate the capacity of the model to predict manifest variables by using Stone-Geisser's $Q^2$ test (Hair et al., 2017). The blindfold test with omission distance equaling to 7 showed that $Q^2$ values generated via the cross-validated redundancy approach were all greater than zero (Perceived Ease of Use: 0.246, Perceived Usefulness: 0.352, Perceived Value: 0.387, and Satisfaction: 0.208). Positive $Q^2$ values, as provided in our case, establish the predictive relevance of our model. We also compared the modified model (Fig. 3) with the original model in terms of $Q^2$ change for the final four dependent variables – perceived ease of use, perceived usefulness, perceived value, and continuance intention. For the $Q^2$ comparison, we used $q^2$ for calculating the effect size as

$$q^2 = (Q^2_{included} - Q^2_{excluded})/(1 - Q^2_{included})$$

For the modified model, no change in $Q^2$ was observed for perceived ease of use and for continuance intention. For perceived usefulness the

**Table 7**
Results of the mediation effects.

| Hypotheses | | Indirect Effect Size | S.D. of Indirect Effect | Empirical t-value | VAF | Result |
|---|---|---|---|---|---|---|
| H6a | OI → **PEOU** →SAT | 0.026 | 0.022 | 1.181 | N/A | No Mediation |
| H6b | OI → **PU** → SAT | 0.068 | 0.034 | 2.000** | 0.414 | Partial Mediation |
| H6c | OI → **PV** → SAT | 0.049 | 0.025 | 1.960** | 0.337 | Partial Mediation |
| H7a | OP → **PEOU** → SAT | 0.043 | 0.031 | 1.387 | N/A | No Mediation |
| H7b | OP → **PU** → SAT | 0.063 | 0.037 | 1.702* | 0.456 | Partial Mediation |
| H7c | OP → **PV** → SAT | 0.088 | 0.039 | 2.256** | 0.539 | Partial Mediation |
| H8a | FOA → **PEOU** → SAT | 0.005 | 0.014 | 0.357 | N/A | No Mediation |
| H8b | FOA → **PU** → SAT | 0.097 | 0.040 | 2.425** | 0.782 | Full Mediation |
| H8c | FOA → **PV** → SAT | 0.094 | 0.038 | 2.473** | 0.796 | Full Mediation |
| H9a | FOT → **PEOU** → SAT | 0.013 | 0.014 | 0.928 | N/A | No Mediation |
| H9b | FOT → **PU** → SAT | 0.104 | 0.040 | 2.600*** | 0.961 | Full Mediation |
| H9c | FOT → **PV** → SAT | 0.110 | 0.041 | 2.682*** | 0.963 | Full Mediation |

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

$Q^2$ value increased from 0.352 to 0.354 ($q^2 = 0.003$), and for perceived value it increased from 0.387 to 0.391 ($q^2 = 0.006$). Overall, the $f^2$ value results suggest that the modified model tested in this *post-hoc* analysis does not have significantly better predictive relevance compared to that of the original model.

In addition to assessing the predictive relevance of the model using the Stone-Geisser's $Q^2$ test, it is also recommended to use the PLSpredict procedure as a robustness test (Shmueli et al., 2016). The method uses training and holdout samples to generate and evaluate predictions from PLS path model estimations. The PLSpredict $Q^2$ values were all greater than zero (Perceived Ease of Use: 0.214, Perceived Usefulness: 0.497, Perceived Value: 0.548, and Satisfaction: 0.423), indicating that our model has the desired predictive relevance.

Third, to provide further insight into the model, we computed the total effect of the exogenous variables on the endogenous variables in the model (Table 8). This offers yet another perspective to scrutinize the effect of the individual constructs on the focal variable of interest. For example, we can see that the constructs that are most influential in effectuating satisfaction are perceived value ($\beta = 0.347$), perceived usefulness ($\beta = 0.350$), fulfilled order timeliness ($\beta = 0.228$), fulfilled order accuracy ($\beta = 0.191$), order procedures ($\beta = 0.198$), and online information ($\beta = 0.145$). Similarly, the results presented in Table 8 suggest that our information flow quality constructs (OI and OP) have a significant influence on perceived ease of use of e-procurement services, while the logistics flow quality constructs (FOA and FOT) do not have a significant influence. Also, both information flow quality and logistics fulfillment quality constructs have a significant influence on perceived usefulness and the perceived value of e-procurement services.
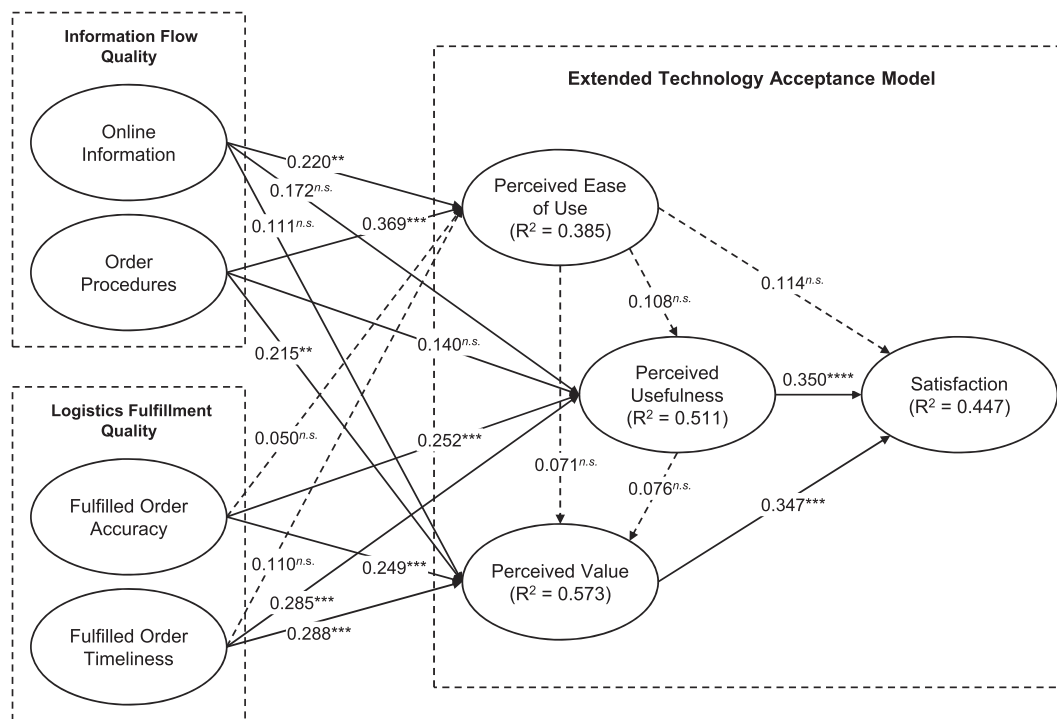


***$p < 0.01$, **$p < 0.05$, *$p < 0.1$, *n.s.* not significant

**Fig. 3.** Results of the Partial Least Square Analysis for Post-Hoc Model 1. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$, *n.s.* not significant.

**Table 8**
Total effect of constructs on endogenous variables.

| Path | Coefficient | T-Statistic | P |
|------|-------------|-------------|---|
| *Satisfaction (SAT)* | | | |
| PEOU → SAT | 0.080 | 0.932 | *n.s.* |
| PU → SAT | 0.303 | 2.582 | *** |
| PV → SAT | 0.291 | 2.591 | *** |
| OI → SAT | 0.214 | 2.474 | ** |
| OP → SAT | 0.233 | 2.738 | *** |
| FOA → SAT | 0.185 | 1.891 | * |
| FOT → SAT | 0.188 | 2.171 | ** |
| *Perceived Ease of use (PEOU)* | | | |
| OI → PEOU | 0.221 | 2.213 | ** |
| OP → PEOU | 0.368 | 4.104 | *** |
| FOA → PEOU | 0.048 | 0.514 | *n.s.* |
| FOT → PEOU | 0.111 | 1.331 | *n.s.* |
| *Perceived Usefulness (PU)* | | | |
| OP → PU | 0.179 | 1.965 | ** |
| OI → PU | 0.196 | 2.522 | ** |
| FOA → PU | 0.257 | 2.634 | *** |
| FOT → PU | 0.297 | 3.543 | *** |
| *Perceived Value (PV)* | | | |
| OI → PV | 0.141 | 1.964 | ** |
| OP → PV | 0.255 | 3.402 | *** |
| FOA → PV | 0.257 | 2.634 | *** |
| FOT → PV | 0.318 | 4.251 | *** |

$***p < 0.01$, $**p < 0.05$, $*p < 0.1$, *n.s.* (not significant).

And fourth, additional insight was provided by the Importance-Performance Matrix Analysis (IPMA), which extends the findings derived from PLS-SEM by taking the performance of each construct into account. As a result, the prioritization of managerial action becomes easier by the identification of constructs with high importance that however have at the same time relatively low performance (Hock et al., 2010). Nowadays, IPMA is becoming more popular so as to extend the conclusions derived from PLS-SEM analysis (Hair et al., 2017; Ringle and Sarstedt, 2016).

Fig. 4 and Fig. 5 present the results derived from IPMA at the construct level and at the indicator level. As shown in Fig. 4, the IPMA of satisfaction (SAT) reveals that the perceived usefulness of e-procurement systems usage is of primary importance in establishing

organizational buyers' satisfaction in use of e-procurement systems. Nevertheless, its performance is marginally underneath to the OI, FOT and PEOU constructs. PV is of related importance, but has a considerable higher performance than that of PU. Accordingly, the managerial activities should focus on the value of e-procurement so as to improve the buyers' satisfaction in continuing its usage.

Among the indirect predecessors of SAT (i.e., OI, OP, FOA and FOT), the FOT has its highest impact on satisfaction, while showing high performance compared to other constructs, followed by FOA. Fig. 5 denotes the importance and performance of organizational buyers' satisfaction in continuing the use of e-procurement systems at the indicator level. Management action should also focus on increasing the performance of the FOT and FOA constructs.

## 6. Discussion

This study confirmed information flow quality (OI and OP) to be influential in determining organizational buyers' perception of e-procurement services (PEOU, PU and PV) and ensuing satisfaction, confirming our positioning of these dimensions as critical resources to obtain the intended effect. However, logistics fulfillment quality (FOA and FOT) was only able to influence PU and PV, as part of the organizational buyers' perception of e-procurement services. Although the other four relationships are supported as expected, the relationship between FOA and PEOU, and the relationship between FOT and PEOU, are not statistically significant. In fact, the magnitude of the coefficient in FOA→PEOU (0.048) is very small relative to the coefficient in FOA→PU (0.257) and FOA→PV (0.272). In addition, the magnitude of the coefficient in FOT→PEOU (0.111) is also very small relative to the coefficients in FOT→PU (0.297) and FOT→PV (0.318). This non-significant finding relating FOA and FOT to PEOU may be due to the fact that, unlike order procedures and online information (both part of information flow quality), logistics fulfillment quality of e-procurement services indeed has no role in contributing to organizational buyers' perception of e-procurement services. Related research may be suggestive of such conclusion (Vaidyanathan and Devaraj, 2008). After all, favorable system resources (logistics fulfillment quality) may have nothing to do with how the system is perceived in terms of its ease of use. As such, while this resource can still serve as such under the RBV, it may just not be as effective for the noted links in our context. In
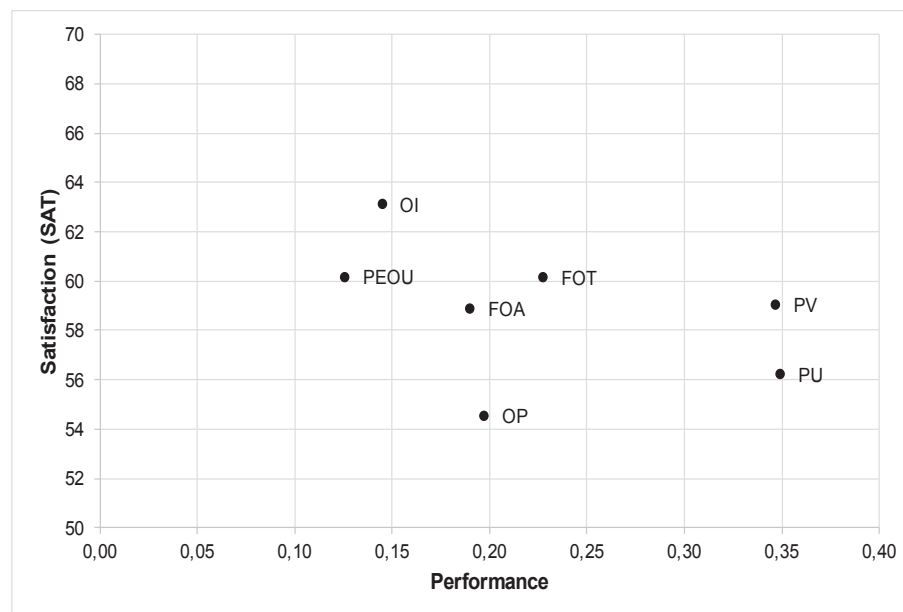


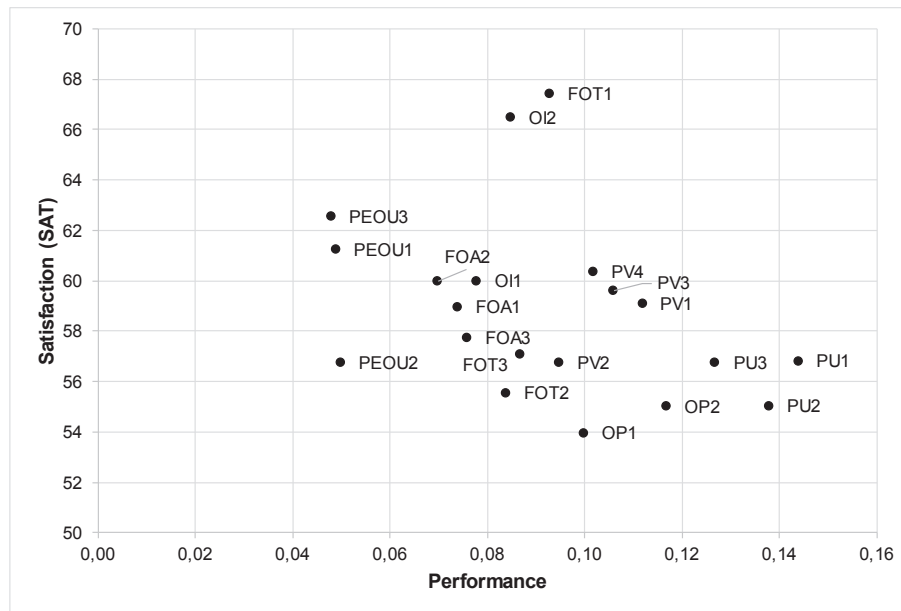**Fig. 4.** IPMA of Satisfaction (at construct level).

**Fig. 5.** IPMA of Satisfaction (at indicator level).

addition, even though logistics fulfillment quality can be very low, this should not necessarily imply that the perceived ease of use is low as well – there could be other contributing factors for why logistics fulfillment quality is low, with perceived ease of use still being quite high. The inclusion of PEOU and its link to FOA and FOT in our conceptual model may thus have been ill-informed, at least as suggested by our data. Future research is encouraged to bring further insight into this unexpected finding.

Nevertheless, our results reveals that perceived usefulness and perceived value have a significant effect on organizational buyers' satisfaction, confirming their functioning as a resource under the RBV. Surprisingly, and similar as above, we found that there is no effect of PEOU on SAT of e-procurement services. Our unique context of a mandated environment may have contributed to this result. While this does not take away from the positioning of perceived usefulness and perceived value as resources per se, it offers a finer grained picture in that these resources are only able to effectuate select outcomes, given the context in which our study was based.

Finally, the non-significance of the mediation effect of PEOU in the relationship between information flow quality (OI and OP) and the dependent variable (SAT), as well as the non-significance of the mediation effect of PEOU in the relationship between logistics flow quality (FOA and FOT) and SAT, is intriguing. Given the substantial literature support on employee acceptance of complex enterprise information systems and inter-organizational systems (Amoako-Gyampah and Salam, 2004; Sun and Bhattacherjee, 2011), we suspect that this insignificant effect may be attributed to the mandatory nature of the systems studied, as their implementation involves high costs, potentially detracting from the value these mediators possess as a resource from an RBV perspective. This highlights the criticality to consider contextual influences in studies relying on previously development frameworks, such as the TAM. The full mediation effect of PU and PV in the relationship between fulfilled order timeliness and the organizational buyers' satisfaction in continued usage of e-procurement is due to the fact that buyers' (organizational users') satisfaction is most important in e-procurement, or for that matter, also in other enterprise/inter-organizational systems. Good system resources, if not accompanied by a favorable perception of the same, are thus likely not as effective in driving the continued use of e-procurement services. This significant mediation by PU and PV seems to have been overlooked in extant IS research.

### 6.1. Contributions and implications for research

This study contributed to extant research by extending the body of knowledge on why and how organizational buyers continue to use e-procurement services. Our research findings offer important theoretical contributions in this domain specifically, but also more generally to the broader body of literature surrounding organizational users' continuance intentions of complex enterprise information systems/inter-organizational systems. Our specific implications for research are as follows.

First, this study is the only research on e-procurement we are aware of that integrates perceived value and quality constructs into the TAM framework to explain organizational buyers' satisfaction fostering the continued use of e-procurement services. Our proposed theoretical model highlights the critical role of information flow quality and logistics fulfillment quality as resources, and refines our understanding of the mediating effect of organizational buyers' perception of e-procurement services (perceived ease of use, perceived usefulness, and perceived value). Our model shows how information flow quality, logistics fulfillment quality, and organizational buyers' perception of e-procurement services are linked together in the resource-based nomological network extending TAM. By developing this framework based on the RBV, coupled with the dynamic capabilities perspective, we effectively extended the individually-grounded TAM model to the organizational context via links to the perceived organizational antecedents of enterprise systems adoption and usage.

Second, to the best of our knowledge, this is the first study that has empirically shown that the effect of information flow quality on organizational buyers' satisfaction effectuating the continuing use of e-procurement services is partially mediated by the perceived usefulness and the perceived value of e-procurement services, positioning these dimensions as critical resources. Surprisingly, the effect of information flow quality on organizational buyers' satisfaction for continued use e-procurement services is not mediated by perceived ease of use. That is, information flow quality may alter the internal cognitive schemata and variables, but does not lead to organizational buyers' satisfaction in continued usage of e-procurement services through perceived ease of use, offering a nuanced view of this resource; this may be due to the mandatory adoption of these complex systems in the organizational setting considered, where buyers may not have a choice in adjusting their use levels of e-procurement services. In other contexts, in which

only certain aspects of e-procurement services must be followed (and where other features are more optional in nature), such a mediation is however expected. Interestingly, between the two central TAM constructs, only perceived usefulness shows a significant effect on satisfaction. This may be due to the fact that organizations spend millions of dollars for the mandatory adoption of these complex systems, along with initiatives to demonstrate their potential for improved procurement processes and competitive advantages. Therefore, only the perceived usefulness of the system may show this effect (since this dimension may be emphasized in corporate internal marketing efforts), rather than its perceived ease of use. However, organizations are ready to support organizational buyers by offering them proper training so as to improve the *perceived ease of use* of these technologies.

Third, to the best of our knowledge, this is the first study that has empirically shown that the effect of fulfilled order timeliness on organizational buyers' satisfaction in continued usage of e-procurement services is fully mediated by perceived usefulness and the perceived value of e-procurement usage, positioning these dimensions as critical resources for channeling the effect. Surprisingly, the impact of logistics fulfillment quality on organizational buyers' continuance intentions of e-procurement services is not mediated by perceived ease of use. That is, logistics fulfillment quality may alter the internal cognitive schemata and variables, but does not lead to organizational buyers' satisfaction in continued usage of e-procurement systems through perceived ease of use of these systems, as was the case for information flow quality. This may again be attributed to the mandatory nature of the services, as described above, and renders these dimensions as not serving as resources for the described relationships within our context.

Fourth, our results suggest a complementary relationship between quality constructs and individual cognitive belief constructs in shaping organizational buyers' satisfaction in the continued usage of e-procurement services. When fulfilled order accuracy and fulfilled order timeliness fails to change the organizational buyers' perception regarding the ease of use of e-procurement services, their usefulness and value are more effective in determining organizational buyers' satisfaction in the continued usage. Therefore, when all three cognitive belief constructs (PEOU, PU and PV) work in tandem, organizational buyers' satisfaction could be achieved more effectively in organizations, illustrating the reinforcing nature of these resources. Without individual cognitive belief constructs (PU, PEOU and PV), information flow quality and logistics fulfillment quality alone will not be effective in fostering e-procurement satisfaction among organizational buyers.

Last but certainly not least, although the current mainstream literature on organizational user acceptance/continuance on enterprise systems/inter-organizational systems has put strong emphasis on individual cognitive processes (Autry et al., 2010; Brinkhoff et al., 2015), this study calls attention to how organizational level factors (the mandatory nature of the systems) influence cognitive beliefs (PEOU, PU and PV), thus complementing the extant literature by expanding its horizon and enhancing theory. Researchers should be aware of theoretical differences when applying other existing IT acceptance frameworks and organizational determinants (e.g., antecedents of PEOU and PU) to explain continuance intentions of enterprise systems that are mandatory.

### 6.2. Implications for practice

Our findings offer valuable guidance to management and IT practitioners. First, not only did we show that the perceived value of e-procurement services can make a difference with respect to organizational buyers' satisfaction in continuing the use of such services, the results also suggest that perceived value is the most important external factor. As such, perceived value shapes the buyers' behavior towards satisfaction much more so than any other determinant.

Second, the salience of perceived usefulness suggests that organizational buyers are outcome-oriented in their expected continued usage

of e-procurement services. This is evidenced by the significance of logistics flow quality and information flow quality in influencing PU, as part of organizational buyers' perception of e-procurement services. Although the use of e-procurement services may be mandatory, organizational buyers' interest to use the system beyond a certain basic level is dependent upon the utility of the system, that is, information flow quality and logistics fulfillment quality. As such, since e-procurement systems are generally complex, considering the concerns of buyers is of utmost importance to foster their level of use; managers should thus be careful in adding to the complexity of systems. More sophisticated applications can become detrimental if they are not understood and appreciated by the users. For best results, managers should emphasize user-friendly aspects of the technology and provide technical training and support as part of a concerted change management effort; this should then be able to lower the psychological burden of organizational buyers' and foster their confidence, leading to continued usage.

Third, the non-significant impact of perceived ease of use on satisfaction is puzzling, especially in light of related research offering support for such a relationship (Premkumar and Bhattacherjee, 2008). What we can say is that, at least within the confines of our data, perceived ease of use does not seem to foster satisfaction in continued usage. However, this must be seen against the context considered, which was a mandated e-procurement environment. This may have caused the non-significant relationship, in addition to the non-significant relationship between logistics fulfillment quality and perceived ease of use. Future research is encouraged to reassess these links in different contexts, especially in ones where e-procurement use is voluntary. As the adoption of e-procurement is mandatory to organizational buyers within our context, organizations should be ready to provide training so that ease of use will not be an impediment in the long run.

Fourth, with the finding that organizational buyers' perception of e-procurement services (perceived usefulness and perceived value) fully mediates the relationship between fulfilled order timeliness and satisfaction, we have found confirmation for the outcome-oriented behavior of buyers. This suggests that there should be effective information sharing between buyers and suppliers through e-procurement systems, which in turn influences fulfilled order accuracy and fulfilled order timeliness, thereby making organizational buyers more likely to continue using e-procurement services. Finally, this study on organizational users' continuance intentions of complex enterprise systems/inter-organizational systems has clearly shown that managing employee usage of these systems in organizations is a complex task that requires comprehensive approaches.

### 7. Conclusions, limitations and future research

The main objective of this study was to bring further insight into organizational buyers' *continuance intentions* for e-procurement services offered in a SaaS environment. This setting is quite different to initial implementation and adoption considerations of systems owned by the buyer, a setting which has frequently been studied. In addition, we aimed to scrutinize fundamental TAM constructs to theorize, based on the RBV coupled with the dynamic capabilities perspective, about organizational buyers' continuance intentions for e-procurement services, effectively applying an established theory to the novel and increasingly popular context of e-procurement services. We confirmed PU and PV as the direct predictors of organizational buyers' satisfaction in continued usage (SAT) of e-procurement services, with PEOU however having no direct effect on SAT. Further, we extended this framework with system quality dimensions, positioned as resources, aiming to explicate how these influence organizational buyers' perceived ease of use, perceived usefulness and perceived value of e-procurement services. In addition, we tested the mediating roles of the central TAM constructs in the relationship between system quality characteristics and satisfaction. We confirmed information flow quality factors (OI and OP) as indirectly

impacting organizational buyers' satisfaction in continued usage of e-procurement services via PEOU, PU and PV. Logistics fulfillment quality factors (FOA and FOT) indirectly affect SAT via PU and PV, but not via PEOU. Overall, with this investigation, we enhanced our understanding of the antecedents of organizational buyers' satisfaction in continued usage of e-procurement services, and thus offered useful and practical implications for organizations wishing to implement e-procurement services.

While we established a sound and rich theoretical model and tested it with a reliable survey instrument and data, we are cognizant of the study's limitations, which however offer opportunities for further research. First, a weakness lies in the cross-sectional research design, where all measurement items were collected at the same point in time (Fawcett and Waller, 2011). This might not capture the true underlying dynamics of satisfaction in continued usage of e-procurement services, due to our inability to capture movement over time. Future research is encouraged to use longitudinal research (e.g., via in-depth multiple-case studies) to overcome this limitation.

Second, future studies should group the data based on the experience of organizational buyers' e-procurement usage in order to identify potential differences in continuance intentions among different groups. Furthermore, future studies could either group the data based on the size and type of organizations, or use multilevel analysis in which organizational level data (e.g., information flow quality and logistics fulfillment quality determinants) and individual level data (e.g., perceived ease of use, perceived usefulness, and perceived value) can be collected and tested with multilevel statistical tools.

Third, this study's results were obtained within one type of e-procurement system offered in a SaaS environment. Future research is needed to validate our findings across other systems, such as in-house e-procurement systems or e-marketplaces. The "degree" to which the services are mandated should also be taken into consideration. It is further likely that there are other variables that are at play, but which were not accounted for in this model. Such dimensions may include top management participation, perceived complexity, perceived risk, satisfaction, reliability and security of the SaaS environment. Future research needs to focus on these issues. In addition, our study was restricted in its focus on four aspects of quality derived from Mentzer et al. (2001) portfolio of dimensions. Future research is encouraged to investigate additional quality aspects as outlined by Mentzer et al. (2001).

Fourth, a limitation exists in that our constructs of information flow quality (online information and order procedures) and logistics fulfillment quality (fulfilled order accuracy and fulfilled order timeliness) were measured by asking respondents for their evaluation of these dimensions. Future researchers is encouraged to use archival data, such as the actual fulfillment records, instead for these constructs.

Fifth, caution must be taken in generalizing the results due to the fact that respondents in this study could be from different cultural backgrounds (i.e., national culture, organizational culture, etc.), with different cultural beliefs influencing their perceptions, attitudes and behavioral intentions. While we aimed to avoid any such extraneous influence by obtaining our contacts from the Directory of Top 1000 Corporate Companies of India, this should be noted as a potential limitation. Future research should thus include the interactions of national and organizational culture as potentially influencing the paths investigated. It is our hope that this study provides motivation and impetus for such endeavors.

## Appendix

Table A1
Survey Instrument

| Constructs | Items |
|---|---|
| Online Information (OI) | |
| OI1 | Online catalog information is available |
| OI2 | Online catalog information is adequate |
| Order Procedures (OP) | |
| OP1 | Online requisitioning process are effective |
| OP2 | Online requisitioning process are efficient |
| Fulfilled Order Accuracy (FOA) | |
| FOA1 | Shipments from online-orders rarely contain the wrong items |
| FOA2 | Shipments from online-orders rarely contain an incorrect quantity |
| FOA3 | Shipments from online-orders rarely contain substituted items |
| Fulfilled Order Timeliness (FOT) | |
| FOT1 | Online ordered deliveries arrive on the date promised |
| FOT2 | Time between placing requisition online and receiving delivery is short |
| FOT3 | The amount of time an online requisition is on back-order is short |
| Perceived Ease of Use (PEOU) | |
| PEOU1 | Learning to use e-procurement systems is easy for me |
| PEOU2 | My interaction with e-procurement system is clear and understandable |
| PEOU3 | Using e-procurement systems would make it easier for carrying out my procurement tasks |
| Perceived Usefulness (PU) | |
| PU1 | Using e-procurement systems increases my job performance |
| PU2 | Using e-procurement systems increases my job productivity |
| PU3 | Using e-procurement systems enhances my job effectiveness |
| Perceived Value (PV) | |
| PV1 | Using e-procurement systems enhances cost reduction |
| PV2 | Using e-procurement systems enhances internal efficiency |
| PV3 | Using e-procurement systems enhances managerial effectiveness |
| PV4 | Using e-procurement systems enhances coordination |
| Satisfaction (SAT) | |
| How do you feel about the overall experience of e-procurement use | |
| SAT1 | Very dissatisfied/Very satisfied |
| SAT2 | Very displeased/Very pleased |
| SAT3 | Very frustrated/very contented |
| SAT4 | Absolutely terrible/absolutely delighted |

*Note*: All items were measured on a 7-point Likert scale (where 1: strongly disagree; 2: moderately disagree; 3: somewhat disagree; 4: neutral (neither disagree nor agree); 5: somewhat agree; 6: moderately agree; and 7: strongly agree).

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