



Unified Theory of Acceptance and Use of Technology: A Synthesis and the Road Ahead

Viswanath Venkatesh

Department of Information Systems, Walton College of Business,
University of Arkansas
vvenkatesh@vvenkatesh.us

James Y. L. Thong

Department of Information Systems, Business Statistics
and Operations Management,
School of Business and Management,
Hong Kong University of Science and Technology
jthong@ust.hk

Xin Xu

Department of Management and Marketing,
Faculty of Business,
The Hong Kong Polytechnic University
xin.xu@polyu.edu.hk

Abstract:

The unified theory of acceptance and use of technology (UTAUT) is a little over a decade old and has been used extensively in information systems (IS) and other fields, as the large number of citations to the original paper that introduced the theory evidences. In this paper, we review and synthesize the IS literature on UTAUT from September 2003 until December 2014, perform a theoretical analysis of UTAUT and its extensions, and chart an agenda for research going forward. Based on Weber's (2012) framework of theory evaluation, we examined UTAUT and its extensions along two sets of quality dimensions; namely, the parts of a theory and the theory as a whole. While our review identifies many merits to UTAUT, we also found that the progress related to this theory has hampered further theoretical development in research into technology acceptance and use. To chart an agenda for research that will enable significant future work, we analyze the theoretical contributions of UTAUT using Whetten's (2009) notion of cross-context theorizing. Our analysis reveals several limitations that lead us to propose a multi-level framework that can serve as the theoretical foundation for future research. Specifically, this framework integrates the notion of research context and cross-context theorizing with the theory evaluation framework to: 1) synthesize the existing UTAUT extensions across both the dimensions and the levels of the research context and 2) highlight promising research directions. We conclude with recommendations for future UTAUT-related research using the proposed framework.

Keywords: Theory Evaluation, Technology Acceptance and Use, Unified Theory of Acceptance and Use of Technology (UTAUT), Research Context, Literature Review, Multi-level Framework.

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1 Introduction

Research on individual acceptance and use of information technology (IT) is one of the most established and mature streams of information systems (IS) research (Venkatesh, Davis, & Morris, 2007). There is also research on technology adoption by groups and organizations (e.g., Sarker & Valacich, 2010; Sarker, Valacich, & Sarker, 2005; Sia, Lee, Teo, & Wei, 2001; Sia, Teo, Tan, & Wei, 2004) that holds the premise that one must first use a technology before one can achieve desired outcomes, such as improvement in employee productivity and task/job performance in organizations. Researchers have proposed and tested several competing models (e.g., the technology acceptance model or TAM) and models based on the theory of planned behavior (TPB) to explain and predict user acceptance and use of IT. About a decade ago, Venkatesh, Morris, Davis, and Davis (2003) synthesized these models into the unified theory of acceptance and use of technology (UTAUT). UTAUT identifies four key factors (i.e., performance expectancy, effort expectancy, social influence, and facilitating conditions) and four moderators (i.e., age, gender, experience, and voluntariness) related to predicting behavioral intention to use a technology and actual technology use primarily in organizational contexts. According to UTAUT, performance expectancy, effort expectancy, and social influence were theorized and found to influence behavioral intention to use a technology, while behavioral intention and facilitating conditions determine technology use. Moreover, various combinations of the four moderators were theorized and found to moderate various UTAUT relationships. In longitudinal field studies of employees' acceptance of technology, UTAUT explained 77 percent of the variance in behavioral intention to use a technology and 52 percent of the variance in technology use. Recently, Venkatesh, Thong, and Xu (2012) proposed and tested UTAUT2, which incorporates new constructs (i.e., hedonic motivation, price value, and habit) that focus on new theoretical mechanisms (see Bagozzi, 2007; Benbasat & Barki, 2007; Venkatesh et al., 2007) in a consumer context. UTAUT2 explained 74 percent of the variance in consumers' behavioral intention to use a technology and 52 percent of the variance in consumers' technology use.

Although research considers UTAUT to have reached its practical limit of explaining individual technology acceptance and use decisions in organizations (Venkatesh et al., 2003), UTAUT-based research has thrived (Venkatesh et al., 2012). Specifically, research has applied UTAUT as is, applied it with other theories, or extended it to study a variety of technologies in both organizational and non-organizational settings. The continued growth of UTAUT-based research has partly arisen due to the proliferation and diffusion of new ITs—such as enterprise systems (Sykes, 2015; Sykes, Venkatesh, & Johnson, 2014), collaboration technology in knowledge-intensive firms (e.g., Brown, Dennis, & Venkatesh, 2010), mobile Internet for consumers (e.g., Thong, Venkatesh, Xu, Hong, & Tam, 2011; Venkatesh et al., 2012), agile IS (Hong, Thong, Chasalow, & Dhillon, 2011), e-government for citizens (Chan, Thong, Venkatesh, Brown, Hu, & Tam, 2010), and health IS in the healthcare industry (e.g., Venkatesh, Sykes, & Zhang, 2011)—in organizations and society. IT has penetrated almost every aspect of the society, and various individuals in various contexts now use it. While the past decade has generated a large number of new ITs and associated studies based on UTAUT, in analyzing the literature, we found that the IS discipline is at a crossroads regarding what the future holds for UTAUT and, in particular, the possible theoretical contributions from further research into technology acceptance and use. We believe that systematically evaluating the contributions of the existing UTAUT-based studies can reveal the utility of UTAUT and the limitations of existing UTAUT-based research from which one can then develop a new framework of technology acceptance and use with a view toward charting promising future research directions. In this paper, we:

1. Comprehensively review the UTAUT literature from September 2003 to December 2014,
2. Evaluate UTAUT and its extensions based on a systematic framework of theory evaluation¹, and
3. Propose a multi-level framework of technology acceptance and use based on the notion of cross-context theorizing to both synthesize existing research and identify future research directions.

This paper proceeds as follows. In Section 2, we describe how we conducted the literature review and, in Section 3, we summarize the UTAUT studies in the IS literature. In Section 4, we employ Weber's (2012) framework of theory evaluation to analyze UTAUT and its extensions, and as a result, we identify three major limitations of this literature. In Section 5, we integrate Weber's (2012) framework, Whetten's (2009) notion of cross-context theorizing, and Johns' (2006) conceptualization of various dimensions of research

¹ We focus on the theoretical contributions rather than method issues in the literature review. Nevertheless, we do agree that method issues can influence findings and conclusions. The current research can serve as a foundation for future research into the interplay between theoretical development and research methodology.

context at two different levels to propose a multi-level framework that synthesizes UTAUT extensions and highlights gaps and opportunities in this research domain. In Section 6, we discuss the implications of our framework and provide recommendations for future research. Finally, in Section 7, we conclude the paper.

2 Literature Review

We used the “cited reference search” method in Web of Science and searched for papers that have cited the original UTAUT paper (i.e., Venkatesh et al., 2003) from September 2003 until December 2014. We also searched the proceedings of two major Association for Information Systems (AIS) conferences: International Conference on Information Systems (ICIS) and Americas Conference on Information Systems (AMCIS) in the AIS online library. To ensure we did not miss any important studies, we further searched each source with the search criterion containing the full name of the theory (i.e., “unified theory of acceptance and use of technology”, its abbreviation (i.e., “UTAUT”), and other variants, such as “user acceptance of information technology: toward a unified view” in “all field”. We examined the papers and conference proceedings that Web of Science generated in the following sequence: 1) we started with papers published in the AIS Senior Scholars’ basket of eight IS journals;² 2) we expanded our set of papers to include those published in the journals listed in the MIS journal rankings on the AIS website;³ and 3) finally, we expanded our literature review to include the two AIS conferences (ICIS and AMCIS). In total, we found 1,267 papers.

We first examine the distribution of journal papers (i.e., excluding the two AIS conferences) found from September 2003 to December 2014 (see Appendix A). In total, 858 journal papers in our review timeframe cited the original paper about UTAUT (Venkatesh et al., 2003): 245 came from the AIS Senior Scholars’ basket of eight journals and 613 came from other IS journals. For the eight journals in the AIS Senior Scholars’ basket, the breakdown of citations to the UTAUT paper showed that *MIS Quarterly* had the largest number of citations (72), followed by the *European Journal of Information Systems* (51) and the *Journal of the Association for Information Systems* (32). The top-three journals with the most citations to the original UTAUT paper were *Computers in Human Behavior* (125), *Information & Management* (55), and *Behavior & Information Technology* (48). In the two AIS conferences, AMCIS had 272 UTAUT citations and ICIS had 137. Appendix A summarizes the number of UTAUT citations in each IS journal and conference by year. The total number of UTAUT citations in each year has steadily increased from 24 in 2004 to 160 in 2011, with a slight drop in 2012 and 2013 (132 citations and 137 citations, respectively) but back to an increase in 2014 (167 citations). In the AIS Senior Scholars’ basket of journals, the number of UTAUT citations has been over 20 in most years (i.e., in 2006, 2007, 2009, 2010, 2011, 2012, and 2014). Similarly, for the remaining IS journals, the number of citations was over 60 from 2009 to 2014. Overall, we found an increasing number of citations to the UTAUT paper over the years.

We analyzed the papers to arrive at a classification scheme for the different themes present in the UTAUT citations, which resulted in a consensus on four broad themes of the UTAUT citations: 1) a general citation to the original UTAUT paper, 2) an application of UTAUT, 3) an integration of UTAUT with other theories, and 4) an extension to UTAUT. Next, we independently examined all 1,267 papers to classify them into the four themes. After performing our independent classifications, we compared the results. We discussed any differences before finalizing the classification of the paper (Appendix B summarizes our classification scheme).

2.1 General Citation

We classified a paper into this category if it only cited the UTAUT paper in passing and did not use UTAUT in any substantial manner, such as applying UTAUT or integrating UTAUT with other theories or extending UTAUT. Most of the papers in this category cited UTAUT in their general discussion (e.g., Kim, 2009; Sarker & Valacich, 2010; Sarker et al., 2005). Some of these general-citation papers were TAM-based studies (e.g., Burton-Jones & Hubona, 2006). We also included research-in-progress studies that applied, integrated, or extended UTAUT (e.g., Yun, Han, & Lee, 2011) in this category because they had not tested their UTAUT-based models yet.

2.2 UTAUT Application

We classified a paper into this category if it was an empirical study that applied either part of or the complete UTAUT as its research model in a particular setting. For instance, Gupta, Dasgupta, and Gupta (2008)

² <http://ais.site-ym.com/?SeniorScholarBasket>

³ <http://ais.site-ym.com/?JournalRankings>

examined UTAUT in the context of e-government adoption in a developing country. Their model comprised all the main effects and one moderator—gender. Note that we did not count studies that applied TAM (Davis, 1989) and its updates (e.g., TAM3: Venkatesh & Bala, 2008) in this category but as general citations.

2.3 UTAUT Integration

We classified a paper into this category if it was an empirical study that integrated part of or the complete UTAUT with at least one other theory with theoretical significance as its research model. For instance, Hong et al. (2011) integrated UTAUT with the IS continuance model and other mechanisms (e.g., habit and personal innovativeness with IT) to examine the drivers of user acceptance of agile IS. Note that we did not count studies that integrated TAM (Davis, 1989) and its updates (e.g., TAM3: Venkatesh & Bala, 2008) in this category but as general citations.

2.4 UTAUT Extension

We classified a paper into this category if it was an empirical study that included part of or the complete UTAUT as the baseline model. In addition, the paper needed to extend the baseline model with either new exogenous, endogenous, moderation, or outcome mechanisms (more on this later). For instance, Neufeld, Dong, and Higgins (2007) studied the impacts of charismatic leadership on the four UTAUT beliefs (i.e., performance expectancy, effort expectancy, social influence, and facilitating conditions) that, in turn, influenced behavioral intention and use. Note that we did not count studies that extended TAM (e.g., Venkatesh, 2000; Venkatesh & Davis, 2000) and its updates (TAM2: Venkatesh & Davis, 2000; TAM3: Venkatesh & Bala, 2008) in this category but as general citations.

Appendix C shows the 1,267 UTAUT citations along the four broad themes. One can classify most of the UTAUT citations in the general citation category (1,205). In addition, we found 12 UTAUT applications, 13 UTAUT integrations, and 37 UTAUT extensions. This relatively small number of UTAUT-based studies (62 in the past 11 years approximately) in major IS journals and conferences signals an imperative need for directions to refine the theory. In Section 3, we discuss the findings from our literature review about the UTAUT applications, integrations, and extensions.

3 Synthesis of the UTAUT Literature

Researchers have applied, integrated, and extended UTAUT to study individual technology acceptance and use across a variety of settings (e.g., different user types, different organization types, different types of technologies, different tasks, different times, and different locations). First, one can categorize technology users into different groups, such as employees, consumers, and citizens. For instance, Hong et al. (2011) used a sample of employees at all levels of an organization (i.e., board directors, senior managers, middle-level managers, and operational personnel). Zhou, Lu, and Wang (2010) used a sample of mobile service users (i.e., consumers). Venkatesh, Thong, Chan, Hu, and Brown (2011) studied citizens' use of e-government services. Other studies have targeted more specific types of users, such as teachers (Pynoo et al., 2011) and physicians (Chang, Hwang, Hung, & Li, 2007). Second, one can group organizations by industry sectors (e.g., manufacturing and service sectors, or private and public organizations). Research has examined a variety of organizations, such as schools (Pynoo et al., 2011), hospitals (Chang et al., 2007) and government organizations (Gupta et al., 2008). Third, one can study different types of technology. Research has examined a range of technologies from the general, such as the Internet (Gupta et al., 2008), to the more specific, such as agile IS (Hong et al., 2011), digital-learning contexts (Pynoo et al., 2011), mobile banking (Zhou et al., 2010), and e-government services (Venkatesh et al., 2011). Fourth, one can study different types of tasks. Tasks that the target technology supports include idea generation and decision making in technology design (Brown et al., 2010), the filing of income tax (Carter & Schaupp, 2008), and medical diagnosing (Chang et al., 2007). Fifth, one can study technology use at different times (i.e., its adoption, initial use, or post-adoptive use). For example, Zhou et al. (2010) focused on user adoption of mobile banking, whereas Venkatesh, Brown, Maruping, and Bala (2008) included adoption, initial use, and post-adoptive use. Sixth, one can group studies by the location (i.e., countries, economic sectors, and so on) in which the target technology has been adopted and used. Some studies have examined technology acceptance and use in locations other than the Western countries, such as India (Gupta et al., 2008), China (Venkatesh & Zhang, 2010) and Korea (Im, Hong, & Kang, 2011). Other studies have focused on specific economic sectors, such as services (e.g., Hong et al., 2011), education (e.g., Chiu & Wang, 2008), food service (e.g., Yoo, Han, & Huang, 2012), medical services and healthcare (e.g., Liang, Xue, Ke, & Wei, 2010), and the public sector (e.g., Dasgupta & Gupta, 2011). In general, research has repeatedly confirmed

the robustness of UTAUT and its main effects. However, research has scarcely examined the moderating effects of age, gender, experience, and voluntariness. Most studies have tested only the main effects (e.g., Chang et al., 2007), whereas others examined a subset of the moderation effects (e.g., Gupta et al., 2008). Overall, many studies support the generalizability of UTAUT, albeit only in terms of its main effects. In Sections 3.1 to 3.3, we discuss UTAUT applications, integrations, and extensions.

3.1 Review of UTAUT Applications

We summarize the research contexts and the relationships validated in the UTAUT applications in Table 1 (Appendix D provides the specific UTAUT hypotheses). The UTAUT applications' research contexts varied. We found only one study that applied UTAUT in its original research context (i.e., in traditional business organizations) (Garfield, 2005). Researchers have applied UTAUT to other types of organizations, such as educational institutions (i.e., universities and schools: El-Gayar & Moran, 2007; Liao, Shim, & Luo, 2004; Pynoo et al., 2011), academic societies (e.g., Gruzd, Staves, & Wilk, 2012), government agencies (e.g., Al-Shafi, Weerakkody, & Janssen, 2009; Gupta et al., 2008), and hospitals (Alapetite, Andersen, & Hertzum, 2009; Chang et al., 2007). These organizations were located not only across a variety of economic sectors, but also across diverse countries/regions, such as Asia (e.g., India, Qatar, Taiwan), Europe (Belgium), and the USA. Users have included students and teachers, government employees, and physicians. Researchers have also examined various types of technologies (e.g., mobile computing technologies such as Tablet PCs: El-Gayar & Moran, 2007; Garfield, 2005), clinical decision support systems (Chang et al., 2007), e-government services (Al-Shafi et al., 2009), digital-learning environments (Liao et al., 2004; Pynoo et al., 2011), and social media (Gruzd et al., 2012). In terms of timing, most of the UTAUT applications focused on users' adoption decisions. However, Alapetite et al. (2009) compared the levels of performance expectancy, effort expectancy, social influence, and facilitating conditions before and after adoption. Only Pynoo et al. (2011) followed the original UTAUT specification and examined technology use in three periods (i.e., user adoption, initial use, and post-adoptive use). Moreover, most of the UTAUT applications examined only the main effects. Few studies tested the moderation effects of individual differences specified in the original UTAUT. For example, Gupta et al. (2008) examined the moderating effects of gender and Al-Shafi et al. (2009) examined the moderating effects of age, gender, and experience. Overall, we found few studies that have tested the moderation effects in studying technology use in existing UTAUT applications. Cumulatively, this finding is both surprising and disappointing because the empirical evidence does not allow one to draw conclusions regarding the generalizability of UTAUT or make inferences about all possible boundary conditions.

3.2 Review of UTAUT Integrations

Researchers have also integrated UTAUT with other theoretical models to study technology acceptance and use and related issues (see Table 2). For instance, Yoo et al. (2012) studied the impacts of extrinsic motivation and intrinsic motivation on employees' intention to use e-learning in the workplace. They conceptualized performance expectancy, social influences, and facilitating conditions as the components of extrinsic motivation, and effort expectancy as a component of intrinsic motivation. Guo and Barnes (2011, 2012) also adopted the same theoretical foundation to examine consumers' purchase intention in the virtual world, but they viewed performance expectancy and effort expectancy as components of extrinsic motivation. Venkatesh et al. (2011) integrated UTAUT beliefs into the two-stage expectation-confirmation model of IS continuance (Bhattacharjee & Premkumar, 2004) to study citizens' continued use of e-government technologies. Other studies have integrated UTAUT with theoretical perspectives such as the equity-implementation model (Hess, Joshi, & McNab, 2010), IS success model (Kim, Jahng, & Lee, 2007), and task-technology fit (Zhou, Lu, & Wang, 2010). We can say that these studies have made some progress. However, here too, there is a lack of integration of the UTAUT moderating variables.

Table 1. Summary of UTAUT Applications

Source	User	Technology	Task	Time	Organization	Location	Relationships validated
Alapetite et al. (2009)	Physicians	Speech recognition	Electronic medical recording	Adoption	Clinical departments in a hospital		Expectations vs. experiences of UTAUT variables
Al-Shafi et al. (2009)	Citizens	E-government services		Adoption	Fifteen public agencies	Qatar	Main effects and the moderating effects of age, gender, and experience
Bühler & Bick (2013)	Citizens	Accessing political social media appearances	Political campaigns	Adoption and use		Germany	Main effects and the moderating effects of age, gender, experience, and voluntariness
Chang et al. (2007)	Physicians	Clinical decision support system	Diagnosing	Adoption	Three hospitals	Taiwan	Main effects in UTAUT
El-Gayar and Moran (2007)	Students	Tablet PC	Learning	Adoption	A public university	Midwest USA	Main effects in UTAUT
Gruzd et al. (2012)	Academic researchers	Social media	Research	Adoption and use	The American Society for Information Science and Technology		Main effects in UTAUT
Gupta et al. (2008)	Employees	Internet		Adoption	A government organization	India	Main effects and the moderating effects of gender
Liao et al. (2004)	Students	Web-based learning environment	Learning	Adoption	A university	South USA	Main effects in UTAUT
Pynoo et al. (2011)	Teachers	Digital-learning environment	Teaching, communication, and administration	Adoption, initial use, and final use	A secondary school	Dutch-speaking part of Belgium	Main effects in UTAUT
Seid & Lessa (2012)		Telecenter		Adoption		Ethiopia	Main effects in UTAUT
Workman (2014)	Consumers	Social media and smartphone applications	Social networking and daily 'functions' such as navigation, weather information, & travel arrangement	Use		Florida, USA	Main effects and the moderating effects of experience

Note: we leave the cells empty if the source (papers) did not provide enough information.

Table 2. Summary of UTAUT Integrations

Source	Technology	Dependent variable	Theoretical foundation	Role of UTAUT	Other mechanisms
Guo & Barnes (2011, 2012)	Virtual world	Purchase intention	Motivation theory, transaction cost theory, and UTAUT	Performance expectancy, effort expectancy, and social influences affect intention	Perceived value, enjoyment, general achievement, and habit
Hess et al. (2010)	Online discussion forum	Intention to use	Equity-implementation model (Joshi, 1991) and UTAUT	Main effects in UTAUT	Perceived equity
Hong et al. (2011)	Agile IS	User acceptance	Tripartite model of attitude (e.g., Eagly & Chaiken, 1993), status quo bias, omission bias, and the availability heuristic	Performance expectancy, effort expectancy, social influences, and facilitating conditions affect Intention	Disconfirmation and satisfaction, comfort with change, habit, and personal innovativeness
Kim et al. (2007)	Portfolio of IT applications	IT use	IS success model (DeLone & McLean, 1992) and UTAUT	Performance expectancy and social influences affect IT utilization	User satisfaction affects IT use
Lian & Yen (2014)	Online shopping	User acceptance	Innovation resistance theory and UTAUT	Main effects of UTAUT as the drivers of online shopping acceptance	Usage, value, risk, image, and tradition as the barriers of online shopping acceptance
Miltgen, Popovic, & Oliveira (2013)	Biometrics	User acceptance	Technology acceptance model (TAM), diffusion of innovations (DOI), and UTAUT	Social influences and facilitating conditions affect user acceptance	Innovativeness and compatibility from DOI, perceived usefulness and perceived ease of use from TAM, trust, privacy concern, and perceived risks
Oliveira, Faria, Thomas, & Popovic (2014)	Mobile banking	User adoption	Task-technology fit theory (TTF), initial trust model, and UTAUT	Main effects of UTAUT and the moderating effects of age and gender	Task-technology fit affects performance expectancy and adoption intention, environmental factors and performance expectancy affect initial trust that in turn influences adoption intention
Pramatari & Theotokis (2009)	RFID-enabled services	Consumer acceptance	Theory of planned behavior (Fishbein & Ajzen, 1975)	Performance expectancy and effort expectancy affect attitude	Attitude, technology anxiety, and privacy concern
Sun, Liu, Peng, Dong, & Barnes (2014)	Social networking	Continuance intention	IS continuance, flow theory, social capital theory, and UTAUT	Main effects of social influence and effort expectancy	User satisfaction, perceived enjoyment, norms, trust, tie strength, and perceived usefulness
Venkatesh et al. (2011)	E-government technology	Continuance intention	IS continuance model (Bhattacharjee & Premkumar, 2004) and trust (e.g., McKnight, Choudhury, & Kacmar, 2002)	Performance expectancy, effort expectancy, social influences, and facilitating conditions as pre-usage beliefs, disconfirmation, and post-usage beliefs	Trust, satisfaction, and attitude
Yoo et al. (2012)	E-learning in the workplace	Intention to use	Motivation theory (e.g., Calder & Staw, 1975): extrinsic motivation and intrinsic motivation affect intention	Performance expectancy, social influences, and facilitating conditions as components of extrinsic motivation; effort expectancy as a component of intrinsic motivation	Attitude and anxiety as components of intrinsic motivation
Zhou et al. (2010)	Mobile banking	User adoption	Task-technology fit theory (Goodhue & Thompson, 1995) and UTAUT	Performance expectancy, effort expectancy, social influences, and facilitating conditions affect user adoption	Task-technology fit affects performance expectancy and user adoption; technology characteristics affects effort expectancy

3.3 Review of UTAUT Extensions

We found four main types of UTAUT extensions: new exogenous mechanisms, new endogenous mechanisms, new moderating mechanisms, and new outcome mechanisms. New exogenous mechanisms refer to the impacts of external predictors on the four exogenous variables in UTAUT (i.e., performance expectancy, effort expectancy, social influence, and facilitating conditions). For instance, Neufeld et al. (2007) theorized and found that charismatic leadership had a positive impact on performance expectancy, effort expectancy, social influence, and facilitating conditions. New endogenous mechanisms refer to: 1) new predictors' impact on the two endogenous variables in UTAUT (i.e., behavioral intention and use behavior) or 2) the enrichment of the four exogenous variables and the two endogenous variables in the original UTAUT. For instance, although not using UTAUT per se, Venkatesh et al. (2008) examined the impact of behavioral expectation on technology use. Similarly, Eckhardt, Laumer, and Weitzel (2009) enriched the social influence construct with five dimensions based on the source of the influence (i.e., from the same department, from other operating departments, from the IT department, from the customers, and from the suppliers). Venkatesh et al. (2008) provide an example of enriching the endogenous variables: they conceptualized and measured technology use by duration, frequency, and intensity. New moderating mechanisms include new moderating effects added to the original UTAUT, including the moderation of new relationships. For example, Venkatesh et al. (2008) examined the moderating effect of experience on the relationship between behavioral intention and technology use, and the relationship between behavioral expectation and technology use. New outcome mechanisms refer to the new consequences of behavioral intention and technology use added to the original UTAUT. For instance, Sun, Bhattacharjee, and Ma (2009) studied the impact of technology use on individual performance. Figure 1 shows the four types of UTAUT extensions at a more abstract level. Table 3 summarizes the four types of UTAUT extension studies.

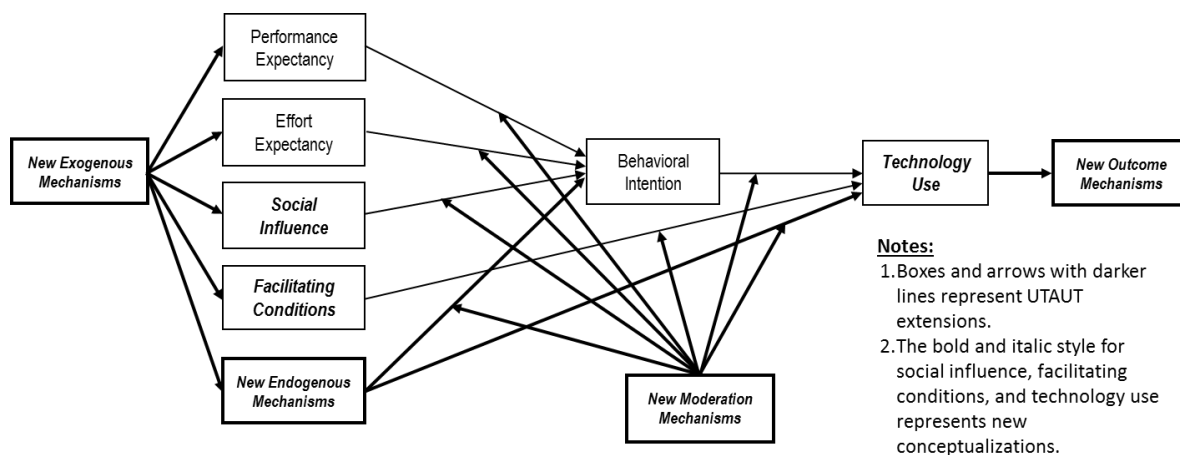


Figure 1. Types of UTAUT Extensions

As Table 3 shows, we found 37 UTAUT extensions. Most UTAUT extensions employed new endogenous mechanisms or new moderation mechanisms followed by new exogenous mechanisms and new outcome mechanisms. Many of the extension studies incorporated new variables predicting behavioral intention and/or technology use (i.e., new endogenous mechanisms). For instance, when studying consumers' use of mobile Internet services, Venkatesh et al. (2012) incorporated hedonic motivation and price value as new predictors of behavioral intention and habit as a new predictor of both intention and technology use. Note that we included refinements of the original UTAUT constructs in the new endogenous mechanisms category. For example, Bourdon and Sandrine (2009) conceptualized both social influences and facilitating conditions as multi-dimensional constructs. Venkatesh et al. (2012) measured technology use as both breadth of use and depth of use. Specifically, they measured technology use by a formative index of six questions on consumers' usage frequencies of six popular mobile Internet applications.

We also found UTAUT extensions with new moderation mechanisms. These new moderation mechanisms include individual differences (e.g., income, education, migration background: Niehaves & Plattfaut, 2010), technology characteristics (e.g., ICT service type: Thong et al., 2011; type of recommender system: Wang, Townsend, Luse, & Mennecke, 2012), organizational-level factors (e.g., organizational facilitating conditions: Park, Lee, & Yi, 2011), and cultural differences (e.g., Korea vs. USA: Im et al., 2011). Note that we included the moderation of new relationships by the original moderating variables in UTAUT in this

category as long as they were proposed/tested in conjunction with new independent variables. For example, Venkatesh et al. (2012) specified age, gender, and experience as moderators of the impacts of hedonic motivation, price value, and habit on behavioral intention and technology use. We found seven studies that extended UTAUT with exogenous mechanisms. For example, Brown et al. (2010) identified a comprehensive set of technology characteristics, individual and group characteristics, task characteristics, and situational characteristics relevant to collaboration as predictors of the four UTAUT predictors. Finally, Table 3 shows that research has examined outcome mechanisms less than the other types of extensions. Only two studies—Sun et al. (2009) and Xiong et al. (2013)—examined new performance-based outcomes.

Table 3. Summary of UTAUT Extensions

Source	New exogenous mechanisms	New endogenous mechanisms	New moderation mechanisms	New outcome mechanisms
Alaiad & Zhou (2013)		Trust		
Al-Gahtani, Hubona, & Wang (2007)			Culture (Saudi Arabia vs. USA)	
Alshare & Mousa (2014)			Espoused culture values	
Borrero, Yousafzai, Javed, & Page (2014)			Technology readiness	
Bourdon & Sandrine (2009)		Enriching social influences; enriching facilitations		
Brown et al. (2010)	Collaboration-related constructs: technology characteristics, individual characteristics, group characteristics, task characteristics, and situational characteristics			
Carter & Schaupp (2008)		Trust, self-efficacy, and experience		
Casey & Wilson-Evered (2012)	Trust and innovativeness			
Chiu & Wang (2008)	Computer self-efficacy	Task value, task cost, and computer self-efficacy		
Dasgupta & Gupta (2011)	Organizational culture			
Eckhardt et al. (2009)		Enriching social influences	Adopter vs. non-adopter	
Im et al. (2011)			Culture (Korea vs. USA)	
Lallmahomed, Ab Rahim, Ibrahim, & Rahman (2013)		Hedonic performance expectancy; enriching system use		
Liang et al. (2010)	Team climate for innovation			
Liew, Vaithilingam, & Nair (2014)		Adoption, perceived economic benefit, and perceived social benefit; enriching use behavior (economic use and social use)	Ethnicity, religion, language, employment, income, education, and marital status	
Loose, Weeger, & Gewald (2014)		Perceived threats		
Lu, Yu, & Liu (2009)			Income and location	
Martins, Oliveira, & Popovic (2014)	Perceived risk	Perceived risk		

Table 3. Summary of UTAUT Extensions

Source	New exogenous mechanisms	New endogenous mechanisms	New moderation mechanisms	New outcome mechanisms
McKenna, Tuunanen, & Gardner (2013)	Adaptive service components, computational service components, collaborative service components, and networking service components	Self-efficacy		
McLeod, Pippin, & Catania (2009)		Tax performance expectancy; privacy and risk	Professionals vs. novices	
Neufeld et al. (2007)	Charismatic leadership			
Niehaves & Plattfaut (2010)			Income, education, and migration background	
Oh & Yoon (2014)		Trust and flow experience	E-learning vs. online game	
Park et al. (2011)		Organizational facilitating conditions	Organizational facilitating conditions	
Saeed (2013)		Perceived financial control and ease of navigation		
Schaupp, Carter, & McBride (2010)		Optimism bias and perceived risk		
Shibl, Lawley, & Debuse (2013)	Professional development, time, cost, training, security, integration, and workflow	Involvement		
Sun et al. (2009)	Perceived work compatibility			Individual performance
Thong et al. (2011)			IT service type; Adoption vs. continued use	
Venkatesh & Zhang (2010)			Culture	
Venkatesh et al. (2008)		Behavioral expectation Duration, frequency, and intensity of use	Age, gender, and experience moderate the impacts of facilitating conditions on behavioral expectation; experience moderates the impacts of behavioral intention and behavioral expectation on use.	
Venkatesh et al. (2012)		Hedonic motivation, habit, and price value	Age, gender, and experience moderating the impacts of hedonic motivation, habit, and price value on intention and use respectively.	
Wang et al. (2012)		Trust	Type of recommender system; type of product	
Wang, Jung, Kang, & Chung (2014)	Perceived innovativeness with IT and computer self-efficacy	Enriching social influence, knowledge sharing outcome expectancy, and security.	User groups (silent vs. social users)	
Weerakkody, El-Haddadeh, Al-Sobhi, Shareef, & Dwivedi (2013)		Trust of Internet and trust of Intermediaries		
Xiong, Qureshi, & Najjar (2013)		Job fit, attitude, self-efficacy, and anxiety		Economic development
Yuen, Yeow, Lim, & Saylani (2010)		Attitude, anxiety, perceived credibility, and self-efficacy	Culture	

4 Theoretical Analysis of UTAUT and its Extensions

We focus on UTAUT extensions because this research category has the greatest potential for making significant theoretical contributions to IS research on technology acceptance and use. We adopt Weber (2012) as the foundation for our analysis because it provides a systematic framework and criteria for both evaluating and developing IS theories, which is a good fit with our overall research objective (i.e., to evaluate the existing UTAUT-based research and identify the future directions for further development of theories of technology acceptance and use). First, we summarize Weber's (2012) framework and criteria for theory evaluation and development based on which we evaluate UTAUT and point out its key merits and major limitations. Second, we analyze the UTAUT extensions to identify the key theoretical tensions between UTAUT extensions and Weber's (2012) evaluation criteria. Third, we introduce our multi-level framework of technology acceptance and use that highlights these tensions. Finally, we identify promising future research directions and provide associated recommendations.

Weber's (2012) overall framework comprises the theory evaluation criteria for both the parts of a theory and the theory as a whole (see Tables 4 and 5). The parts of a theory have four dimensions: the constructs, the associations, the states, and the events (see the first column in Table 4). The theory as a whole has five dimensions: the importance, the novelty, the parsimony, the level, and the falsifiability of the focal theory (see the first column in Table 5). Each dimension includes several evaluation criteria (see second column in Tables 4 and 5). Following the criteria, we evaluate the quality of UTAUT (see third column in Tables 4 and 5).

Overall, in evaluating UTAUT based on Weber (2012), our findings suggest it is a high quality theory. In particular, UTAUT performs well in defining and articulating its parts (the focal class of things, the attributes in general, the associations, and the state space: see Table 4). Given that it synthesizes existing theories, UTAUT as a whole also performs well in the importance, novelty, and falsifiability dimensions: it focuses on the important phenomenon of technology acceptance and use, makes important changes to existing theories by introducing higher-order moderation effects in the model, and it is subject to rigorous empirical validation (Table 5). However, UTAUT as a whole has two limitations: its relatively low parsimony due to the complex interactions among the attributes as implied by the moderation effects and the lack of a meso-level formulation of the model (see Table 5).

Paradoxically, our analysis indicates that UTAUT's merits (see above) hinder further efforts in refining and extending UTAUT. That is, UTAUT's well-defined parts, the well-accepted importance and boundary of research on individual technology acceptance and use in organizations, and UTAUT's well-established and falsifiable way of articulating novelty (i.e., adding/deleting constructs and associations to UTAUT) have bound research that extends UTAUT. These factors not only lead to the limited number of UTAUT extensions but also hamper further significant theoretical advancement of the theory. To save space, we provide details of our analysis in Appendix E and summarize the results below.

As Table E1 in Appendix E shows, we classified the theoretical advancements in the parts of UTAUT extensions into three categories following Weber's (2012) framework. The first category included studies that focused on the original user class (individual users in organizations) and extended UTAUT by either enriching an established attribute (e.g., social influence: Bourdon & Sandrine, 2009; Eckhardt et al., 2009) or adding new attributes (e.g., behavioral expectation: Venkatesh et al., 2008). The second category had extensions that expanded the boundary of the user class to include consumers, citizens, and so on, and, accordingly, introduced new user attributes (e.g., citizens: Carter & Schaupp, 2008; Niehaves & Plattfaut, 2010; consumers: Lu et al., 2011; Venkatesh et al., 2012). Finally, the third category had extensions that incorporated new classes and their attributes into UTAUT. Some studies extended UTAUT by incorporating the technology/task class and the technology/task-type attribute (Thong et al., 2011; Wang et al., 2012)⁴. Park et al. (2011) incorporated the organization class and the attribute of organizational facilitating conditions into UTAUT and examined cross-level associations in their model⁵. Extension studies also included the location class and the culture attribute in the model (Al-Gahtani et al., 2007; Im et al., 2011; Venkatesh & Zhang, 2010; Yuen et al., 2010). Overall, UTAUT extensions have mainly focused on the

⁴ Following Weber (2012), we do not count studies of attributes of technology and/or task as perceived by individual users into the category of incorporating new classes in UTAUT because all individual user perceptions are essentially still user attributes (see Table 1 in Weber (2012) and the last paragraph on page nine in Weber (2012)).

⁵ Following the previous footnote's logic, we still counted individual user's perceptions of organization attributes as user attributes. Thus, we counted Liang et al. (2010) as adding a new attribute to UTAUT. In contrast, because Park et al. (2011) conceptualized and measured facilitating conditions at the organization level (i.e., invariant at the individual user level), we counted their work as incorporating a new class and its attribute.

constructs and associations, and the original UTAUT has bound these extensions with only incremental expansions of the classes, attributes, and associations.

As Table E2 in Appendix E shows, we classified UTAUT extensions' importance to research as researchers have advocated into three categories. The first category emphasized the importance of some "new" technology, such as knowledge-sharing systems (Bourdon & Sandrine, 2009), collaboration technology (Brown et al., 2010), e-government services (e.g., McLeod et al., 2009), and IT for consumers (e.g., Venkatesh et al., 2012). The second category included studies that were motivated by the importance of some higher-level contextual factors, such as culture (e.g., Al-Gahtani et al., 2007; Dasgupta & Gupta, 2011; Im et al., 2011), organizational facilitations (Park et al., 2011), leadership (Neufeld et al., 2007), and team climate (Liang et al., 2010).⁶ Finally, only a handful of studies were more theory driven. For example, two studies focused on the importance of theoretical advancement in re-conceptualizing technology use in UTAUT (Venkatesh et al., 2008; Lallmahomed et al. 2013). Following the motivations above, most UTAUT extensions mainly established their novelty by making changes to UTAUT (e.g., Sun et al., 2009; Venkatesh & Zhang, 2010). In terms of parsimony, most studies reduced or omitted the complexity of the higher-order moderations in UTAUT (e.g., Al-Gahtani et al., 2007; Sun et al., 2009). However, some studies further increased the number of associations (e.g., Brown et al., 2010; Liew et al. 2014; Venkatesh et al., 2012). Finally, most UTAUT extensions still followed the micro formulation with only one exception—Park et al. (2011), who modeled organizational facilitating conditions at the group level (i.e., a meso formulation). In summary, motivated by the importance of new technologies, higher-level contextual factors, and theoretical advancement, UTAUT extensions again mainly made incremental changes to UTAUT as a whole with mixed progress toward parsimony and only one meso-level formulation.

The above analysis indicates that the UTAUT literature basically followed the "UTAUT paradigm" and took the relatively easier approach to novelty by adding new mechanisms (i.e., constructs and associations) to UTAUT (e.g., Venkatesh et al., 2012) or enriching established mechanisms (e.g., Bourdon & Sandrine, 2009). This approach limits the theoretical contributions' significance. Thus, we propose the need for a paradigm shift of UTAUT extensions in particular and of research on technology acceptance and use in general. To this end, we borrow the theoretical notion of contextualization (e.g., Hong, Chan, Thong, Chasalow, & Dhillon, 2014; Johns, 2006; Whetten, 2009) to further analyze contributions of the existing UTAUT literature. We adopt the contextualization approach not only because context has become one of the important theoretical lens in the IS field (e.g., Hong et al., 2014) but also based on our observation that existing UTAUT research has explicitly or implicitly referred to "new contexts" as one of the major research motivations/contributions (see the "importance" column in Table E2 in Appendix E and Appendix F). We adopt Whetten's (2009) framework of cross-context theorizing to evaluate the UTAUT literature's contributions—in particular, the distinction between contextualizing theory (theory *in* context) and theorizing about context (theory *of* context) and the distinction between contribution *of* theory and contribution *to* theory (Whetten, 2009: Table 1, p. 37). We show from our analysis that the existing UTAUT literature has mainly focused on "UTAUT *in* context" with a few theory applications that have focused on "UTAUT *of* context" (see Table 5). Based on the findings, we derive specific recommendations for future UTAUT-based research that can make more meaningful and significant contributions.

⁶ Most of these studies were formulated at the individual level with one exception (i.e., Park et al., 2011).

Table 4. Weber's (2012) Framework and Theory Evaluation of the Parts of UTAUT*

Dimensions of parts of a theory	Evaluation criteria	Evaluation of UTAUT ⁷
Constructs	<ul style="list-style-type: none"> Underlying inside-boundary class of things identified clearly. Inside-boundary attributes in general defined precisely. <p>Explanatory note: <i>A construct in a theory represents an attribute in general of some class of things in its domain. For example, performance expectancy is one attribute in general of information systems users as the class of things. Note that all user's "perceptions" (e.g., user's perception of technologies) are essentially attributes of the "user" class. For instance, "perceived system responsiveness" is a user attribute, while "system response time" is an online system attribute (Weber, 2012).</i></p>	<ul style="list-style-type: none"> Information system users in organizations <i>identified clearly</i> as the inside-boundary class of things. Ten inside-boundary attributes in general <i>defined precisely</i> (i.e., performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention, use behavior, age, gender, experience, and voluntariness of use).
Associations	<ul style="list-style-type: none"> Inside-boundary associations defined precisely. Compelling justification provided for associations. <p>Explanatory note: <i>In a static setting, an association shows that the values of one construct somehow relate to the values of another construct. For instance, high values of performance expectancy will tend to be associated with high values of behavioral intention. In a dynamic setting, an association shows a history of values for instances of one construct is conditional on a history of values for instances of another construct. For example, the rate of change of behavioral intention is conditional on the rate of change of performance expectancy.</i></p>	<ul style="list-style-type: none"> Inside-boundary higher-order moderation effects (i.e., contingent associations) <i>defined precisely</i> (i.e., H1, H2, H3, H4b, and H6⁷). <i>Compelling justifications</i> provided for the associations.
States	<ul style="list-style-type: none"> Inside-boundary states specified clearly. Outside-boundary states specified clearly. <p>Explanatory note: <i>A state of a thing is a vector of attributes in particular (i.e., a vector of attributes in general with their associated values). For instance, a state of one IS user at T1 in the empirical test of UTAUT is depicted as:</i></p> <p>use = 2 hours per day intention = 6 performance expectancy = 5 effort expectancy = 3 social influence = 4 facilitating conditions = 7 age = 36 gender = male experience = post-training voluntariness of use = mandatory.</p>	<ul style="list-style-type: none"> Although UTAUT does not explicitly specify the inside-boundary and outside-boundary states, it incorporates voluntariness of use, social influence, and facilitating conditions to explain a <i>general state space that includes most instances in the organizational setting</i> (e.g., while a user may have low performance efficacy, low effort efficacy, and, thus, low intention, the user's use can be high due to high social influence and/or high facilitating conditions and/or mandatory conditions).
Events	<ul style="list-style-type: none"> Inside-boundary events specified clearly. Outside-boundary events specified clearly. <p>Explanatory note: <i>An event of a thing is a change from one of its states to another of its states. For instance, at T2 in the empirical test of UTAUT, the state of the user (from the row above) changes to:</i></p> <p>use = 3 hours per day intention = 7 performance expectancy = 6 effort expectancy = 5 social influence = 4 facilitating conditions = 7 age = 36 gender = male experience = 1 month voluntariness of use = mandatory.</p>	<ul style="list-style-type: none"> As UTAUT is essentially a static theory, it does not specify the inside- and outside-boundary events.
<p>* We adopted the evaluation criteria from Weber (2012) to systematically assess UTAUT. We each independently evaluated UTAUT following Weber (2012) and reached a consensus with each evaluation criterion. Table 4 summarizes our evaluation of the parts of UTAUT.</p>		

⁷ Please refer to Appendix D for all the hypotheses of UTAUT.

Table 5. Weber's (2012) Framework and Theory Evaluation of UTAUT as a Whole*

Dimensions of the theory as a whole	Evaluation criteria	Evaluation of UTAUT
Importance	<ul style="list-style-type: none"> • Importance to practice. • Importance to research (citation evidence). 	<ul style="list-style-type: none"> • UTAUT is <i>important to practice</i> because individual technology acceptance and use in organizations is important to IT business value. • UTAUT is <i>important to research</i> as evidenced by the 1,267 citations to the original paper.
Novelty	<ul style="list-style-type: none"> • New focal phenomena. • New ways to conceive existing focal phenomena. • New and important changes made to an existing theory: <ol style="list-style-type: none"> 1) Adding/deleting constructs 2) Adding/deleting associations 3) Defining constructs and associations more precisely, and 4) Specifying the boundary of the theory more precisely. 	<ul style="list-style-type: none"> • UTAUT <i>synthesizes</i> eight representative and influential research models of individual technology acceptance and use. The novelty of UTAUT mainly lies in <i>the new and important changes it makes to existing theories</i>: <ol style="list-style-type: none"> 1) It omits three constructs related to technology acceptance and use (computer anxiety, computer self-efficacy, and attitude) from the final model 2) It adds the higher-order moderation effects in the model 3) It precisely defines the moderation effects, and 4) It precisely specifies the boundary of the theory (i.e., technology acceptance and use by individuals inside organizations) as the focal phenomenon.
Parsimony	<ul style="list-style-type: none"> • Achieving a good level of explanatory power in relation to focal phenomena using a relatively small number of constructs and associations. 	<ul style="list-style-type: none"> • Although UTAUT has achieved a high level of explanatory power, its <i>level of parsimony</i> is relatively low with the large number of associations implied by the higher-order moderation effects.
Level	<ul style="list-style-type: none"> • One should formulate the theory at an appropriate level (micro/meso/macro). 	<ul style="list-style-type: none"> • UTAUT is at the micro/individual level. However, given that the focal phenomenon is individual technology acceptance and use inside organizations, a <i>meso-level formulation is also necessary</i>.
Falsifiability	<ul style="list-style-type: none"> • One should articulate the theory clearly so that it is subject to robust empirical tests. 	<ul style="list-style-type: none"> • UTAUT's parts and level are clear and precise; UTAUT is <i>subject to robust empirical tests</i>.
<p>* We adopted the evaluation criteria from Weber (2012) to systematically assess UTAUT. We each independently evaluated UTAUT following Weber (2012) and reached a consensus with each evaluation criterion. Table 5 summarizes our evaluation of UTAUT as a whole.</p>		

4.1 Cross-context Theorizing Based on UTAUT

The role of context in influencing theorizing and empirical findings has received much attention (e.g., Johns, 2006). Researchers have conceptualized context in several ways. Cappelli and Sherer (1991) defined context as the surroundings associated with and that help to illuminate a particular phenomenon. Contextual factors are, in general, located at the levels “above those expressly under investigation” (p. 56) (i.e., organizational factors constitute the context for individual members and the external environment is the context for organizations). Similarly, Mowday and Sutton (1993) characterized context as “stimuli and phenomena that surround and thus exist in the environment external to the individual, most often at a different level of analysis” (p. 198). Johns (2006) more generally defined context as “situational opportunities and constraints that affect the occurrence and meaning of organizational behavior as well as functional relationships between variables” (p. 386). Recently, Hong et al. (2014) defined the IS research context as the characteristics and usage contexts of the technology artifact and comprehensively discussed contextualizing IS research. We adopt Hong et al.'s (2014) definition of the IS research context in the current research.

To evaluate the theoretical contributions of the UTAUT literature from the contextualization perspective, we adopted Whetten's (2009) framework of cross-context theorizing. Whetten (2009) distinguishes two types of cross-context theorizing: contextualizing theory (theories in context) and theorizing about context (theories of

context). Contextualizing theory refers to the extent to which a theory explicitly accounts for relevant contextual conditions. In contrast, theorizing about context uses context effects as explanations and develops new and improved context-effects explanations (Whetten, 2009). In Whetten's (2009) view, context effects refer broadly to the set of factors surrounding a phenomenon that exert direct or indirect influence on it (see also Johns, 2006). Each type of cross-context theorizing has two types of theoretical contributions (i.e., contribution of the theory and contribution to the theory), which results in a two-by-two categorization of theoretical contributions of cross-context theorizing. Whetten (2009, p. 37) discusses the research question, purpose, method, and outcome of these four types of contributions. We employ this two-by-two categorization to analyze the contributions of UTAUT literature in the current study. Table 6 summarizes the results.

Table 6. Cross-context Theorizing of UTAUT Extensions

Type of theorizing	UTAUT in context		UTAUT of context	
Type of contribution	Contribution of contextualized UTAUT	Contribution to contextualized UTAUT	Contribution of context-effects UTAUT	Contribution to context-effects UTAUT
Purpose	Understand a new context via context-sensitive application of UTAUT.	Improve UTAUT by showing how it works differently in a new context.	Understand differences in context-specific technology acceptance and use via UTAUT and relevant context-effects theories.	Use UTAUT research results to identify new context-effects theories or to refine current context effects.
Method	To ensure the consistency of UTAUT relationships across contexts, control for context-distinguishing effects related to technology acceptance and use.	To account for observed differences in UTAUT relationships across contexts, incorporate context-distinguishing effects as interactions.	Use context-distinguishing effects as explanations added to UTAUT.	Add to the library of context effects suitable for UTAUT.
Contributions of UTAUT literature	UTAUT applications.	UTAUT extensions—new moderation mechanisms.	UTAUT integrations & UTAUT extensions—new endogenous mechanisms.	Opportunities for future research.
Example	Pynoo et al. (2011) followed the original UTAUT specification and examined technology use in three periods (i.e., user adoption, initial use, and post-adoptive use) in the digital-learning context.	Thong et al. (2011) examined ICT service type as a new moderator added to UTAUT.	Venkatesh et al. (2012) added the impacts of hedonic motivation, price value, and habit on behavioral intention and technology use as moderated by specified age, gender, and experience.	Opportunities for future research.

As Table 6 shows, the existing UTAUT literature has mainly made the first three types of cross-context theorizing contributions; namely, contribution of contextualized UTAUT, contribution to contextualized UTAUT, and contribution of context-effects UTAUT. Contextualized UTAUT research mainly comprises UTAUT applications and UTAUT extensions with new moderation mechanisms identified in our literature review. For example, Pynoo et al. (2011) followed the original UTAUT specification and examined technology use in three periods (i.e., user adoption, initial use, and post-adoptive use) in the digital-learning context. Thong et al. (2011) examined ICT service type as a new moderator added to UTAUT. Moreover, existing UTAUT literature also covered one type of context-effects UTAUT research (i.e., contribution of context-effects UTAUT). For example, Venkatesh et al. (2012) added the impacts of hedonic motivation, price value, and habit on behavioral intention and technology use as moderated by age, gender, and experience. From analyzing these studies, we note the lack of paradigm-shifting research that identifies new context-effects theories or significantly refines the current context effects and in which UTAUT is not necessarily the major component of a new theory but rather a stepping stone to identify a new theory. We believe a paradigm shift is the most promising direction for future research to make significant contributions to the UTAUT literature in particular and to research on technology acceptance and use in general.

Whetten (2009) provides two specific suggestions for the paradigm-shifting cross-context theorizing: 1) to identify multiple new context effects in a combinational configuration and 2) to add a contextual moderation (i.e., adding interactions among context effects). Accordingly, we propose two enablers. First, to help researchers identify a combination of multiple new context effects, we provide a topology of research context of technology acceptance and use based on Johns (2006) and identify some potentially new libraries/dimensions of context effects. Second, to help researchers theorize about contextual moderators, we layer different libraries/dimensions of context effects in a multi-level framework. Finally, we illustrate the application of our framework to the formulation of a research model of the impacts of transformational leadership on ERP feature use.

4.2 Research Context of Technology Acceptance and Use

We extend Johns' (2006) topology to identify eight dimensions of the context of technology acceptance and use. Johns (2006) identified seven dimensions of context at two different levels; namely, the omnibus-level context that comprises the who, where, when, and why dimensions and the discrete-level context with the task, social, and physical dimensions. Specifically, we integrate relevant IS research (e.g., Burton-Jones & Straub, 2006; Goodhue & Thompson, 1995) and adapt the seven context dimensions in Johns (2006) to be more specific to the technology acceptance and use setting; namely, user (who), location (where), time (when), rationale (why), task (task), organization (social) and environment (physical). We add one more discrete dimension (i.e., technology) to represent the IT artifact (Table 7).

One can conceptualize these eight dimensions as different classes with different attributes that are relevant to individual technology acceptance and use (Weber, 2012). More importantly, each class/dimension serves as the template for a library of context effects (i.e., attributes) (Whetten, 2009). In Section 5, we use UTAUT extensions to illustrate our conceptualization and identify future research opportunities. We discuss the eight dimensions of the research context of technology acceptance and use one by one below. Overall, based on these dimensions, our analysis suggests that the existing literature has studied four of them (environment, organization, location, and events) less than the others (see Appendix F)⁸. Following Whetten (2009), one could focus on these four categories to identify the combinations of new context effects.

First, we focus on the technology user class instead of the general organizational members to which Johns (2006) refers. Our conceptualization of technology users also extends Johns (2006) and Goodhue and Thompson (1995) to include consumers and citizens who fall outside the organizational boundary. User attributes include demographics, occupation, and user type (e.g., employees, consumers, and citizens). As Table F1 in Appendix F indicates, the existing UTAUT literature has extensively examined the user class. Studies have theorized user demographics (e.g., age, gender, experience) as moderators in the original UTAUT and later as moderating new relationships (e.g., Venkatesh et al., 2008; Venkatesh et al., 2012). Liang et al. (2010) studied physicians as an occupational group and their associated tasks (making prescriptions and conducting lab tests) to examine the impact of team climate for innovation on technology use. Consumers as a user type served as the context for the extensions in UTAUT2 (Venkatesh et al., 2012) and, in particular, for the new endogenous mechanism underlying the relationship between price value and behavioral intention. Other individual attributes of users have also served as mechanisms of UTAUT extensions. For instance, Brown et al. (2010) studied the impacts of technology experience and computer self-efficacy as the antecedents to performance expectancy and effort expectancy (i.e., new exogenous mechanisms). Several studies have also examined the impacts of computer self-efficacy on behavioral intention and use (e.g., Carter & Schaupp, 2008; Chiu & Wang, 2008).

⁸ We found that none of the UTAUT extensions explicitly addressed the roles of the environment class and rationale class and, thus, omit these two in Appendix F.

Table 7. Dimensions of the Context of Technology Acceptance and Use

Context dimension	Johns' (2006) conceptualization	Our conceptualization based on Weber (2012)
User class	Who: the occupational and demographic context.	The individuals who use technologies to assist them in performing their tasks (Burton-Jones & Straub, 2006; Goodhue & Thompson, 1995). We focus on technology users instead of the general organizational members. Technology users can be employees, consumers, or citizens with a variety of user attributes, such as their demographics and occupation.
Technology class	No such dimension.	The IT artifact that individual users use in carrying out their tasks (Burton-Jones & Straub, 2006; Goodhue & Thompson, 1995). Technology attributes mainly include the overall function and the features of different technologies in the same class and other characteristics, such as usability.
Task class	Task: autonomy, uncertainty, accountability, resources, etc.	The goal-oriented processes and tasks supported by the target technology in turning inputs into outputs (Burton-Jones & Straub, 2006; Goodhue & Thompson, 1995). Task attributes include task type, such as decision making vs. idea generation, stages of the process/sequence of tasks (e.g., software design, coding, testing) and others (e.g., autonomy, uncertainty, accountability).
Time/event class	When: the time (absolute and relative) at which the research was conducted or research events occur.	The time relative to the implementation/introduction of the target technology (i.e., adoption, initial use, and post-adoptive use) (Jasperson, Carter, & Zmud, 2005). We extend this notion by including other events, such as pre-implementation and post-implementation interventions—e.g., incentive alignment (Venkatesh & Bala, 2008).
Organization class	Social context: social density, social structure, social influence, etc.	The social context of technology acceptance and use (i.e., team, unit/division, organization, user community, informal social network, etc.) (Jasperson et al., 2005). We conceptualize the organization class as the social context of technology acceptance and use that not only includes formal organization forms, such as project teams, functional unit, business division, and the entire organization but also informal social entities, such as user communities and other informal social networks. Examples of organization attributes include team climate, organizational culture, unit leadership, and centrality of the informal social network.
Location class	Where: the location of the research site (region, culture, industry).	The location where the target technology is implemented or introduced, adopted, and used. Location attributes include various factors, such as national culture, regional economic status, and industry competition.
Environment class	Physical context: temperature, light, built environment, decor, etc.	The physical environment and conditions in which the target technology is used. Environment attributes include temperature, light, conditions of the building, etc.
Rationale class	Why: the rationale for conducting the research or collecting research data.	The rationale for conducting the research or collecting research data. Rationale attributes are typically research purposes. For example, Jawahar and Williams (1997) found that performance appraisals made for administrative purposes were one-third of a standard deviation more favorable than those made for developmental or research purposes.

Second, we add a new class (i.e., technology) to the context of technology acceptance and use to represent the IT artifact (Hong et al., 2014). Technology attributes mainly include the overall function and the features of the target technology (Burton-Jones & Straub, 2006) and other characteristics, such as usability. The target technologies served as the stimuli for UTAUT extensions in several studies. For instance, enterprise information systems (EIS) provided the context for Neufeld et al. (2007) to study the influences of charismatic leadership on UTAUT beliefs. E-government technologies involving sensitive information served as several studies' context for extensions, such as trust, risk, and privacy (Carter & Schaupp, 2008; McLeod et al., 2009; Schaupp et al., 2010). As another example, Brown et al. (2010) examined the impacts of social presence, immediacy, and concurrency of online collaboration technology on performance expectancy and effort expectancy.

Third, task attributes include task type, such as decision making versus idea generation, stages of the process/sequence of tasks (e.g., software design, coding, testing), and other characteristics (e.g., autonomy, uncertainty, accountability). Users perform a variety of tasks that new technologies support (Burton-Jones & Straub, 2006; Jaspersen et al., 2005). Thus, research has associated tasks with the target technology as the context for UTAUT extensions. For instance, Web-based learning (Web as the technology and learning as the task) both provide values (e.g., goal attainment, utility, playfulness) and incur costs (e.g., social isolation, delay in responses, risk of arbitrary learning), which, in turn, influence the use of the technology (Chiu & Wang, 2008). Similarly, electronic tax filing, electronic tax preparation, and Internet banking provide the context in which research has hypothesized trust, risk, and credibility as UTAUT extensions because users are now using the new Internet technology to perform tasks that involve sensitive information (Carter & Schaupp, 2008; Schaupp et al., 2010; Yuen et al., 2010). Most UTAUT extensions have conceptualized tasks in a general manner (e.g., learning (Chiu & Wang, 2008), organizational tasks (Sun et al., 2009), knowledge contribution (Bourdon & Sandrine, 2009)). Research has not explicitly examined task types, stages, and other characteristics. An exception is Brown et al. (2010), who included task type—idea generation and decision making—as an exogenous mechanism.

Fourth, following Weber (2012), we extend the time dimension to include events that can change attribute states over time, such as interventions that can change user perceptions about the technology (Venkatesh & Bala, 2008). UTAUT extensions typically take a relative view of time (Johns, 2006) and specify three different stages of technology acceptance and use relative to the implementation/introduction of the target technology: adoption, initial use, and post-adoptive use (Jaspersen et al., 2005). Adoption refers to the stage before and right after a target technology implementation/introduction when users make the acceptance decision based on information from training, trial usage, and other second-hand resources. Initial use refers to the stage when users begin to apply the technology to accomplish their work/life tasks. Post-adoptive use refers to the stage when users mainly engage in the feature-level use of the technology, such as using existing features, adopting new features, and initiating the extension of features. Although Jaspersen et al. (2005) focused on the post-adoptive behavior in work systems, we follow the conceptualization of system usage of Burton-Jones and Straub (2006) and extend Jaspersen et al. (2005) to other settings, such as consumers' or citizens' technology use. As Table F1 in Appendix F shows, most UTAUT extensions focused on the adoption stage (e.g., Carter & Schaupp, 2008; Eckhardt et al., 2009; Lu et al., 2009) and several studies have examined both adoption and initial use (e.g., Brown et al., 2010; Venkatesh & Zhang, 2010). A handful of studies have extended the time frame into the post-adoptive stage (e.g., Neufeld et al., 2007; Sun et al., 2009; Venkatesh et al., 2008; Venkatesh et al., 2012).

Fifth, we define the organization class as the social context of technology acceptance and use that not only includes formal organization forms, such as project teams, functional unit, business division, and the entire organization but also informal social entities, such as user communities and other informal social networks. Examples of organization attributes include team climate, organizational culture, unit leadership, and centrality of the informal social network. Several UTAUT extensions examined the impacts of some of these attributes on technology acceptance and use, such as charismatic leadership (Neufeld et al., 2007), team climate for innovation (Liang et al., 2010), and organizational culture (Bourdon & Sandrine, 2009; Dasgupta & Gupta, 2011). Although, conceptually, organization attributes function at higher levels, which influences the mechanisms at the individual level, most of the existing UTAUT extensions modeled the impacts of these factors without leveraging the levels perspective (Kozlowski & Klein, 2000). An exception is Park et al. (2011), who hypothesized organization-level facilitating conditions to affect technology adoption and moderate relationships at the individual level.

Sixth, we adapt the location class (i.e., the where dimension (industry, region, culture) in Johns (2006)) to the context of technology acceptance and use. Location attributes include various factors, such as national

culture, regional economic status, and industry competition. The existing UTAUT extensions have mainly focused on the moderating effects of national culture on the UTAUT relationships. For instance, Al-Gahtani et al. (2007) compared the results from testing UTAUT in Saudi Arabia with those in the original UTAUT study conducted in the USA (Venkatesh et al., 2003). Venkatesh and Zhang (2010) compared the UTAUT relationships between China and the USA. Im et al. (2011) examined the differences in the empirical results between a Korean sample and an American sample. Yuen et al. (2010) provided a cross-cultural comparison of UTAUT relationships between developed countries (USA and Australia) and developing countries (Malaysia). Work has not examined other location attributes (e.g., regional and industrial characteristics) in existing UTAUT extensions.

Finally, both the environment class and the rationale class have the potential to influence the theorizing and empirical findings related to technology acceptance and use. The environment class corresponds to the physical context dimension in Johns (2006), with the attributes related to physical environment and conditions (e.g., temperature, light, building) in which the target technology is used. The rationale class corresponds to the why heuristics in Johns (2006) and refers to the rationale for conducting the research or collecting data (e.g., if one surveys users to evaluate a system or conduct research). As Table F1 in Appendix F shows, we found no UTAUT extensions that explicitly addressed the roles of the environment class and the rationale class in shaping their research models.

In summary, our analysis of UTAUT extensions suggests that one can synthesize existing research along the eight classes of research context of technology acceptance and use (Hong et al., 2014; Johns, 2006). Moreover, the notions of the research context and cross-context theorizing complement our theoretical analysis of UTAUT and its extensions based on Weber (2012) and reveals that, as a first direction, future research should focus on adding libraries of new context effects from the environment, organization, location, and event dimensions (Whetten, 2009). Whetten (2009) also suggests adding contextual moderation as the second approach to contribute to context-effects theory. Thus, we present a multi-level framework to specify different libraries of context effects at different levels to facilitate the theorizing of the contextual moderation (Figure 2).

5 A Multi-level Framework of Technology Acceptance and Use

As Figure 2 shows, we propose a multi-level framework of technology acceptance and use that highlights the important areas for future research. As the middle part of Figure 2 shows, we first extend UTAUT with the theoretical mechanisms from UTAUT2 (Venkatesh et al., 2012). Individual beliefs include performance expectancy, effort expectancy, social influence, hedonic motivation, and price value that influence behavioral intention. Because price value is not relevant in organizational contexts (see Venkatesh et al., 2012), studies in such settings can omit it. Facilitating conditions and habit influence both behavioral intention and technology use. All the above relationships form the baseline model of UTAUT/UTAUT2 (as the dotted box in the middle part of Figure 2 depicts) to help researchers identify new context-effects theories or to refine current context effects (Whetten, 2009). Finally, we add the individual outcomes of technology acceptance and use to the baseline model. We omit the moderation effects of age, gender, experience, and voluntariness from the baseline model following our evaluation of the parsimony of UTAUT. Thus, we describe the baseline model only with main effects.

The baseline model: The main effects in UTAUT/UTAUT2 should serve as the baseline model of future research for parsimony and refining current context effects and/or identifying new context effects.

The lower part of Figure 2 depicts individual-level contextual factors. We merged the moderating effects of age, gender, and experience in UTAUT into the impacts of the user attributes, which the double arrows pointing from the user characteristics box to the baseline model depicts. One can expand user attributes to include other demographic variables. In addition, technology attributes, task attributes, rationale attributes, and events/time also act as contextual factors that engender different extensions (i.e., new exogenous mechanisms, new endogenous mechanisms, and new moderation mechanisms) to the baseline model.

The upper part of Figure 2 represents higher-level contextual factors. First, the physical environment surrounding individual users serves as the immediate context of technology acceptance and use. Environment attributes include lights, temperature, and so on. Second, we merged the moderation effects of voluntariness in UTAUT into the impacts of organization attributes, which the double arrows pointing from the organization-attributes box to the baseline model at the individual level depicts. One can also conceptualize social influence and facilitating conditions in UTAUT as organization attributes (Burton-Jones

& Gallivan, 2007; Park et al., 2011). Other organization attributes can include climate, organizational culture, leadership, collective technology use, and outcomes that have cross-level effects (i.e., main effects and/or moderating effects) at the individual level. Finally, location attributes (e.g., national culture, economic development, industry competition) can also serve as higher-level contextual factors that have cross-level impacts on the baseline model at the individual level. Although viewing location/organization attributes as higher-level factors is implicit in how we conduct analysis/studies across contexts (e.g., testing UTAUT in fresh contexts), we need multi-sample, multi-study research to theorize the influences of location/organization attributes in the model.

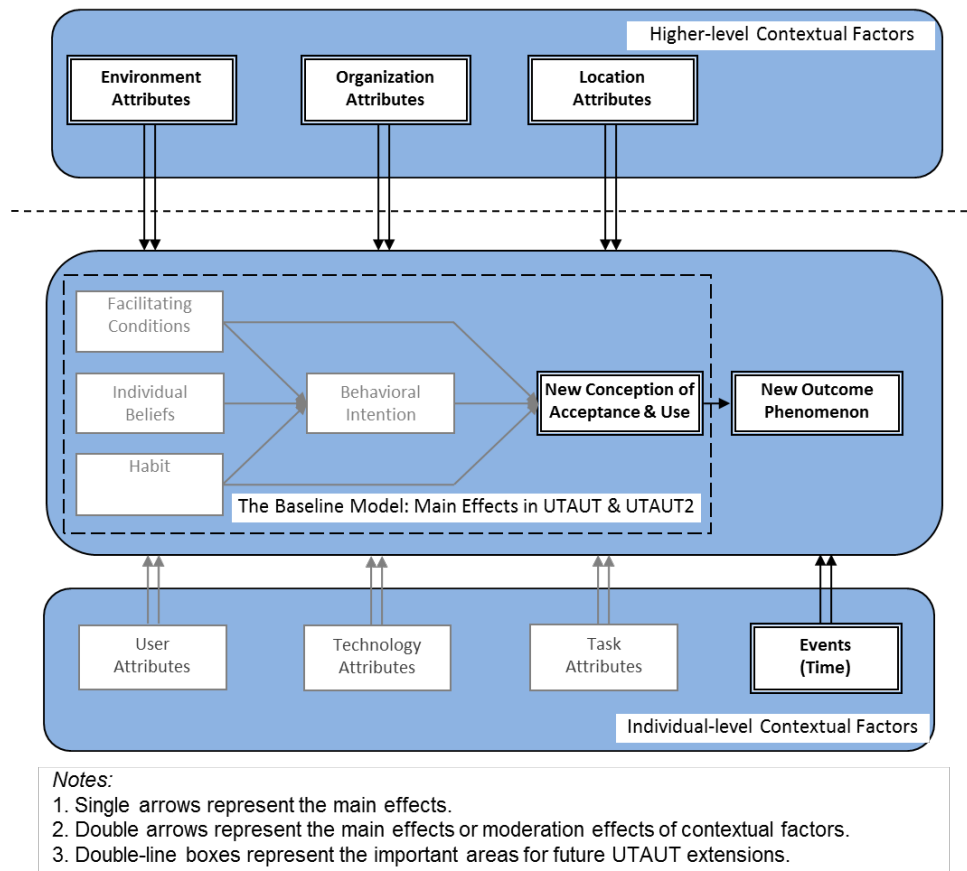


Figure 2. A Multi-level Framework of Technology Acceptance and Use

6 Recommendations for Future Research Directions

We can derive several implications from our multi-level framework—we leverage the framework to provide recommendations for future research on technology acceptance and use (as the double-line boxes in Figure 2 depicts) following Weber (2012) and Whetten (2009).

First, our framework suggests focusing on the novelty of contribution through new conceptualizations of technology acceptance and use and/or on new phenomena. Following Weber (2012), our evaluation of UTAUT extensions suggests that most studies have specified new changes to UTAUT and neglected potential extensions of UTAUT with contributions of much novelty (i.e., new focal phenomena and/or new conceptions of focal phenomena). Whetten (2009) also suggests one can make significant contributions of cross-context theorizing through either refining current context effects or identifying new context-effect theories. Thus, we believe that re-conceptualizing technology use can serve as the foundation for refining current context effects, while focusing on new phenomena facilitates the identification of new context-effects theories.

We highlight these two directions of future research in the middle part of Figure 2. One promising direction is to conceptualize technology use at the feature level and link it to individual outcomes in our framework. Technology features generally refer to the building blocks or components of the technology designed to support user tasks (Burton-Jones & Straub, 2006; Jasperson et al., 2005). Research has theorized feature-

level use, which includes both exploitation (i.e., extent to which a user exploits features of the system to perform his/her task) and exploration (i.e., search for novel or innovative ways of doing things with the technology), as a driver of individual outcomes, particularly individual task performance (Burton-Jones & Gallivan, 2007; Burton-Jones & Straub, 2006). Similarly, Jasperson et al. (2005) also conceptualized post-adoptive use as users' feature adoption decisions, feature use behaviors, and feature extension behaviors after an IT application was installed, made accessible to the user, and applied by the user in accomplishing the user's work activities. They further proposed that users' post-adoptive technology use produces the cumulative impacts on the higher-level work system performance. Thus, users' performance improves as they use features more, apply more features in their work, and find new or innovative ways of using the features. In addition to work performance, the impacts of feature-level use on other job-related outcomes (e.g., job satisfaction, organizational commitment) and consumer outcomes (e.g., brand loyalty (Xu, Thong, & Venkatesh, 2014) or users' quality of life) are worth investigating.

Although researchers consider it as an important research area, our literature review indicated that UTAUT extensions and IS research in other areas have not adequately examined the link between feature-level use and individual outcomes (see Sykes & Venkatesh, forthcoming). We found only one UTAUT extension that examined the impact of technology use on individual performance: in this study, the authors measured technology use by self-reported usage frequency (Sun et al., 2009). Other UTAUT-based studies have mainly measured technology use by usage duration, frequency, and intensity or a subset of these three measures on a self-report basis (e.g., Brown et al., 2010, Liang et al., 2010; Venkatesh et al., 2008). Several UTAUT extensions have measured technology use with one or two items on the breadth of application use. For instance, as we note elsewhere, Venkatesh et al. (2012) measured consumers' frequency of use of six different mobile applications. Al-Gahtani et al. (2007) measured use by the variety of application usage and the variety of tasks supported by IT. Similarly, IS research that linked technology use to individual impacts measured technology use mainly using duration, frequency, and intensity or a subset of the three measures. Also, research has mainly operationalized individual impact as performance. For instance, Yuthas and Young (1998) measured use as duration and volume and examined the impact of technology use on cost control performance. Goodhue and Thompson (1995) operationalized system use with perceived dependence and examined its influence on perceived performance. An exception is Burton-Jones and Straub (2006), who examined the impact of feature-level use (i.e., deep structure use) on objective task performance; similarly, Sykes and Venkatesh (forthcoming) examined the impact of deep structure use on supervisor-rated performance.

A handful of studies have measured technology use at the feature level, and we lack research on the impacts of feature-level use on the various individual outcomes. Our framework suggests that UTAUT/UTAUT2 can serve as a baseline model for future research to examine the determinants of feature-level use and the link between feature-level use and different individual outcomes. For instance, we can still refine current UTAUT beliefs and contextual factors to still serve as the determinants of feature-level use (e.g., one can refine usage experience to reflect user expertise that affects user learning about different systems features). Moreover, one can combine/organize new context effects along the different dimensions of contextual factors less explored in previous research—i.e., environment factors, location factors, organization factors, and events. For instance, organizational-level factors, such as work system interventions, can stimulate feature-level use (Jasperson et al., 2005). Furthermore, one can also identify new context-effects theories by integrating the baseline model in our framework with other theories to examine the impact of feature-level use on different individual outcomes. For example, one can integrate research on person-job fit (Edwards, 1991) with UTAUT to examine the impact of feature use on person-job fit. Thus, we note the following two recommendations for future research:

Recommendation 1: Conceptualize individual technology use at the feature level and use UTAUT/UTAUT2 as the baseline model to refine the conceptualization and measurement of the current context factors that have impacts on feature-level use.

Recommendation 2: Link feature use to different individual outcomes and use UTAUT/UTAUT2 as the baseline model to identify new context effects along the following four dimensions: environment, location, organization, and event.

In addition to refining current context effects and identifying new context effects, Whetten (2009) also suggests theorizing contextual moderations (i.e., higher-order interactions among context factors) for the contribution to context-effects theory. To facilitate this cross-context theorizing, we propose significantly enriching the specification of contextual factors at higher levels of a hierarchy—from the immediate physical environment to the intermediate social/organizational context and to the relatively remote

segment/industry/country context. Such an enrichment is also consistent with our evaluation of UTAUT and its extensions based on Weber (2012)—we lack meso-level formulations of research models. In addition to examining the impacts of different user attributes, technology attributes, and task attributes, existing UTAUT extensions have mainly theorized and tested the impacts of organizational factors such as climate, culture, and leadership at the individual level.

As Figure 2 indicates, we identified eight dimensions of the context of technology acceptance and use from existing literature and aligned them at different levels in our framework. Among them, we specified the attributes of users, technology, tasks, research rationale, and events at the individual level and environment attributes, organization attributes, and location attributes at higher levels. Note that one can break down organizations into other structures that warrant a multi-level examination (e.g., team, business unit). For instance, one can incorporate factors related to team processes and outcomes supported by technology—such as trust in teams (e.g., Sarker, Ahuja, Sarker, & Kirkeby, 2011), agility in teams (Sarker & Sarker, 2009), group polarization (e.g., Sia, Tan, & Wei, 2002), and group system interface (e.g., Sia, Tan, & Wei, 1997)—into the baseline model to study how team-level factors influence individual acceptance and use. A multi-level approach to study the impacts of contextual factors on technology acceptance and use can address several limitations of an individual-level study and delineate the impacts of the organizational factors at different levels (Burton-Jones & Gallivan, 2007; Kozlowski & Klein, 2000) and, thus, provide support for the falsifiability of the extensions (Weber, 2012).

Recommendation 3: Theorize the cross-level influences of the environment factors, the organization factors, and the location factors on feature use and individual outcomes and conduct multi-level research to empirically examine the impacts of these contextual factors.

Finally, one can also theorize a higher-order contextual moderation by incorporating the event dimension. This type of extension is also consistent with our evaluation of the “parts” of UTAUT and its extensions based on Weber (2012), which suggests a focus on time/events that change the states of the attributes of different classes of things, especially user perceptions, technology use, and outcomes over time. This type of extension will provide richer theoretical and managerial implications by transforming UTAUT from a static theory to a dynamic one. UTAUT and its extensions typically take a relative view of time (Johns, 2006) and consider the implementation/introduction of the target technology as the major event. Existing research specifies three different stages of technology acceptance and use in general: adoption, initial use and post-adoptive use (Jasperson et al., 2005). As we discuss in Section 2, most UTAUT extensions have focused on one or two of the three stages with a few exceptions. We propose focusing on examining the dynamics of user perceptions, technology use, and individual outcomes over time in future UTAUT extensions. For instance, researchers can examine the change of usage frequency and job performance across the three phases of adoption, initial use, and post-adoptive use, and theorize what contextual factors may help users learn and explore different system features more quickly. Alternatively, researchers may introduce other events, such as managerial interventions (e.g., change management strategies), as new contextual factors and investigate the effectiveness of these interventions by examining the change of user perceptions of the target technology, their use pattern, and the outcomes in both the short and long run. In this regard, one can employ latent growth modeling to empirically assess the new theoretical models (see Bala & Venkatesh, 2013 for an LGM illustration).

Recommendation 4: Incorporating time/events in the contextual moderation to examine the impacts of time/events on the change of the states of user perceptions, use patterns, and outcomes.

To illustrate our recommendations in a holistic manner, we provide a simple multi-level model below that reflects some of the key directions we identify and discuss (see Figure 3).

As Figure 3 shows, the illustrative model first focuses on a new focal phenomenon (i.e., individual job performance) as determined by feature-level technology use. This new focus augments the importance of the work to both research (the positive link between technology use and an individual outcome) and practice (individual job performance). The model also offers two new conceptions of the focal phenomenon: it conceptualizes technology use at the feature level and habit as user habit with the legacy system. Presumably, the old habit will have negative impact on the use of the new system and further inhibit the improvement of individual job performance. We introduce transformational leadership as an organization attribute at a higher level in the model. Through intellectual stimulation and inspirational motivation, transformational leadership acts will both increase users’ feature-level use and reduce the negative impact

of legacy system habit. One can test this meso-level model using HLM. One can also modify the illustrative model to incorporate the time/event class. For instance, researchers may study the change of feature-level use and job performance over time and examine the impacts of legacy system habit and transformational leadership on this process. Presumably, legacy system habit may hinder user learning and use of the features of the new system and, thus, negatively affect the slope of the learning curve, while transformational leadership may have the opposite effect. One can employ latent growth modeling to test such a model.

The theoretical contributions the above model makes from the perspective of cross-context theorizing comprise: 1) refining current context effects—legacy system habit to feature-level use, 2) adding a new library of context effects with a new focal outcome—job performance (i.e., effects from legacy system habit to feature level use to job performance and the moderation effects of transformational leadership), and 3) incorporating time/events in the contextual moderation.

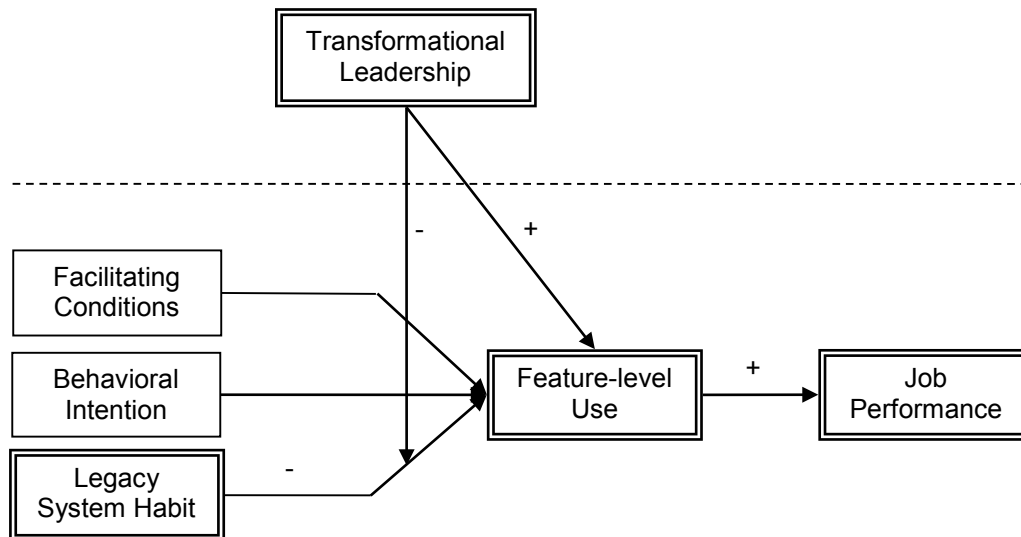


Figure 3. Impacts of Transformational Leadership on Post-adoptive Use and Performance

7 Conclusion

We comprehensively review the UTAUT literature from September 2003 until December 2014 to understand the latest developments in research on technology acceptance and use. We organize the existing UTAUT extensions into four types: new exogenous mechanisms, new endogenous mechanisms, new moderation mechanisms, and new outcome mechanisms. Moreover, we theoretically analyze the literature following Weber's (2012) framework of theory evaluation. To assess and facilitate the theoretical contributions from the UTAUT literature, we further analyze the literature based on the concept of cross-context theorizing (Whetten, 2009). We integrate the results of our theoretical analysis with eight dimensions of the context for technology acceptance and use to present a multi-level framework. This framework not only synthesizes existing UTAUT extensions but also (more importantly) highlights promising future research directions (identifying new libraries of context effects and specifying contextual moderation) to make significant theoretical contributions to the technology acceptance and use domain.

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Appendix A: UTAUT Citations over Time

Table A1. UTAUT Citations over Time

Source	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Sum
<i>MIS Quarterly</i>	1	4	6	8	3	12	7	7	5	9	10	72
<i>Information Systems Research</i>		2	6	1	3	1	2	4	6			25
<i>Journal of Management Information Systems</i>		3	1		1	1	5	4	7	1	2	25
<i>Journal of the Association for Information Systems</i>			2	8		3	4	3	7	2	3	32
<i>European Journal of Information Systems</i>		4	4	10	4	3	3	7	5	3	8	51
<i>Information Systems Journal</i>		1	1		2	1	4	2		2	2	15
<i>Journal of Information Technology</i>			2	1	1	4	2				1	11
<i>Journal of Strategic Information Systems</i>		3			4			1		1	5	14
AIS Senior Scholars' journals: subtotal	1	17	22	28	18	25	27	28	30	18	31	245
<i>ACM Transactions on Computer-Human Interaction</i>				1	1		1	1	2			6
<i>Behavior & Information Technology</i>			1	1	1	4	5	7	5	9	15	48
<i>Business Horizons</i>						1			1			2
<i>Communications of the ACM</i>				1	1	1						3
<i>Computers in Human Behavior</i>				2	4	10	16	17	15	16	45	125
<i>Decision Sciences</i>	1		3	1	3	1	1	1				12
<i>Decision Support Systems</i>			1	2	4	2	4	5	5	11	5	39
<i>Electronic Commerce Research and Applications</i>						2	3	5	2		1	13
<i>Electronic Markets</i>						3	3		2	4	3	15
<i>European Journal of Operational Research</i>									1			1
<i>Expert Systems with Applications</i>				1		3	1	5		3		13
<i>Human-Computer Interaction</i>						1						1
<i>IEEE Transactions on Engineering Management</i>		1	2	3	3	2	2	3	1		1	18
<i>IEEE Transactions on Professional Communication</i>				1			1	1				3
<i>IEEE Transactions on Systems, Man, and Cybernetics</i>					1							1
<i>Information & Management</i>		1	9	8	7	4	1	6	4	7	8	55

Table A1. UTAUT Citations over Time

Source	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Sum
<i>Information and Organization</i>					3		1			3	2	9
<i>Information and Software Technology</i>		1					2	1				4
<i>Information Research</i>					1			1				2
<i>Information Systems Frontiers</i>					4	1	4	1	2	1		13
<i>Information Systems Management</i>		1							2	2	3	8
<i>Information Technology & Management</i>							1	2		2		5
<i>Information Technology & People</i>							1	1	3		1	6
<i>International Journal of Electronic Commerce</i>		1	1	2	2		1		1	1	1	10
<i>International Journal of Human-Computer Studies</i>			4	4		4	5	1	2	3	1	24
<i>International Journal of Information Management</i>			1		2	4	3	4	4	8	9	35
<i>Journal of Collaborative Computing</i>							1					1
<i>Journal of Computer Information Systems</i>		3	2	2	9	6	4	3	4	4	7	44
<i>Journal of Database Management</i>				1		1	2					4
<i>Journal of Engineering and Technology Management</i>					1	1			1			3
<i>Journal of Global Information Management</i>		1			1	1	3		2	2	2	12
<i>Journal of Global Information Technology Management</i>							3	3		1	1	8
<i>Journal of Information Science</i>				1		1						2
<i>Journal of Organizational and End User Computing</i>							5			4	6	15
<i>Journal of Organizational Computing and Electronic Commerce</i>				1			2	1	3			7
<i>Journal of Systems and Software</i>						1	1	2	2	2		8
<i>Journal of the American Society for Information Science & Technology</i>			2		6	8	3	1	2	3		25
<i>Management Science</i>		2	3				2					7
<i>Omega</i>					1			1				2
<i>Organization Science</i>				1								1
<i>Organizational Behavior and Human Decision Processes</i>		1			1							2

Table A1. UTAUT Citations over Time

Source	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Sum
<i>Wirtschaftsinformatik</i>					1							1
Other IS journals: subtotal	1	12	29	33	57	62	82	73	66	86	112	613
<i>Proceedings of the International Conference on Information Systems</i>	2	2	11	7	12	17	21	24	15	17	9	137
<i>Proceedings of the Americas Conference on Information Systems</i>	20	15	27	31	25	41	26	35	21	16	15	272
AIS conferences: subtotal	22	17	38	38	37	58	47	59	36	33	24	409
Grand total	24	46	89	99	112	145	156	160	132	137	167	1267

Appendix B: Classification Scheme for UTAUT Citations

Table B1. Classification Scheme for UTAUT Citations

Category	Classification criteria	Examples
UTAUT application	<ol style="list-style-type: none"> 1. An empirical study that applies either part of or the complete UTAUT as its research model. 2. Excludes studies that applied TAM/TAM2/TAM3. 	Gupta et al. (2008) examined UTAUT in the context of e-government adoption in a developing country. Their research model comprised all the main effects and one moderator—gender.
UTAUT integration	<ol style="list-style-type: none"> 1. An empirical study that integrates part of or the complete UTAUT with at least one other theory. 2. Excludes studies that integrate with TAM/TAM2/TAM3. 	Hong et al. (2011) integrated UTAUT with the IS continuance model and other mechanisms (e.g., habit and personal innovativeness with IT) to examine the drivers of user acceptance of agile IS.
UTAUT extension	<ol style="list-style-type: none"> 1. An empirical study that includes part of or the complete UTAUT as the baseline model. 2. The paper must extend the baseline model with either new exogenous, endogenous, moderation, or outcome mechanisms. 3. Excludes studies that extend TAM/TAM2/TAM3. 	Neufeld et al. (2007) studied the impacts of charismatic leadership on the four UTAUT beliefs (i.e., performance expectancy, effort expectancy, social influence, and facilitating conditions), which, in turn, influenced behavioral intention and use.
General citation	Only cites the UTAUT paper in passing and does not use UTAUT in any substantial manner.	<ol style="list-style-type: none"> 1. Cite UTAUT in general discussions (e.g., Kim, 2009; Sarker & Valacich, 2010; Sarker et al., 2005); and 2. Research-in-progress papers based on UTAUT but without the empirical study (e.g., Yun et al., 2011)

Note: a paper needed to satisfy all the criteria of a particular category to be classified into that category.

Appendix C: Classification of UTAUT Citations

Table C1. Classification of UTAUT Citations

Source	General citation	UTAUT application	UTAUT integration	UTAUT extension	Sum
<i>MIS Quarterly</i>	70	0	0	2	72
<i>Information Systems Research</i>	25	0	0	0	25
<i>Journal of Management Information Systems</i>	23	0	1	1	25
<i>Journal of the Association for Information Systems</i>	31	0	0	1	32
<i>European Journal of Information Systems</i>	49	0	1	1	51
<i>Information Systems Journal</i>	14	0	1	0	15
<i>Journal of Information Technology</i>	9	0	1	1	11
<i>Journal of Strategic Information Systems</i>	13	1	0	0	14
AIS Senior Scholars' journals: subtotal	234	1	4	6	245
<i>ACM Transactions on Computer-Human Interaction</i>	6	0	0	0	6
<i>Behavior & Information Technology</i>	45	0	0	3	48
<i>Business Horizons</i>	2	0	0	0	2
<i>Communications of the ACM</i>	3	0	0	0	3
<i>Computers in Human Behavior</i>	115	3	3	4	125
<i>Decision Sciences</i>	12	0	0	0	12
<i>Decision Support Systems</i>	37	0	1	1	39
<i>Electronic Commerce Research and Applications</i>	13	0	0	0	13
<i>Electronic Markets</i>	14	0	1	0	15
<i>European Journal of Operational Research</i>	1	0	0	0	1
<i>Expert Systems with Applications</i>	12	1	0	0	13
<i>Human-Computer Interaction</i>	1	0	0	0	1
<i>IEEE Transactions on Engineering Management</i>	17	0	0	1	18
<i>IEEE Transactions on Professional Communication</i>	3	0	0	0	3
<i>IEEE Transactions on Systems, Man, and Cybernetics</i>	1	0	0	0	1
<i>Information & Management</i>	49	0	1	5	55
<i>Information and Organization</i>	9	0	0	0	9
<i>Information and Software Technology</i>	4	0	0	0	4
<i>Information Research</i>	2	0	0	0	2
<i>Information Systems Frontiers</i>	13	0	0	0	13
<i>Information Systems Management</i>	7	1	0	0	8
<i>Information Technology & Management</i>	4	0	0	1	5
<i>Information Technology & People</i>	6	0	0	0	6
<i>International Journal of Electronic Commerce</i>	10	0	0	0	10
<i>International Journal of Human-Computer Studies</i>	23	1	0	0	24
<i>International Journal of Information Management</i>	32	0	1	2	35
<i>Journal of Collaborative Computing</i>	1	0	0	0	1
<i>Journal of Computer Information Systems</i>	41	0	1	2	44
<i>Journal of Database Management</i>	4	0	0	0	4
<i>Journal of Engineering and Technology Management</i>	3	0	0	0	3
<i>Journal of Global Information Management</i>	12	0	0	0	12

Table C1. Classification of UTAUT Citations

Source	General citation	UTAUT application	UTAUT integration	UTAUT extension	Sum
<i>Journal of Global Information Technology Management</i>	7	0	0	1	8
<i>Journal of Information Science</i>	2	0	0	0	2
<i>Journal of Organizational and End User Computing</i>	15	0	0	0	15
<i>Journal of Organizational Computing and Electronic Commerce</i>	6	0	1	0	7
<i>Journal of Systems and Software</i>	8	0	0	0	8
<i>Journal of the American Society for Information Science & Technology</i>	25	0	0	0	25
<i>Management Science</i>	7	0	0	0	7
<i>Omega</i>	2	0	0	0	2
<i>Organization Science</i>	1	0	0	0	1
<i>Organizational Behavior and Human Decision Processes</i>	2	0	0	0	2
<i>Wirtschaftsinformatik</i>	1	0	0	0	1
Other IS journals: subtotal	578	6	9	20	613
<i>Proceedings of the International Conference on Information Systems</i>	136	0	0	1	137
<i>Proceedings of the Americas Conference on Information Systems</i>	257	5	0	10	272
AIS conferences: subtotal	393	5	0	11	409
Grand total	1205	12	13	37	1267

Appendix D: UTAUT Hypotheses

Table D1. UTAUT Hypotheses

H1	The influence of performance expectancy on behavioral intention is moderated by gender and age, such that the effect is stronger for men, particularly younger men.
H2	The influence of effort expectancy on behavioral intention is moderated by gender, age, and experience, such that the effect is stronger for women, particularly younger women and those younger women in the early stages of experience with the new technology.
H3	The influence of social influence on behavioral intention is moderated by gender, age, voluntariness, and experience, such that the effect is stronger for women, particularly older women and particularly in mandatory settings in the early stages of experience with the new technology.
H4a	Facilitating conditions will not have a significant influence on behavioral intention.
H4b	The influence of facilitating conditions on usage is moderated by age and experience, such that the effect is stronger for older workers particularly with more experience with the new technology.
H5a	Computer self-efficacy does not have a significant influence on behavioral intention.
H5b	Computer anxiety does not have a significant influence on behavioral intention.
H5c	Attitude toward using technology does not have a significant influence on behavioral intention.
H6	Behavioral intention does have a significant positive influence on usage.

Appendix E: Evaluation of UTAUT Extensions

Table E1. Evaluation of UTAUT Extensions: Theoretical Advancements in the Parts of the Theory

Source	Constructs	Associations	States & events	Category
Bourdon & Sandrine (2009)	Enriched attributes: social influences and facilitations.	Different types of social influences and facilitations as <i>enriched endogenous antecedents</i> to intention.	N/A	I: same user class with enriched and/or new attributes
Brown et al. (2010)	New attributes: technology characteristics, individual characteristics, group characteristics, task characteristics, and situational characteristics.	Different characteristics as <i>new exogenous antecedents</i> to UTAUT independent variables.	N/A	I: same user class with enriched and/or new attributes
Casey & Wilson-Evered (2012)	New attributes: trust and innovativeness.	Trust and innovativeness as <i>new exogenous antecedents</i> to UTAUT independent variables.	N/A	I: same user class with enriched and/or new attributes
Chiu & Wang (2008)	New attributes: computer self-efficacy, task value, and task cost as perceived by individual users.	Computer self-efficacy, task value, and task cost as <i>new endogenous antecedents</i> to intention. Computer self-efficacy as a <i>new exogenous antecedent</i> to UTAUT independent variables.	N/A	I: same user class with enriched and/or new attributes
Dasgupta & Gupta (2011)	New attribute: organizational culture as perceived by individual users.	Organizational culture as a <i>new exogenous antecedent</i> to UTAUT independent variables.	N/A	I: same user class with enriched and/or new attributes
Eckhardt et al. (2009)	Enriched attribute: social influences. New attribute: user status (adopter vs. non-adopter).	Different types of social influences as <i>enriched endogenous antecedents</i> to intention. User status as a <i>new moderator</i> of main effects.	N/A	I: same user class with enriched and/or new attributes
Liang et al. (2010)	New attribute: team climate for innovation as perceived by individual users.	Team climate for innovation as a <i>new exogenous antecedent</i> to UTAUT independent variables.	N/A	I: same user class with enriched and/or new attributes
Loose et al. (2013)	New attributes: perceived threats (business and privacy threats) and employer attractiveness.	Perceived threats as a <i>new endogenous antecedent</i> to intention. Employer attractiveness as a <i>new consequence</i> of intention.	N/A	I: same user class with enriched and/or new attributes
Neufeld et al. (2007)	New attribute: charismatic leadership as perceived by individual users.	Charismatic leadership as a <i>new exogenous antecedent</i> to UTAUT independent variables.	N/A	I: same user class with enriched and/or new attributes
Sun et al. (2009)	New attributes: perceived work compatibility and individual performance.	Perceived work compatibility as a <i>new exogenous antecedent</i> to UTAUT independent variables. Individual performance as a <i>new outcome</i> of use.	N/A	I: same user class with enriched and/or new attributes

Table E1. Evaluation of UTAUT Extensions: Theoretical Advancements in the Parts of the Theory

Source	Constructs	Associations	States & events	Category
Venkatesh et al. (2008)	New attribute: behavioral expectation. Enriched attribute: duration, frequency, and intensity of use.	Age, gender, and experience <i>moderating</i> the impacts of facilitating conditions on behavioral expectation. Experience moderating the impacts of behavioral intention and behavioral expectation on use.	N/A	I: same user class with enriched and/or new attributes
Alaiad & Zhou (2013)	User class expanded: patients. New attributes: trust.	Information security as a <i>new endogenous antecedent</i> to intention.	N/A	II: expanded user class with new attributes
Alshare & Mousa (2014)	User class expanded: consumers. New attributes: information security and espoused culture.	Information security as a <i>new endogenous antecedent</i> to intention. Espoused culture values as <i>new moderators</i> of main effects.	N/A	II: expanded user class with new attributes
Borrero et al. (2014)	User class expanded: students. New attributes: technology readiness.	Technology readiness as a <i>new moderator</i> of main effects.	N/A	II: expanded user class with new attributes
Carter & Schaupp (2008)	User class expanded: citizens. New attributes: trust, self-efficacy, and experience.	Trust, self-efficacy, and experience as <i>new endogenous antecedents</i> to intention.	N/A	II: expanded user class with new attributes
Lallmahomed et al. (2013)	User class expanded: consumers. New attributes: hedonic performance expectancy.	Hedonic performance expectancy as a <i>new endogenous antecedent</i> to use.	N/A	II: expanded user class with new attributes
Liew et al. (2014)	User class expanded: citizens. New attributes: economic benefit, social benefit, ethnicity, religion, language, employment, income, education, and marital status.	Economic benefit and social benefit as <i>new endogenous antecedents</i> to use. Ethnicity, religion, language, employment, income, education, and marital status as <i>new moderators</i> of main effects.	N/A	II: expanded user class with new attributes
Lu et al. (2009)	User class expanded: consumers. New attributes: income and location.	Income and location as <i>new moderators</i> of main effects.	N/A	II: expanded user class with new attributes
Martins et al. (2014)	User class expanded: consumers. New attributes: risk.	Risk as a <i>new endogenous antecedent</i> to intention and a <i>new exogenous antecedent</i> to performance expectancy.	N/A	II: expanded user class with new attributes

Table E1. Evaluation of UTAUT Extensions: Theoretical Advancements in the Parts of the Theory

Source	Constructs	Associations	States & events	Category
McKenna et al. (2013)	User class expanded: consumers. New attributes: adaptive service components, computational service components, collaborative service components, networking service components, self-efficacy, and anxiety.	Self-efficacy and anxiety as <i>new endogenous antecedents</i> to intention. Adaptive service components, computational service components, collaborative service components, and networking service components as <i>new exogenous antecedents</i> to independent variables.	N/A	II: expanded user class with new attributes
McLeod et al. (2009)	User class expanded: citizens. New attributes: privacy, risk, and expertise (professionals vs. novices).	Privacy and risk as <i>new endogenous antecedents</i> to intention. Expertise as a <i>new moderator</i> of main effects.	N/A	II: expanded user class with new attributes
Niehaves & Plattfaut (2010)	User class expanded: citizens New attributes: income, education, and migration background.	Income, education, and migration background as <i>new moderators</i> of main effects.	N/A	II: expanded user class with new attributes
Saeed (2013)	User class expanded: consumers. New attributes: financial control, ease of navigation, online banking usage, and channel preference.	Financial control, ease of navigation, and online banking usage as <i>new endogenous antecedents</i> to intention. Channel preference as a <i>new consequence</i> in parallel to intention.	N/A	II: expanded user class with new attributes
Schaupp et al. (2010)	User class expanded: citizens. New attributes: optimism bias and perceived risk.	Optimism bias and perceived risk as <i>new endogenous antecedents</i> to intention.	N/A	II: expanded user class with new attributes
Shibl et al. (2013)	User class expanded: general practitioners. New attributes: trust in the knowledge base and involvement.	Trust in the knowledge base and involvement as <i>new endogenous antecedents</i> to intention.	N/A	II: expanded user class with new attributes
Venkatesh et al. (2012)	User class expanded: consumers. New attributes: hedonic motivation, habit, and price value.	Age, gender, and experience <i>moderating</i> the impacts of hedonic motivation, habit, and price value on intention and use, respectively.	N/A	II: expanded user class with new attributes
Wang et al. (2014)	User class expanded: user group (silent users vs. social users). New attributes: PIIT, computer self-efficacy, security, realization of one's value, and extrinsic benefit expectations.	Security, realization of one's value, and extrinsic benefit expectations as <i>new endogenous antecedents</i> to intention. PIIT and computer self-efficacy as <i>new exogenous antecedents</i> to independent variables.	N/A	II: expanded user class with new attributes

Table E1. Evaluation of UTAUT Extensions: Theoretical Advancements in the Parts of the Theory

Source	Constructs	Associations	States & events	Category
Weerakkody et al. (2013)	User class expanded: citizens. New attributes: trust of internet and trust of intermediaries.	Trust of Internet and trust of intermediaries as <i>new endogenous antecedents</i> to intention.	N/A	II: expanded user class with new attributes
Xiong et al. (2013)	User class expanded: small business owners. New attributes: job fit, attitude, self-efficacy, anxiety, and the development of small business.	Job fit, attitude, self-efficacy, and anxiety as <i>new endogenous antecedents</i> to intention. The development of small business as a <i>new consequence</i> of intention.	N/A	II: expanded user class with new attributes
Al-Gahtani et al. (2007)	New class: location (Saudi Arabia vs. USA). New attribute: culture of the location.	Culture as a <i>new moderator</i> of main effects.	N/A	III: new classes with new attributes
Im et al. (2011)	User class expanded: consumers. New class: location (Korea vs. USA). New attribute: culture of the location.	Culture as a <i>new moderator</i> of main effects.	N/A	III: new classes with new attributes
Oh & Yoon (2014)	User class expanded: consumers. New class: online information services. New attributes: trust and flow.	Trust and flow as <i>new endogenous antecedents</i> to intention; information service type as a <i>new moderator</i> of main effects.	N/A	III: new classes with new attributes
Park et al. (2011)	New class: organizations. New attribute: organizational facilitating conditions (OFC).	OFC as both a <i>new endogenous antecedent</i> to use and a <i>new moderator</i> of main effects.	N/A	III: new classes with new attributes
Thong et al. (2011)	User class expanded: consumers. New class: IT services. New attributes: IT service type (communication vs. infotainment) and user status (adoption vs. continued use).	IT service type and user status as <i>new moderators</i> of existing interaction effects.	N/A	III: new classes with new attributes
Venkatesh & Zhang (2010)	New class: Location (China vs. USA). New attribute: culture of the location.	Culture as a <i>new moderator</i> of existing interaction effects.	N/A	III: new classes with new attributes
Wang et al. (2012)	User class expanded: consumers. New classes: recommender systems and tasks. New attributes: trust, type of recommender system (collaborative filtering vs. content-based), and task type (buying hedonic vs. utilitarian products).	Trust as a <i>new endogenous antecedent</i> to intention. Type of recommender system and task type as <i>new moderators</i> of main effects.	N/A	III: new classes with new attributes

Table E1. Evaluation of UTAUT Extensions: Theoretical Advancements in the Parts of the Theory

Source	Constructs	Associations	States & events	Category
Yuen et al. (2010)	<p>User class expanded: consumers.</p> <p>A new class: location (developed vs. developing countries).</p> <p>New attributes: culture of the location; attitude, anxiety, perceived credibility, and self-efficacy of consumers.</p>	Attitude, anxiety, perceived credibility, and self-efficacy as <i>new endogenous antecedents</i> to intention. Culture as a <i>new moderator</i> of main effects.	N/A	III: new classes with new attributes

Table E2. Evaluation of UTAUT Extensions—Theoretical Advancements in the Theory as a Whole*

Source	Importance [#]	Novelty	Parsimony [^]	Level
Alaiad & Zhou (2013)	The importance of robot technology adoption in the healthcare industry.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 1 new association added.	Micro
Al-Gahtani et al. (2007)	The importance of culture difference.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Reducing UTAUT associations of higher-order moderations.	Micro
Alshare & Mousa (2014)	The importance of espoused culture.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 6 new associations added.	Micro
Borrero et al. (2014)	The importance of social networking sites (SNS) in Internet social movements.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 5 new associations added.	Micro
Bourdon & Sandrine (2009)	The importance of knowledge sharing systems.	New changes made to UTAUT: 1) Adding/deleting associations 2) Defining constructs and associations more precisely.	Omitting UTAUT associations of higher-order moderations. 6 new associations added.	Micro
Brown et al. (2010)	The importance of collaboration technology.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Reducing UTAUT associations of higher-order moderations. 20 new associations added.	Micro
Carter & Schaupp (2008)	The importance of e-government (E-file) system for citizens.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 3 new associations added.	Micro
Casey & Wilson-Evered (2012)	The importance of the online family mediation system.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 7 new associations added.	Micro

Table E2. Evaluation of UTAUT Extensions—Theoretical Advancements in the Theory as a Whole*

Source	Importance [#]	Novelty	Parsimony [^]	Level
Chiu & Wang (2008)	The importance of web-based learning system for students.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 11 new associations added.	Micro
Dasgupta & Gupta (2011)	The importance of organizational culture.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Reducing UTAUT associations of higher-order moderations. 4 new associations added.	Micro
Eckhardt et al. (2009)	The variety of workplace referents for technology adoption. The importance of human resource system.	New changes made to UTAUT: 1) Adding/deleting associations 2) Defining constructs and associations more precisely.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 5 new associations added.	Micro
Im et al. (2011)	The importance of culture difference in consumer adoption of IT.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 10 new associations added.	Micro
Lallmahomed et al. (2013)	The importance of predicting different conceptualizations of use in a hedonic volitional setting.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 5 new associations added.	Micro
Liang et al. (2010)	The importance of team climate for innovation in affecting IT use for the highly autonomous tasks performed by physicians.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to intention. 4 new associations added.	Micro
Liew et al. (2014)	The importance of social networking sites (SNS) to socio-economic benefits in developing countries.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 110 new associations added.	Micro
Loose (2013)	The importance of bring your own device (BYOD) to business.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 2 new associations added.	Micro
Lu et al. (2009)	The importance of location difference in consumer adoption of IT.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations related to use. 6 new associations added.	Micro
Martins et al. (2014)	The importance of Internet banking to banks and users.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 4 new associations added.	Micro
McKenna et al. (2013)	The importance of information service components	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 13 new associations added.	Micro

Table E2. Evaluation of UTAUT Extensions—Theoretical Advancements in the Theory as a Whole*

Source	Importance [#]	Novelty	Parsimony [^]	Level
McLeod et al. (2009)	The importance of e-government (e-tax) for citizens.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 4 new associations added.	Micro
Neufeld et al. (2007)	The importance of charismatic leadership in mitigating the changes and turbulence engendered by enterprise information systems.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 4 new associations added.	Micro
Niehaves & Plattfaut (2010)	The importance of age-divide to citizens' acceptance and use of Internet.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Reducing UTAUT associations of higher-order moderations. 12 new associations added.	Micro
Oh & Yoon (2014)	The importance of trust and flow in explaining the use of different types of information services.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 9 new associations added.	Micro
Park et al. (2011)	The importance of organization-level (here class-level) facilitating conditions to individual technology acceptance.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to intention. 8 new associations added.	Meso
Saeed (2013)	The importance of IS as a means of control activities in the context of mobile banking.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 5 new associations added.	Micro
Schaupp et al. (2010)	The importance of e-government (e-tax) for citizens.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 5 new associations added.	Micro
Shibl et al. (2013)	The importance of general practitioners' adoption of clinical DSS.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 2 new associations added.	Micro
Sun et al. (2009)	The importance of the ERP technology.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 6 new associations added.	Micro
Thong et al. (2011)	The importance of IT service type (i.e., the differences between mobile communication services and mobile entertainment services) for consumers.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Reducing UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 5 new associations added.	Micro
Venkatesh & Zhang (2010)	The importance of culture difference.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Reducing UTAUT associations of higher-order moderations.	Micro

Table E2. Evaluation of UTAUT Extensions—Theoretical Advancements in the Theory as a Whole*

Source	Importance [#]	Novelty	Parsimony [^]	Level
Venkatesh et al. (2008)	The importance of behavioral expectation in predicting different dimensions of use.	New ways to conceive focal phenomenon: technology use. New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations related to intention. Omitting UTAUT associations related to the impact of facilitating conditions on use. 17 new associations added.	Micro
Venkatesh et al. (2012)	The importance of habit, price value, and hedonic motivation in affecting consumer use of IT.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations related to voluntariness. 20 new associations added.	Micro
Wang et al. (2012)	The importance of the type of recommender system and the task type.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 9 new associations added.	Micro
Wang et al. (2014)	The importance of Enterprise 2.0 technology.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 20 new associations added.	Micro
Weerakkody et al. (2013)	The importance of intermediaries in facilitating e-government adoption and diffusion.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. 2 new associations added.	Micro
Xiong et al. (2013)	The importance of ICT to small business owners in a developing economy (China).	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 6 new associations added.	Micro
Yuen et al. (2010)	The importance of culture difference and the importance of Internet banking.	New changes made to UTAUT: 1) Adding/deleting constructs 2) Adding/deleting associations.	Omitting UTAUT associations of higher-order moderations. Omitting UTAUT associations related to use. 12 new associations added.	Micro

* Because all the UTAUT extensions are empirical studies, they satisfy the falsifiability criterion.
[#] Because we focus on the theoretical advancements in UTAUT extensions, we mainly evaluate the importance to research. Also, because studies are distributed across different years, the numbers of citations may not be an accurate metric of theoretical importance. Thus, we evaluate the importance to research mainly by the research motivation that the researchers provide.
[^] Following Weber (2012), we count the number of associations based on the number of interactions between any two attributes. Thus, a two-way interaction effect implies three associations in total (i.e., two direct/main effects and one interaction effect).

Appendix F: Context Dimensions of UTAUT Extensions

Table F1. Context Dimensions of UTAUT Extensions

Source	User	Technology	Task	Time	Organization	Location
Alaiad & Zhou (2013)	Patients	Healthcare robot		Adoption		USA
Al-Gahtani et al. (2007)	Knowledge workers	Desktop applications			Major firms	Saudi Arabia
Alshare & Mousa (2014)	A convenience sample	Mobile payment devices		Adoption		Qatar
Borrero et al. (2014)	Undergraduate students (as survey participants)	SNS (social networking sites)		Adoption and post-adoptive use		Spain
Bourdon & Sandrine (2009)	Knowledge workers	Knowledge management system	Knowledge contribution		Two high-tech and consulting businesses	France
Brown et al. (2010) ⁹	Knowledge workers	Collaboration technology (chat, videoconference, meeting notes, etc.)	Idea generation & decision making in technology design, coding, testing, etc.	Six months after training (adoption, and initial use)	One business unit in a Fortune 500 company in the high-tech sector	USA
Carter & Schaupp (2008)	Citizens	E-government (e-file system)	Filing of income tax returns	Adoption		USA
Casey & Wilson-Evered (2012)	Staff and managers	Online family mediation services	Family dispute resolution		A family consultation institution	Australia
Chiu & Wang (2008)	Part-time students	Web-based course management system	Learning		A university	Taiwan
Dasgupta & Gupta (2011)	Employees	Internet			A government organization	India
Eckhardt et al. (2009)	HR managers	CV databases		Adoption	Companies with 500 to 200,000 employees	Germany
Im et al. (2011)	Consumers	MP3 player and Internet banking				Korea vs. USA
Lallmahomed et al. (2013)	Facebook users	Social networking sites (Facebook)		Adoption	A large public university	Malaysia
Liang et al. (2010)	Physicians	Order entry system	Prescriptions and lab orders		Clinical departments in a hospital	China
Liew et al. (2014)	Facebook users	Social networking sites (Facebook)		Adoption and post-adoptive use		Klang Valley in Malaysia

⁹ We focus on Study 2 in Brown et al. (2010) as it provided results for the complete research model.

Table F1. Context Dimensions of UTAUT Extensions

Source	User	Technology	Task	Time	Organization	Location
Loose et al. (2013)	University students with business and engineering specialization	Bring Your Own Device (BYOD) services		Adoption		Germany
Lu et al. (2009)	Consumers	Mobile data services		Adoption		Urban China
Martins et al. (2014)	Students and ex-students from a university	Internet banking services		Adoption		Portugal
McKenna et al. (2013)	Consumers	A desktop simulation of a mobile service named City Wanderer mobile service	<ol style="list-style-type: none"> 1. Ticket reservation 2. Preferences and receiving automatic services. 3. Developing presence profile 4. Received local information 5. Finding something and getting directions 6. Finding nearby attractions, festivals, and events. 	Adoption		
McLeod et al. (2009)	CPAs and university students	Tax software	Tax preparation	Adoption	One professional organization and one public university	
Neufeld et al. (2007)	Managers and front-line employees	Enterprise information systems		EIS implemented in the past 18 months (adoption, initial use, and possibly post-adoptive use)	Six midsize to large manufacturing companies	Canada
Niehaves & Plattfaut (2010)	Senior citizens	Internet				Western Societies
Oh & Yoon (2014)	University students and salaried workers	e-learning Internet service and online gaming		Adoption		Seoul and Gyeonggi Province in South Korea
Park et al. (2011)	Students	Web-based course management system		Adoption	A university	
Saeed (2013)	Consumers	Mobile banking services		Adoption		
Schaupp et al. (2010)	Citizens	E-government (e-file system)	Filing of income tax returns	Adoption		USA

Table F1. Context Dimensions of UTAUT Extensions

Source	User	Technology	Task	Time	Organization	Location
Shibl et al. (2013)	General practitioners	Clinical decision support systems		Adoption		Australia
Sun et al. (2009)	Employees	ERP systems	Organizational tasks in general	ERP implemented within 3 years (adoption, initial use, and post-adoptive use)	Diverse group of industries	China
Thong et al. (2011)	Consumers	Mobile data services: communication vs. infotainment		Adoption and post-adoptive use		Hong Kong
Venkatesh & Zhang (2010)	Employees			Four periods: 1 week, 1 month, 3 months and 6 months after training (adoption and initial use)	Business unit	USA vs. China
Venkatesh et al. (2008)	Employees at all levels	A web-based front-end for informational and transactional systems		Five periods during and after the implementation within one year with 3-month intervals (adoption, initial use, and post-adoptive use)	A telecomm. firm	USA
Venkatesh et al. (2012)	Consumer	Mobile Internet services (six different applications)		Post-adoptive use		Hong Kong
Wang et al. (2012)	Undergraduate students (as experiment subjects)	Online recommendation system	Online purchase		A large university	Midwest USA
Wang et al. (2014)	Employees	Enterprise 2.0 applications		Adoption	Knowledge-intensive businesses, including three companies in the software industry and four companies in the trading industry	China
Weerakkody et al. (2013)	Citizens	E-government service provided by the traffic department		Adoption		Madinah city in Saudi Arabia

Table F1. Context Dimensions of UTAUT Extensions

Source	User	Technology	Task	Time	Organization	Location
Xiong et al. (2013)	Small business owners	ICT		Adoption	Small businesses	Zhejiang Province and Sichuan Province in China
Yuen et al. (2010)	Consumers	Internet banking service		Adoption		Developed countries (USA and Australia) vs. developing countries (Malaysia)
Note: we found no UTAUT extensions that explicitly addressed the roles of the environment class and rationale class, and, thus, we omit those two columns from the table. We obtained some of the information (e.g., countries) by contacting the authors.						

About the Authors

Viswanath Venkatesh is a Distinguished Professor and George and Boyce Billingsley Chair in Information Systems at the Walton College of Business, University of Arkansas. His research focuses on understanding the diffusion of technologies in organizations and society. For over two decades, he has worked with several companies and government agencies, and has rigorously studied real world phenomena. The sponsorship of his research has been about US\$10M. His work has appeared in leading journals in human-computer interaction, information systems, organizational behavior, psychology, marketing, medical informatics, and operations management journals. He is one of only two scholars to have published 20 or more papers in *MIS Quarterly (MISQ)*. From 2005-2014, he was the most productive in terms of publications in the premier journals in information systems (i.e., *Information Systems Research (ISR)* and *MISQ*). He is widely regarded as one of the most influential scholars in business and economics, with over 50,000 citations and about 13,000 citations per Google Scholar and Web of Science, respectively. In 2014, he was recognized by Thompson Reuters as one of only 95 high-impact scholars in business and economics (highlycited.com) based on publications from 2000 to 2012. In 2008, his *MISQ* (2003) paper was identified as a current classic by Science Watch (a Thompson Reuters' service) and, since 2009, it has been the most influential paper in one of the four *Research Front Maps* in business and economics. Since 2012, he serves as a Senior Editor (SE) at *MISQ*. From 2008 to 2011, he served as an SE at *ISR*. *MISQ* named him "Reviewer of the Year" in 1999.

James Y. L. Thong is a Chair Professor and Head of the Department of ISOM, School of Business and Management, Hong Kong University of Science and Technology. He received his PhD in Information Systems from the National University of Singapore. His research on technology adoption, e-government, human-computer interaction, computer ethics, and IT in small business has appeared in *Information Systems Research*, *MIS Quarterly*, *Journal of Management Information Systems*, and *Journal of the AIS*, among others. He has served as an associate editor for *Information Systems Research* and *MIS Quarterly*. He received the "2011 Best Associate Editor Award" from *Information Systems Research*.

Xin Xu is an Associate Professor of the Department of Management & Marketing, Faculty of Business, Hong Kong Polytechnic University. He received his Ph.D. in information system from the Hong Kong University of Science and Technology. His current research interests include IT innovation management, social media analytics, mobile computing, and human-computer interaction. His work has appeared in the leading academic journals *MIS Quarterly*, *Information Systems Research*, *Management Science*, *Information Systems Frontiers*, and *IEEE Transactions on Engineering Management*. He now serves as Associate Editor for *MIS Quarterly*.

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