

The extended Unified Theory of Acceptance and Use of Technology (UTAUT2): A systematic literature review and theory evaluation

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Abstract

The extended unified theory of acceptance and use of technology (UTAUT2) is less than ten years old and has already garnered more than 6,000 citations with extensive usage in information systems and beyond. This research employed cited reference search to systematically review studies that cited UTAUT2 originating article. Based on UTAUT2 usage, the downloaded articles were classified into four categories such as: 1) General citation, 2) UTAUT2 application, 3) UTAUT2 integration, and 4) UTAUT2 extensions. Weber's (2012) theory evaluation framework revealed UTAUT2 as a robust theory on most dimensions except for parsimony arising from the complex model. UTAUT2 extensions emerged as popular UTAUT2 utilization category as researchers extended the model with context specific variables. Finally, UTAUT2 extensions were mapped to Johns' (2006) context dimensions to identify various limitations of the existing technology adoption research and to provide multi-level framework for future researchers with libraries of context dimensions.

Keywords: UTAUT, UTAUT2, systematic review, technology adoption and diffusion, research context, citation analysis

1. Introduction

The advent of Internet and smartphones in 21st century has made information technologies an indispensable part of human life, that were mostly available only to organisational users during the late 20th century. Technology adoption and diffusion research is a mature stream of exploration within the contemporary information systems (IS) literature and IS researchers are in continuous quest to understand various factors influencing individual acceptance and use of emerging information technology (IT) (Hughes et al., 2016, 2017, 2020). This widespread research stream has witnessed assortment of research methodologies examining multitude of technologies in range of countries with the extant literature revealing numerous theories, contexts, units of analysis and research methods (Dwivedi & Williams, 2008; Choudrie & Dwivedi, 2005; Williams et al., 2009). The varying research contexts based on technology, user type, location, adoption time and task performed gave rise to many competing theories

and models. For instance, Technology Acceptance Model (TAM), Diffusion of Innovation (DoI), Theory of Planned Behaviour (TPB), and Task Technology Fit (TTF) Theory that were mostly deployed to examine assortment of adoption and diffusion-related issues (Dwivedi et al., 2006, 2007; Dwivedi and Weerakkody, 2007; Kapoor et al., 2014). Based on exhaustive review of eight dominant technology adoption models, Venkatesh et al. (2003) developed unified theory of acceptance and use of technology (UTAUT) in the organisational context emphasising on the utilitarian value (extrinsic motivation) of organisational users after elimination of similar/redundant constructs (see Venkatesh et al., 2003 for review). The rise of consumer technologies necessitated the extension of UTAUT model to consumer context emphasising on hedonic value (intrinsic motivation) of technology users. This led to incorporation of three new constructs such as hedonic motivation, price value, and habit to original UTAUT, the new extended version is popularly referred as UTAUT2. However, in UTAUT2, voluntariness of use was dropped as moderator since consumers have no organisational mandate and in many situations, consumer behaviour is voluntary (Venkatesh et al., 2012). The predictive ability of UTAUT2 theory is much higher in comparison to UTAUT; explaining about 74 percent of the variance on consumers' behavioural intention to and 52 percent of the variance in consumers' technology usage of focal technology (Venkatesh et al., 2016).

Despite UTAUT2 model recent introduction in the year 2012, it has already garnered more than 6,000 citations in Google Scholar alone spanning from IS field and beyond emphasising on its predictive ability. This provides relevance for researchers to employ UTAUT2 as theoretical lens for understanding technology adoption related issues in variety of settings either stand-alone, or in combination with other theories, or with addition of external variables. UTAUT2 studies are not confined only to the consumer user type alone. Researchers have deployed UTAUT2 to examine various users types such as "Citizens" adoption to m-health (Dwivedi et al., 2016), "nurses" willingness to home tele-health (Van Houwelingen et al., 2014). Recent outburst of mobile subscribers is fuelling the growth of information and communication technology (ICT) worldwide, mobile has become the highest scale of adopted consumer technology worldwide representing two thirds of global population reaching 5 billion unique mobile subscribers in the year 2017 covering individual technology users from all the spectrum of the society (Baabdullah et al., 2019; Gsmaintelligence, 2017; Slade et al., 2013; 2014; Tamilmani et al., 2018). This has given rise to numerous technology companies such as Apple, Alphabet, and Microsoft in the same order emerging as three topmost-valued organisations across the globe based on market capitalization (PWC, 2017). This provides exciting context for individual technology acceptance and use research and what lies ahead in future. Given UTAUT2 central role in individual technology adoption research, a systematic review of the existing UTAUT2 studies will reveal the limitations of the model and provide fruitful directions for future research. This study objective will be achieved through following steps: 1) Locating studies that cited UTAUT2 theory using cited reference search method, 2) Systematically review and classify UTAUT2 cited articles based on model usage, 3) UTAUT2 theory evaluation using Weber's (2012) framework both on the parts of the theory and as a whole, 4) Synthesise UTAUT2 extensions using Johns' (2006) context dimension to identify future research directions, and 5) finally propose a multi-level framework of technology acceptance and use with libraries of context for future research.

The remainder of this paper is structured as follows: Section 2 presents the literature review the process employed in this study. Section 3 synthesises UTAUT2 literature into various types based on its citation type. Section 4 deploys Weber's (2012) framework and Johns' (2006) context dimension to evaluate UTAUT2 theory robustness and its utilization types. Section 5

integrates frameworks in Section 4 and synthesises UTAUT2 extensions to propose multi-level framework. Section 6 provide research propositions and future research directions. Finally, the paper ends with conclusion in Section 7.

2. Literature review

This study employed combination of systematic review and “cited reference search” method for Venkatesh et al. (2012) UTAUT2 article in Scopus and Web of Science bibliographic databases from March 2012 to March 2017 (Alsudairi & Dwivedi, 2010; Gurzki & Woisetschlaeger, 2017; Pina et al., 2013; Tamilmanni et al., 2020; Toufaily et al., 2013; Waseem et al., 2018). The cited reference search for UTAUT2 returned 1320 results in total: 497 citations from Web of Science and the remaining majority of 823 from Scopus. On closer examination, 452 citations were found common among both databases resulting in 868 unique citations spread across 371 Scopus, 45 Web of Science, and 452 common citations. The next step involved screening of 868 citations for fully downloadable papers across sources including journals, conferences, and book chapters to minimise the publication bias. The screening resulted in 650 fully downloadable articles that could be broadly classified into five categories based on publication domain (with frequency) as follows: 1) Information management ABS journals (161), 2) Other journals (272), 3) AIS conferences (114), 4) Other conferences (99), and 5) Book chapter (4) (see Appendix A).

This study began examining distribution of papers with specific focus on ABS journals and AIS conferences. In terms of ABS journals, Computers in Human Behaviour (42) had the largest number for citations; Followed by International Journal of Information Management (13) at distant second, and Information Systems Research (9) at the third place. Meanwhile, all AIS conferences had almost similar number of citations, Americas Conference on Information Systems (AMCIS) (33) emerged as the leading conference with UTAUT2 cited papers. The remaining three AIS conferences International Conference on Information Systems (ICIS) (30), European Conference on Information Systems (ECIS) (27), and Pacific Asia Conference on Information Systems (PACIS) (24) were not far behind. UTAUT2 citation numbers gathered momentum from just 14 citations in 2012 to reach a maximum of 222 citations in the year 2016; UTAUT2 has already garnered 35 citations in the year 2017 up until mid of March. A similar increasing trend is observed in all the five subcategories refer to Appendix A for exhaustive summary of each ABS journal and AIS conference citations year on year.

Researchers classified the downloaded articles into four broad themes based on UTAUT2 usage such as: 1) General citation, 2) UTAUT2 application, 3) UTAUT2 integration, and 4) UTAUT2 extensions. Appendix B depicts the rules followed for classification, their categories with frequency and example. This resulted in thorough examination of 650 downloaded articles again to classify each one of them into anyone of the four UTAUT2 citation category. Initially, all authors classified articles independently, followed by comparison of results to arrive at consensus on the classification of the downloaded article into the respective category.

2.1 General citations

General citation is the major UTAUT2 citation category with 503 studies. These studies cited Venkatesh et al. (2012) paper for generic reason without using theory in substantial manner as compared to other three categories. An earlier related study on these 650 articles titled “A Systematic Review of Citations of UTAUT2 Article and Its Usage Trends” found as much as 77% of the articles cited UTAUT2 for general purpose. Meanwhile, the remaining 23%, even if they utilised UTAUT2, did so in combination with external theories with rare inclusion of moderators (Tamilmanni et al., 2017). Studies in general citation category mostly cited

UTAUT2 in the introduction section while referring to evolution of popular technology adoption theories. Two such instances of UTAUT2 general citation category are as follows with the quotes from actual studies in italics. On the first instance, Chuah et al. (2016, p. 277) cited UTAUT2 alongside other dominant technology adoption theories while examining consumer smart watch adoption as below:

“.... ..a number of theoretical models have proposed to study the user's adoption of new technologies. Examples include IDT (Rogers, 1962); UTAUT (Venkatesh et al. 2003) and its extension (Venkatesh et al. 2012)”

On the second instance Gu et al. (2014, p. 2) cited UTAUT2 right at the beginning of their manuscript while discussing individual technology acceptance of IT Innovations as in the below verse:

“Understanding individual acceptance and use of IT innovation is an important and classical research topic in information's systems research (Moore & Benbasat 1991; Venkatesh et al. 2003; Venkatesh et al. 2012)”

Other popular general citation categories include but are not limited to studies citing UTAUT2 to support their research findings without adapting constructs/measurement items from the model. One such instance, Wang et al. (2016, p. 7) cited UTAUT2 to substantiate their findings on Chinese consumer's habitual behavior towards Sina Weibo a social media platform as in below section:

“Furthermore, Sina Weibo users' habits had significant positive effects on their continuance intentions. These findings are consistent with previous work studying IS continuance (Limayem et al., 2007; Barnes and Bohringer, 2011; Venkatesh et al., 2012)”

Researchers apart from citing UTAUT2 in the introduction and findings section also cited the theory for hypothesis development, research design, while criticising TAM or UTAUT2, in the future research directions section, and justifying UTAUT2 model utilisation for a specific context (see Tamilmani et al., 2017 for full review).

2.2 UTAUT2 application

These are empirical studies that utilised only UTAUT2 constructs and its moderators in their research model either in part or as whole. In total, 24 studies fell under UTAUT2 application category. For instance, Hsieh et al. (2014) employed UTAUT2 model as is with all main and moderating effects to examine consumer use of smartphones and tablets in Taiwan; On the other hand, Mtebe et al. (2016) employed all the main effects of UTAUT2 except use behaviour and moderators' effects to examine teachers' adoption of multimedia content in Tanzanian schools.

2.3 UTAUT2 integration

UTAUT2 integration category comprises of both empirical (43 studies) and conceptual (14 studies). Studies in this category integrate entire UTAUT2 or part of the model with at least one other theory of theoretical significance in their research model. For instance, Oliveira et al. (2016) integrated Diffusion of innovations (DOI) with UTAUT2 to empirically examine consumers intention to recommend mobile payment technology in Portugal. Similarly, Rosli

et al. (2012) integrated Technology-Organization-Environment (TOE) framework with UTAUT2 and proposed conceptual model to evaluate factors influencing individual's computer-assisted auditing tools (CAATs) acceptance in public audit firms.

2.4 UTAUT2 extension

Like UTAUT2 integration's UTAUT2 extension also comprises of both empirical (65) and conceptual (1) studies. The major difference is studies in this category did not include external theories instead they included external variables through one or combination of seven mechanisms such as new exogenous, endogenous, moderation, mediation, outcome, internal or external mechanisms retaining the entire or part of the UTAUT2 as a baseline model. Such instance include but are not limited to Alalwan et al. (2017) extension of UTAUT2 with trust as the external variable to empirically examine customer's adoption to mobile banking in Jordan. Meanwhile, Alazzam et al. (2016) was the only conceptual study in this category, which extended UTAUT2 with trust in storage data as an external variable to examine medical staff's acceptance of electronic health record in Jordanian context.

In summary, the 650 downloaded articles are classified into one among the above mentioned four categories. The majority of articles fell under the general citation category comprising 503 articles. The remaining three categories together such as: 1) UTAUT2 application (24 studies), 2) UTAUT2 integration (57 studies), and UTAUT2 extensions (66 studies) comprised of 147 articles. Appendix C provides exhaustive information on distribution of papers across these four different categories. The following section discusses the findings from the last three categories that utilised UTAUT2 in detail.

3. UTAUT2 literature synthesis

Researchers in their quest to understand individual technology acceptance and use have either applied, integrated, and extended UTAUT2 across variety of settings. These could be broadly grouped into six categories such as: 1) different types of users, 2) different types of organisation, 3) different types of technology, 4) different task types, 5) different times, and 6) different locations. The first group comprises of multiple technological users in myriad settings such as employees use of technology in an organisation, consumer use of products and citizens use of various electronic government services. An example for employee user type is Stefi (2015), examination on Software developer's perspective on software component reuse in organisation. Similarly, Escobar-Rodríguez and Carvajal-Trujillo (2013) examination on consumers to understand the drivers behind airline tickets purchase is an example of consumer user type and citizens user type include Dwivedi et al. (2016) examination on citizens adoption to m-health across three countries such as USA, Canada and Bangladesh. In addition , few research investigations focused on specific type of user class such as tourists (Kourouthanassis et al., 2015), students (Escobar-Rodrguez et al., 2014), Teachers (Nistor et al., 2014) and Jobseekers (Huang & Chuang, 2016). The second group focused on different type of organisations based on the sector (e.g. Private/public organisations, manufacturing/service sector). Researchers have examined spectrum of organisations such as hospitals (Alazzam et al., 2015), schools (Mtebe et al., 2016), multinational private companies (De Oca & Nistor, 2014), private university (Wong et al., 2014) and public university (Yuan et al., 2015). The third group is on different types of technology examined ranging from as generic as Mobile Internet (Ramírez-Correa et al., 2014) and Social Networking Sites (SNS) use (Robin et al., 2016) to more specific and advanced technologies including e-government (Lallmahomed et al., 2017), mobile payments (Koenig-Lewis et al., 2015), music as a service (Wagner et al.,

2014), wearable healthcare technology (Gao et al., 2015), cloud based e-learning (Nguyen et al., 2014b) and pervasive information systems (Google Glass) (Segura & Thiesse, 2015).

The fourth group of UTAUT2 studies is based on various type of tasks performed by technology users such as teaching (Mtebe et al., 2016), learning (Ali et al., 2016), accessing electronic health record (Alazzam et al., 2015) and travelling (Himmel et al., 2016). The fifth group is on different times at which researchers examined the technology use (e.g. adoption, initial use or continuous usage). For instance, Ramantoko et al. (2015) examined consumer adoption to home digital services in Indonesia. Meanwhile, Carlsson and Walden (2016) examined young elderly usage of digital wellness applications during both adoption and initial use times. The sixth group is on different locations where the research is undertaken (e.g. Countries, cultures, economic status and so on). Researchers have employed UTAUT2 to examine technologies across countries ranging from: developed individualist Western countries like the USA (Koochikamali et al., 2015; Koochikamali et al., 2017) and the UK (Choudrie et al., 2014); Collectivist Islamic country like Jordan (Alalwan et al., 2017; Qasim & Abu-Shanab, 2016); developing countries such as Brazil (Baptista et al., 2017), China (Jia et al., 2014; Khalilzadeh et al., 2017), and South Africa (Bere, 2014). This reaffirms the generalisability of UTAUT2 model across context, countries, and culture. However, majority of the studies examined only the main effects of UTAUT2 (e.g., Alemu & Negash, 2015; Ali et al., 2016) with rare inclusion of moderators. Even in case of studies that included moderators they mostly employed only a subset of moderation effects (e.g., Yuan et al., 2015). These findings are in lines with Venkatesh et al. (2016) review on UTAUT based studies that found UTAUT moderators are rarely employed by researchers and they excluded effects of moderators while proposing multi-level framework for technology acceptance and use. This raises serious concern on the generalisability of UTAUT2 as a whole.

3.1 UTAUT2 applications literature review

This section provides literature synthesis of 24 empirical studies that applied UTAUT2 theory across range of contexts to validate all or subset of its main and moderating relationships as depicted in Appendix D. Majority of the studies applied UTAUT2 in its original context (i.e. consumer) with some studies employing them in the organisational context. Organisational context involved variety of institutions such as hospitals (Alazzam et al., 2015), schools (Mtebe et al., 2016), a large multinational company (De Oca & Nistor, 2014) and public university (Raman & Don, 2013). These organisations comprised a range of technological users such as healthcare professionals, schoolteachers, employees and pre-service teachers performing their respective tasks of accessing electronic health record, teaching using multimedia content, learning at workplace through virtual community of practice and learning through management system (MOODLE). Besides organisational users, researchers also focused on variety of consumers such as small scale farmers (Alemu & Negash, 2015), students (Kaba & Touré, 2014; Sharifi fard et al., 2016; Wong et al., 2014), young elderly people aged between 60-75 years (Carlsson & Walden, 2016). UTAUT2 application studies involved users engagement in plethora of technologies such as commodity exchange platforms (Alemu & Negash, 2015), mobile social networking sites (Guo, 2014), ReWIND: lecture capturing system (Nair et al., 2015), Mobile TV (Wong et al., 2014), branchless banking technology (Kurila et al., 2016) and Mobile Internet (Ramírez-Correa et al., 2014; Rondan-Cataluña et al., 2015). Majority of the UTAUT2 application studies examined user adoption decisions since they examined new to the market technologies in nascent stages of their product life cycle. However, few studies such as Himmel et al. (2016) and Kupfer et al. (2016) examined both consumer's adoption and use decisions of intermodal travel system and smart shower meter integrated to smartphone applications respectively. The studies in this category mostly

employed all or subset of UTAUT2 main effects with limited use of moderators. Such instances include but are not limited to Guo (2014) research on consumer mobile social networking adoption and Isa and Wong (2015) research on consumers intention to use Internet marketing. However, there were instances of UTAUT2 model being employed as such without any adaptations including its moderator's age, gender and experience to examine consumers use behaviour of smart phone and tablets (e.g., Hsieh et al., 2014). UTAUT2 model is perfect example of an oxymoron with its huge popularity as most comprehensive and cited IS theory on one hand, on the other hand the findings reveal scarce utilisation of the model on its entirety limiting the generalisability.

3.2 UTAUT2 integrations literature review

This category includes 43 empirical and 14 conceptual studies (see Appendix E) that integrated UTAUT2 model fully or partially with another model of theoretical significance. UTAUT2 empirical integration studies comprised all three major technology user types: 1) Employees, 2) consumers and 3) citizens examining range of technologies. For instance Brauner et al. (2016) integrated UTAUT2 with serious games technology acceptance model (SG-TAM) to evaluate the impact of business simulation games on improving employees overall efficacy. The consumer as a user type involved integration of Protection Motivation Theory (PMT) and Privacy Calculus Theory with UTAUT2 in order to evaluate their intention to adopt wearable health care technology devices (Gao et al., 2015). Meanwhile, citizens' adoption to e-government services in Mauritius witnessed integration e-government adoption model (GAM) and UTAUT2. The conceptual UTAUT2 integration had similar user groups as that of UTAUT2 empirical integrations. For instance, Balaid et al. (2014) developed conceptual framework to examine employee's knowledge maps adoption in software development organisation. The consumer user type involved conceptual model development through UTAUT2 integration with Service Quality Model (SQM), Expectation Confirmation Theory (ECT), and Marketing Mix Theory (MMT) to understand consumer repurchasing behaviour of mobile telecommunication services in Australia (Bhatti et al., 2016). Meanwhile, Hassan et al. (2014) integrated UTAUT2 with Privacy Calculus Theory in their preliminary study on citizens intention to use smart national identity card in Malaysia for developing a new I-P technology adoption framework. Despite the similarity between user types, UTAUT2 integration studies lacked integration of new moderating variables and very scarce utilisation of existing moderators.

3.3 UTAUT2 extensions literature review

Venkatesh et al. (2016) literature review on UTAUT classified its extensions into four types such as: new exogenous, new endogenous, new moderating, and new outcome mechanisms. This study extended them with three new mechanisms namely: new mediating, new external, and new internal mechanisms taking the total extensions count to seven for UTAUT2. Figure 1 depicts all these seven UTAUT2 extension types including the three new extensions. In total 66 studies employed UTAUT2 extensions mechanisms on 114 instances as some studies employed more than one type of UTAUT2 extensions (see Appendix F).

3.3.1 Existing UTAUT2 extensions

New endogenous mechanism emerged as the most popular extension category with 49 studies employing new antecedents on the two UTAUT2 endogenous variables (i.e. behavioural intention and use behaviour) to understand their impact. Besides the research of Marriott and

Williams (2016) that proposed conceptual model through extension of UTAUT2 with external variables such as perceived risk, trust, mobile affinity and innovativeness to examine consumer mobile shopping, the remaining 48 new endogenous mechanisms studies were empirical in nature. The instances of empirical examination of new endogenous mechanisms includes but are not limited to the extension of UTAUT2 with perceived risk in examining consumer adoption of telebanking in Jordan (Alalwan et al., 2016) and privacy concerns to explain user generated content sharing behaviour in social networking sites (Herrero & Martín, 2017). The second most popular existing UTAUT2 extension, new moderation mechanisms comprises of 15 studies that refer to effect of new moderator variables alone or in combination with existing UTAUT2 moderator's age, gender and experience on various path relationships including new relationships. Few such instances of new moderator are personal innovativeness to evaluate student's online shopping intention of agricultural products (An et al., 2016) and privacy concern to evaluate students location disclosure on social networking applications (Koohikamali et al., 2015).

New exogenous mechanism the third most popular existing extension mechanism comprised of 13 studies that involve introduction of new antecedents to the existing seven UTAUT2 exogenous variables (i.e., performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value and habit). Such instances comprises mapping of personal innovativeness and self-efficacy as antecedents of habit to evaluate consumerization of IT (Dernbecher et al., 2013) and the effect of ubiquity (UBI), unobtrusiveness (UNO) and context awareness (CAW) on multiple UTAUT2 exogenous variables to explore consumer adoption of pervasive information systems such as Google glass (Segura & Thiesse, 2015). The final existing extension category new outcome mechanism refers to addition of new outcome variables other than the existing UTAUT2 endogenous variables i.e. use behaviour and behavioural intention in research model. The four new outcome mechanisms are : 1) Job offer success in social networking sites (Buettner, 2016); 2) Satisfaction (Gerlach et al., 2014); 3) User in degree (Järvinen et al., 2016); and 4) Consumerization of IT (Dernbecher et al., 2013).

3.3.2 New UTAUT2 extensions

UTAUT2 extensions saw addition of three new extension mechanisms such as: new mediating, new external, and new internal mechanisms as mentioned in beginning of this section apart from existing four UTAUT extensions. New external mechanisms emerged as the most utilised newly added mechanism with as much as 14 studies employing relationships among new latent variables that were not part of original UTAUT2 structural model. The path relationships between perceived risk, perceived benefit, opinion leadership and attitude toward LB-SNA (Koohikamali et al., 2015) and path relationship between trust in system and perceived risk (Slade et al., 2015b) are few instances of new external mechanisms. Meanwhile, with ten studies new internal mechanisms that refer to enrichment of existing UTAUT2 latent variables through new path associations emerged as the second most popular new extensions. In this category, majority of the studies included the original link between effort expectancy (similar to perceived ease of use) and performance expectancy (similar to perceived usefulness) in the technology acceptance model (e.g., Alalwan et al., 2017; Lin et al., 2013). Apart from EE→PE path relationship, studies also witnessed enrichment of UTAUT2 latent constructs such as facilitating conditions (FC) and effort expectancy (EE) through new path relationships between FC→EE such as to examine software developer's adoption of software components (Stefi, 2015). New mediating mechanism — the final new UTAUT2 extension mechanism comprised of nine studies that witnessed inclusion of new mediating variables between the

existing UTAUT2 mediating variable behavioural intention and existing UTAUT2 exogenous variables and/or new external exogenous variables in the research model. Such instances include introduction of attitude toward electric vehicles as mediating variables to examine consumer purchase intentions of electric vehicles (Degirmenci & Breitner, 2017) and initial trust to examine consumers trust in wearable commerce (Gu et al., 2016)

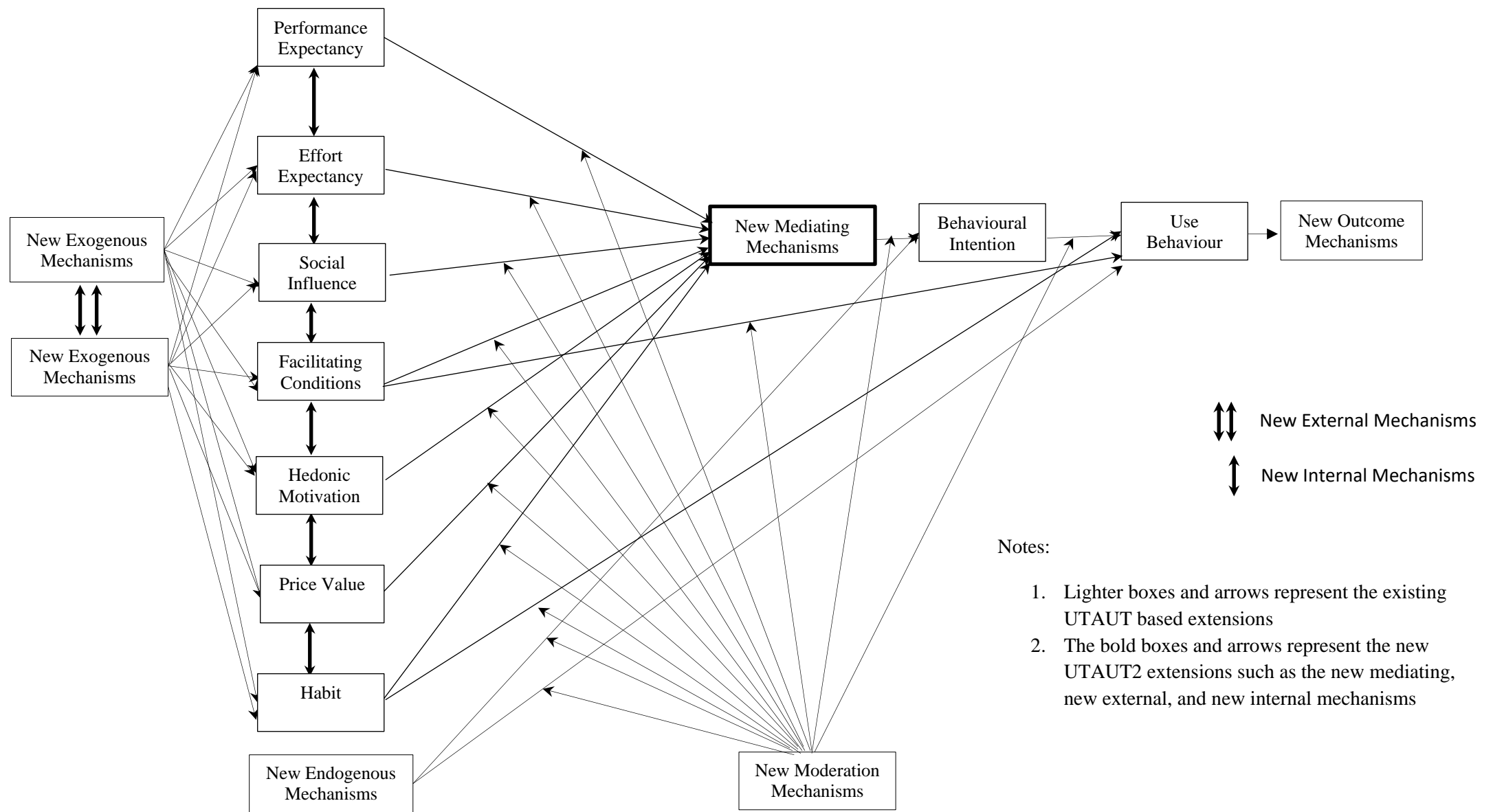


Figure 1: UTAUT2 extensions (Source: Extensions adapted from Venkatesh et al., 2012)

4. Development and evaluation of IS theories

Weber (2012) provides a systematic framework to both evaluate existing theories and develop new IS theories that align well with overall aims and objectives of this research (i.e. to evaluate robustness of UTAUT2 theory and its usage patterns). The framework is already used to evaluate popular IS theories such as virtuality and knowledge in teams (Griffith et al., 2003) and UTAUT (Dwivedi et al., 2017, 2020; Rana et al., 2016, 2017; Venkatesh et al., 2003; Williams et al., 2015) revealing noteworthy findings. UTAUT theory evaluation based on Weber's (2012) framework revealed extensions as the significant contributor to the mature IS research stream on individual technology acceptance and use (Venkatesh et al., 2016). Along the similar lines, this study on UTAUT2 theory evaluation found extensions as the major contributor with as much as 66 studies extending the theory through addition of various new external constructs and associations across the seven extension mechanisms. The theory evaluation framework of Weber (2012) comprises standards for both the parts of the theory and theory as a whole. Given the preceding discussion, this section first summaries Weber's (2012) framework and evaluates UTAUT2 theory to discover its various strengths and shortcomings. Second, this section analyses 66 UTAUT2 extensions to establish theoretical tension between the criterion prescribed in the actual framework and outcome emerging from the studies.

4.1 Theoretical assessment of UTAUT2 parts of the theory

The Weber (2012) framework for part of theory comprises four dimensions such as the constructs, the associations, the states and the events.

4.1.1 UTAUT2 constructs

In a theory, constructs represent an attribute of some class of things in general in its domain opposed to a representation of particular attribute in a specific thing. Things are either concrete (e.g. information system user) or conceptual (e.g. mathematical function). Class of things refers to things that possess at least one property in common (Weber, 2012). For instance, all individual users of social networking site "Facebook" are members of class of thing called "Facebook Users". A robust theory will clarify the meaning of an attribute and its attached class of things as a first step of theory development. Since, attributes are always attached to class of things and they do not exist as standalone. (Weber, 2012) .

UTAUT2 theory clearly articulates the inside boundary conditions on class of things extending the individual technology acceptance and use to consumers context from the organisational users context in UTAUT. The class of thing empirically examined to validate UTAUT2 model is 1512 consumers of "Mobile Internet" a specific type of technology users. Apart from class of things, the UTAUT2 precisely defined twelve-inside attributes in general including nine constructs: performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC), hedonic motivation (HM), price value (PV), habit (HA), behavioural intention (BI) and use behaviour (UB) with measurement items; and three moderators such as : age, gender and experience (see Venkatesh et al., 2012, p. 160 for model).

4.1.2 UTAUT2 associations

Associations refer to interaction among various attributes/constructs in a theory/model. The evaluation of association's parts of a theory is a two-step process. First step is to evaluate inside-boundary associations for their precise definition and second step is to evaluate whether compelling justification provided for the associations. Moreover, constructs in a theory/model may represent attributes in general of a single class or multiple class of things covering a static/dynamic or combination of both static and dynamic phenomenon (Weber, 2012).

The UTAUT2 focuses on a single class of things – “Consumer” technology adoption – under static setting where an association shows the value of one construct somehow relates to the values of another construct (Weber, 2012). For instance, in the UTAUT2 model, the higher values of hedonic motivation will tend to be associated with higher values of behavioural intention and ultimately higher values for consumer use of technology in non-organisational contexts. Meanwhile, in a dynamic setting “an association shows a history of values for instances of one construct is conditional to history of values for instance of another construct” (Weber, 2012, p. 8). The compliance of the UTAUT2 in association parts of theory evaluation is high as hypotheses (i.e. H1, H2, H3, H4(a), H4(b), and H5) provide precise definition for inside boundary association with higher order moderation effects and compelling justification for making these associations during the hypothesis development.

4.1.3 UTAUT2 states

States of a thing/class of things is a vector of attributes in particular. The quality of theories are evaluated based on their ability to specify clear and as precise as possible their state space on class of things that falls inside and outside boundary of the theory (Weber, 2012). For instance, let us assume only three constructs i.e. PE, EE and BI in the UTAUT2 model each measuring consumer use of technology on 7 point scale (with ‘1’ representing values on lower end of the scale and ‘7’ on the higher end). The conceivable state space for these three attributes contains 343 states ($7*7*7$). In such a scenario, it is straightforward to assume no consumer having values 7 or 6 for intention to use technology, will have low values for PE and EE that are both equal to or less than 2. This means, the following eight states: (7,1,1), (7,1,2) (7,2,1) (7,2,2) (6,1,1), (6,1,2) (6,2,1) (6,2,2) can be deemed unlawful, which will not occur naturally and can be attributed as outside boundary states of the model. The remaining 335 states between the three constructs are lawful representing the inside boundary states of the model.

The UTAUT2 model has twelve attributes in general associated through various combinations resulting in vast amount of conceivable state space making it nearly impossible to explicitly specify inside and outside boundary states. Although the distinction of boundary states is not explicit, the addition of hedonic motivation, price value and habit to UTAUT2 emphasizes the theory focus on consumer setting as a general state of space. For instance while consumers with low PE and EE are expected to have low intention to use mobile internet lawfully, the consumers use of mobile internet may be high due to other factors such as HM (of streaming music) and high perceived PV (of free mobile Internet from service providers) making it difficult to explicitly define the boundary conditions for state space.

4.1.4 UTAUT2 events

An event of a thing/class of things is defined as change from one of its states to the other (e.g. Consumer mobile Internet use behaviour at different time periods). Theories covering event space are evaluated based on their clear specification of inside and outside event spaces. Theories that explicitly define event spaces are prone to more empirical examinations as researchers are well equipped to reason the lawful and unlawful events occurring at different time periods during their research (Weber, 2012). UTAUT2 did not specify any inside and outside boundary events since it is predominantly a static theory.

Dimensions of parts of a theory	Evaluation criteria	Evaluation of UTAUT2 theory parts
Constructs	<ul style="list-style-type: none"> Clearly identified inside boundary class of things. Precisely defined inside boundary attributes in general. 	<ul style="list-style-type: none"> UTAUT2 identifies Consumer users of technology as the inside boundary class of things. UTAUT2 precisely defines twelve-inside attributes in general including nine constructs and three moderators.
Associations	<ul style="list-style-type: none"> Precisely defined inside boundary associations. Compelling justification provided for associations. 	<ul style="list-style-type: none"> UTAUT2 hypothesis precisely define inside boundary and higher order moderation effects associations. The explanation of hypothesis provides compelling justification for the associations
States	<ul style="list-style-type: none"> Clear specification of inside boundary states. Clear specification of outside boundary states. 	<ul style="list-style-type: none"> UTAUT2 does not specify the inside and outside states explicitly, the incorporation of new constructs such as hedonic motivation, price value, habit and omission of voluntariness of use as moderator emphasize the theory focus on consumer setting as a general state of space.
Events	<ul style="list-style-type: none"> Clear specification of inside boundary events. Clear specification of outside boundary events. 	<ul style="list-style-type: none"> UTAUT2 does not specify the inside and outside events since it is essentially a static theory.

Table 1: UTAUT2 Parts of the Theory evaluation (Source: Adapted from Weber, 2012)

4.2 Theoretical assessment of UTAUT2 theory as a whole

Weber (2012) framework to evaluate focal theory on a whole comprises five dimensions one more than the parts of the theory such as the importance, the novelty, the parsimony, the level and the falsifiability.

4.2.1 UTAUT2 importance

The degree of importance of focal phenomenon in a theory to both practitioners and researchers is the single most important factor in determining the importance/utility of a theory (Corley & Gioia, 2011; Weber, 2012). A rigorous theory with well-defined parts is of no use if the focal phenomenon is not of interest to the above two parties. UTAUT2 theory scores very high on both front appealing to practitioners since its focal phenomenon is on the burgeoning multibillion-dollar consumer technology industry with numerous interconnected technology devices, applications and services targeting this segment of technology users (Stofega and Llamas, 2009). In terms of importance to the research community, 868 citations to the paper in just five years' time is very good evidence. The above discussion underscores the importance of UTAUT2 theory to both researchers and practitioners alike.

4.2.2 UTAUT2 novelty

Weber (2003) describes the contribution of theory can be deemed novel to a discipline on three instances: 1) First, the theory focus on the new focal phenomenon not covered by prior theories, 2) Second, the theory conceives the existing well known focal phenomena in new ways as never conceived earlier, and 3) Finally, when new theory make important changes to an existing theory – through addition and/or deletion of constructs and associations, through more precise definition of existing constructs and associations or through more precise specification on the boundary conditions of the theory.

The IS adoption and diffusion research on individual technology users as focal phenomenon is one of the mature streams with majority of the studies focusing on organisation users including UTAUT, until the recent novel introduction of consumer users of technology as a new focal phenomenon in the Venkatesh et al. (2012) UTAUT2 model. The UTAUT2 does this very neatly following Locke and Golden-Biddle (1997) two rhetorical strategies on contribution of theory to research: 1) First, Venkatesh et al. (2012), structure the existing knowledge of literature systematically to carve out clear niche for their contribution to technology adoption on the consumer context; 2) Second they “subvert” or “problematize” the existing literature on individual technology adoption research for their narrow focus on organizational users primarily driven through extrinsic motivation underscoring their cognitive attributes. Thus, UTAUT2 focusing on consumer use of technology driven through intrinsic motivation underscoring both their cognitive and emotional attributes is posited as remedy to overcome the shortcomings. The UTAUT2 novelty is mainly determined through the new and important changes it makes to the existing theories: 1) It adds and precisely defines the boundary condition for non-organisational individual users of technology (i.e. consumers) as new focal phenomenon replacing the organisational users in the UTAUT; 2) It adds and precisely defines three new constructs in relation to consumers technology use (hedonic motivation, price value and habit) from existing literature into the existing UTAUT, 3) It omits voluntariness of use as moderator since consumers use of technology is completely voluntary unlike employees mandatory use of technology in organisation.

4.2.3 UTAUT2 parsimony

Parsimony is the ability of theory to achieve good level of predictive and explanatory power using relatively small number of constructs and associations. The smaller number of constructs often leads to smaller conceivable state space due to relatively smaller number of associations. This makes it easier to articulate the boundary conditions of a theory about class of things, associations, states and events of parsimonious theory (Weber, 2012).

The “small number” is a relative term; the study of Miller (1956), provides some guidelines on this front in their paper “magical number seven, plus or minus two” making researchers to consider theories with no more than seven constructs and/or associations to be parsimonious (Weber, 2012). In terms of UTAUT2, although the theory has achieved higher exploratory power in comparison to UTAUT with addition of new constructs and associations for both behavioural intention (56 percent to 74 percent) and technology use (40 percent and 52 percent). In terms of parsimony, the level is very low with higher order moderation effects making the theory more complex limiting its usage in its original form despite high predictive power.

4.2.4 UTAUT2 level

Theories are usually formulated at three different levels such as: 1) Micro level - theories focussing on narrow constrained set of focal phenomena with precisely defined associations and constructs resulting in higher explanatory power. However, narrow focus of these theories runs the risk of not being considered as important, 2) Macro level – unlike micro level, theories in this segment focus on broad range of phenomenon making the generalisability of the theory much easier. However, these theories fail to define associations precisely leading to less explanatory power and often runs into the danger of “theory of everything”, and 3) Finally, Merton and Merton (1968) argue that theories in a particular discipline should be in the “middle –range” i.e. Meso-level acting as a link between the micro and macro world. However, Boudon (1991) states the precise definition of “middle-range theories” remains problematic, as theories that are considered too high or too low in one discipline might be at appropriate level in another discipline. Thus, the judgement for appropriate level of theory formulation best lies with the researchers in their respective discipline (Weber, 2012).

“Consumers” the focal phenomenon of UTAUT2 theory is one possible class of thing out of multiple class of things under individual technology user class making UTAUT2 as a micro level theory. Apart from consumer user class, the UTAUT2 theory is used to examine various related individual user classes such as “visually impaired persons” use of tele-guidance based navigation system (Chaudary et al., 2017), “Citizens” use of e-government services (Dwivedi et al., 2016; Fakhoury & Aubert, 2015), and “students” use of Facebook for learning (Escobar-Rodríguez et al., 2014). Given the usage of UTAUT2 in examining range of consumer user types, a higher-level formulation is also necessary.

4.2.5 UTAUT2 falsifiability

Theories with well-defined focal phenomenon on the class of things and precisely defined boundary conditions for parts of the theory such as constructs associations, states and events are capable of robust empirical examinations often referred as falsifiability (Godfrey-Smith, 2009). On the other hand, in absence of precise definition for the parts and focal phenomenon in a theory, researchers are not capable to predict the context resulting in lesser empirical examination and become problematic to explain the empirical outcomes (Weber, 2012). In the case of UTAUT2 theory, precisely defined focal phenomenon and parts of the theory have resulted in robust empirical examinations. However, the main effects are subjected to rigorous testing than moderation effects, due to simplicity of associations among the attributes in general in comparison to the complex associations between the higher orders moderators.

Dimensions of the theory as a whole	Evaluation criteria	Evaluation of UTAUT2 theory as a whole
Importance	<ul style="list-style-type: none"> Focal phenomenon’s degree of importance to the practice. Focal phenomenon’s degree of importance to the research. 	<ul style="list-style-type: none"> UTAUT2 focal phenomenon “consumer” user class is of greater importance to practice with the burgeoning consumer technology industry. 868 citations for UTAUT2 within five years underscores the focal phenomenon degree of importance to the researchers.
Novelty	<ul style="list-style-type: none"> Theory should focus on new focal phenomena. Theory conceives the existing focal phenomena in new ways. 	<ul style="list-style-type: none"> UTAUT2 extended the UTAUT model developed for individual technology acceptance in organization’s context. The novelty of UTAUT2 mainly lies conceiving the existing focal

	<ul style="list-style-type: none"> • New theory make important changes to the existing theory in following ways: • Addition/deletion of constructs. • Addition/deletion of associations. • Defining constructs and associations more precisely, and • Specifying the boundary conditions of the theory more precisely. 	<p>phenomenon of individual technology acceptance in new context (i.e., Consumers). In doing so it makes new and important changes to the existing theories:</p> <ul style="list-style-type: none"> • UTAUT2 theory omits voluntariness of use as moderator from UTAUT since consumers use of technology is completely voluntary • UTAUT2 added three new constructs pertaining to consumer use of technology (hedonic motivation, price value and habit). • UTAUT2 theory precisely defines the association among the constructs through its robust hypothesis • UTAUT2 theory precisely specify the boundary of the theory (i.e., Consumers - non organizational individual users of technology) as new focal phenomenon
Parsimony	<ul style="list-style-type: none"> • Ability of theory to achieve good level of predictive and explanatory power in relation to the focal phenomenon using a relatively small number of associations and constructs. 	<ul style="list-style-type: none"> • Although UTAUT2 has achieved higher exploratory power for both behavioral intention (56 percent to 74 percent) and technology use (40 percent and 52 percent) in comparison to UTAUT. The addition of new constructs and associations with higher order moderation effects has resulted in relatively low parsimony for UTAUT2.
Level	<ul style="list-style-type: none"> • Scholars must formulate theories at appropriate level such as (micro/meso/macro) with respect to their discipline. 	<ul style="list-style-type: none"> • UTAUT2 is formulated as “micro level” theory with “consumers” as focal phenomenon. Given the broad related individual use of technology user class such as students and citizens(Rana et al., 2013; Weerakkody et al., 2007, 2009, 2017), a higher-level formulation is also necessary.
Falsifiability	<ul style="list-style-type: none"> • Theories with well-articulated parts and precisely defined parts are subject to robust empirical examinations. 	<ul style="list-style-type: none"> • The robust empirical examination of UTAUT2 is testimony of its well-articulated focal phenomenon and parts of the theory.

Table 2: UTAUT2 theory evaluation as a whole (Source: Adapted from Weber, 2012)

UTAUT2 theory evaluation results based on Weber (2012) framework suggest the theory is of high quality. UTAUT2 scores high in parts of the theory, with well-articulated focal phenomena, attributes in general and the associations among the constructs. Meanwhile, the states and events parts of UTAUT2 perform relatively less due to absence of boundary condition and high conceivable space. Meanwhile in terms of theory as a whole, UTAUT2 scores high on importance, novelty and falsifiability out of the total five dimensions. UTAUT2 focal phenomenon consumer use of technology a burgeoning multibillion-dollar underscores the importance, introduction of emotional attributes and higher order moderators to balance otherwise a largely cognition based UTAUT2 brings novelty and the theory is subject to robust empirical examination (refer Table 2). Despite the above-mentioned advantages, the UTAUT2 theory as a whole has two shortcomings: 1) parsimony – the theory scores relatively low on this dimension with complex associations among the attributes and their higher order moderators; and 2) the theory solely focuses on the individual users of technology and lacks higher-level formulation in the model.

This study as outlined in beginning of this section used Weber (2012) framework not only to evaluate UTAUT2 theory but also the 66 studies that extended the theory referred as UTAUT2 extensions. The preceding theoretical evaluation of UTAUT2 reveal the theory is of high quality on both parameters of theory evaluation *the parts of the theory* and *theory as a whole*. Paradoxically, the comprehensive nature of UTAUT2 theory coupled with the benefits that are

seen as emerging from theoretical evaluation has limited the number of studies to develop the UTAUT2 model further. Thus, hampering theory development in individual technology adoption arena.

Appendix G divulges the advancements emerging from UTAUT2 extension theoretical evaluation on both the parameters *UTAUT2 parts of the theory* and *UTAUT2 theory as a whole* based on Weber (2012) theory evaluation framework. The UTAUT2 extensions evaluation on parts of theory saw emergence of three broader categories: Type I, Type II and Type III as seen from Table G1. Type I is the largest category with 39 studies and they all focused on same user class as in UTAUT2 (i.e. Consumers) and extended the theory with addition of new attributes such as Self-efficacy, Trust (e.g., Alalwan et al., 2015) and/or enriching existing attributes such as Performance expectancy, Effort expectancy (e.g., Alalwan et al., 2017; Hew et al., 2015; Wong et al., 2015). The second largest category Type II comprised of 23 studies. Apart from adding new and/or enriching existing attributes as in Type I, studies in Type II category extended the boundary of consumer user class in UTAUT2 to include user types such as Citizens (e.g., Fakhoury & Aubert, 2015), Students (e.g., Hajli & Lin, 2016; Koohikamali et al., 2015), Nurses (e.g., Van Houwelingen et al., 2014). The final category Type III witnessed studies incorporating new classes and their attributes to extend UTAUT2. This was the smallest category among all comprising of only four studies. Three out of four studies introduced more than one location as a new class to evaluate Individuals adoption and use of range of technologies such as mobile health (Dwivedi et al., 2016), Instagram (Järvinen et al., 2016), and informal learning (Lai et al., 2016). The final study in this category Indrawati and Primasari (2016) introduced consumer goods organisations as new user class to examine organisation adoption of digital media advertising. In total, the parts of UTAUT2 extensions have made only incremental expansion to the classes, attributes and associations of the UTAUT2 theory.

Table G2 depicts UTAUT2 extensions evaluation results on theory as whole. The importance of UTAUT2 extension studies emerge from the myriad technologies under investigation having burgeoning user class of consumers and its variants as focal phenomenon. The important technologies examined range from as simple as mobile Internet (Baabdullah et al., 2015; Fuksa, 2013) to as advanced as tele-guidance based navigation system use of visually impaired and blind persons (Chaudary et al., 2017) for exhaustive list refer to importance column in the Table G2. The novelty of UTAUT2 extension studies is primary driven by their changes to the UTAUT2 model through addition/deletion of attributes and associations. In terms of parsimony, majority of the UTAUT2 extension studies reduced/omitted higher order moderators and their complex associations from the UTAUT2 theory (Abed et al., 2015; Fakhoury & Aubert, 2015), the parsimony column in Table G2 provides comprehensive analysis of all UTAUT2 extension studies and their modifications to UTAUT2 model in their quest to achieve parsimony. Finally, majority of UTAUT2 extensions focused on individual user class of things as a focal phenomenon following the micro level formulation as the original UTAUT2 theory. Indrawati and Primasari (2016) research focusing on consumer goods organisation as new user class of thing is a lone exception to form a meso-level formulation. In summary, UTAUT2 extensions as whole, once again made only incremental changes to the UTAUT2 theory motivated by the importance of myriad new technologies, omitting complex associations/attributes for higher parsimony with one meso-level formulation.

The preceding discussion on UTAUT2 extensions evaluation on parts of theory and theory as a whole reveal their relatively easier approach to the theoretical advancements of UTAUT2. These studies introduced novelty to UTAUT2 through addition of new mechanisms or enriching established mechanisms. In other words, the UTAUT2 extensions followed the

“UTAUT2 paradigm” failing to make significant theoretical advancements adding fuel to the paradox debate of UTAUT. There is need for paradigm shift in the field of individual technology acceptance and use research to address these growing concerns surrounding new theory development and advancements of existing theory. In order to address above shortcomings, this study adopted the contextualisation approach of Johns (2006) that is becoming more popular in the IS field (Hong et al., 2013; Venkatesh et al., 2016) to evaluate UTAUT2 extensions. To that extent majority of the UTAUT2 extension studies have explicitly or implicitly referred “new contexts” as one of their major motivations for conducting research (refer to “Importance” column in Table G2 in Appendix G). The evaluation of UTAUT2 extensions using contextualization lens is expected to unfold recommendations for future UTAUT2 research that can make contributions that are more significant.

4.3 Contextualization of UTAUT2 extension studies

This section extends Johns (2006) seven dimensions of context with a view to identify multiple new contexts and to potentially provide a new topology having libraries of context for researchers in the technology acceptance and use arena. Johns (2006) recognized seven ways of contextualizing research at two different levels chiefly, the omnibus-level comprising who, where, when, and why context dimensions grounded in journalistic practice and the discrete level comprising task, social and physical context dimensions grounded in classic social physiology (see Johns, 2006 for review). This study adapted Johns (2006)’s framework with seven different dimensions such as: 1) user (who), 2) location (where), 3) time (when), 4) rationale (why), 5) task, 6) Organisation (social), and 7) environment (physical) to the technology acceptance and use context . These seven dimensions were then extended with addition of a new dimension called “technology” at the discrete level representing the specific type of information technology artefact examined in the studies to provide new the topology of context dimensions for technology acceptance and use (refer Table 3). These eight different context dimensions can be categorized into eight different classes based on Weber (2012), as class represent unique attributes of individual technology acceptance and use. These eight-dimensional classes are mapped to UTAUT2 extensions to propose multi-level framework in Section 5. The below section provides discussion on each of the eight context dimensions.

Context dimension	Conceptualization of John’s (2006)	Conceptualization of this study based on Weber (2012)
User class	Refers to “who” heuristics and focuses on the occupation and demographic characteristics of focal phenomenon	UTAUT2 focal phenomenon is Consumer class of individual technology users. This study focuses on all class of individuals such as citizens, employees, and students without restraining itself to the consumer class of technology users.
Technology class	No such dimension	This represents the range of information technology artefacts used by individuals to accomplish their tasks (Hong et al., 2013). The IT artefacts with unique technological characteristics enabled researchers to extend UTAUT2 mostly with privacy and security related variables.
Task class	This discrete context “task” refers to autonomy, uncertainty, accountability, resources. etc.	This represents the range of tasks performed by individuals while accessing various IT artefacts to attain their desired outcome. Task attributes include task type such as payment, learning, scientific collaboration, location disclosure to name a few among others (e.g., autonomy, uncertainty, accountability)
Time/event class	Adapted from “when” heuristic	The implementation/introduction of focal technology relatively determines the examination time for UTAUT2 extensions research

	“Time” refers to period of research conducted or when the research events occur.	(e.g., adoption, initial use and post adoptive use) (Jasperson et al., 2005; Johns, 2006). UTAUT2 extensions mostly examined focal technologies at adoption stages followed by researchers focusing on combination of different time intervals.
Location class	Adapted from “where” heuristic “Location” refers to the research site (region, culture, industry)	Location refers to the place where introduction, adoption and usage of focal technology happens. Unique location attributes such as national culture, industry competition and regional economic status served as rich context for researchers to extend UTAUT2.
Organization class	Refers to the social context at discrete level such as social density, social structure, and social influence etc.	The social context of technology acceptance and use comprises of informal social entities such as user communities, social networks and functional groups (Kizgin et al., 2020; Tamilmani et al., 2018; Venkatesh et al., 2016). Majority of the UTAUT2 extensions failed to leverage organization context since the theory focus is on consumer context. However, there are instances of studies that introduced organizational attributes such as company and product characteristics as moderators in their research.
Environment class	Refers to the physical context: temperature, light, built environment, décor etc.	Environment refers to the physical environmental conditions of focal phenomenon under investigation such as light, temperature, conditions of the building etc. No existing UTAUT2 studies. Opportunities for future research.
Rationale class	Adapted from “why” heuristic refers to rationale for conducting the research or collecting data for the research.	Rationale refers to the reason for conducting the research or collecting research data. No existing UTAUT2 studies. Opportunities for future research.

Table 3. Technology acceptance and use context dimensions (Source: Dimensions adapted from Venkatesh et al., 2016)

The first context dimension “User class” focuses on “who” heuristics of Johns (2006) referring to the occupation and demographic characteristics of focal phenomenon. This study adapted and extended Omni-bus level context “who” to include users of all forms of technology (e.g., consumers, citizens, and employees) without restraining only to the focal phenomenon of UTAUT2 (i.e. consumers). In doing so, this study included individual technology users such as teachers, nurses and software developers who are outside the boundary condition of consumers. In addition, there are studies that introduced new demographic attributes as moderators apart from the existing moderators (age, gender, and experience) of consumer user class in the UTAUT2 model. Few such instances include introduction of “marital status” as moderator to examine student’s mobile learning (Bere, 2014), “profession” as moderator to examine consumer purchase intention of electric vehicles (Degirmenci & Breitner, 2017) and “education level” as moderator to evaluate consumer use of e-learning (Nguyen et al., 2014b; Nguyen et al., 2014c). Occupational group as user class comprised of studies evaluating “Software developers” adoption level to reuse the software components (Stefi, 2015) and “nurses” willingness to use home tele-health (Van Houwelingen et al., 2014). The extended user class “citizen” served as context for addition of waiting time and self-concept as new endogenous variables to UTAUT2 dependent variables for evaluating citizens adoption to m-health (Dwivedi et al., 2016). Besides the above mentioned attributes, other individual attributes such as “novelty seeking” and “information sensitivity” served as exogenous extension on various UTAUT2 independent variables for evaluating consumer value co-

creation in hotels (Morosan & DeFranco, 2016a) and their intention to use Biometric e-gates in airports (Morosan, 2016) respectively.

“Technology class” the newly added second dimension of context represents various information technology artefacts that individual users utilized to perform their tasks (Hong et al., 2013). The information technology attributes determine distinct features of the focal technology such as usability, overall functioning and performance of the focal phenomenon (Burton-Jones & Straub Jr., 2006). The focal technologies under examination served as the motivation for addition of external variables to UTAUT2 through various extension mechanisms. Studies involving financial technologies (Fintech) applications mostly extended UTAUT2 with trust and privacy-based constructs as they dealt with monetary transactions. For instance, Morosan and DeFranco (2016b) added general privacy, system-related privacy and perceived security as new endogenous variables to examine consumer intentions to use ‘Near Field Communications (NFC)’ mobile payments in hotels. Meanwhile, Slade et al. (2015a) research extended UTAUT2 with addition of perceived risk and trust in provider as new endogenous mechanism to explore consumer adoption of proximity mobile payments. Finally, Buettner (2016)’s research examined “working professionals” job search through career oriented social networking sites and extended UTAUT2 with radically new outcome variable “Job offer success” and unique external technological variables attributable to social networks such as number of contacts.

The third context dimension “Task class” a discrete level adaptation from Johns (2006) refers to various tasks (e.g., learning, performing financial transactions, purchase) carried by individuals while engaging with information technologies. The IT artefact supports various tasks and goal-oriented processes to turn the inputs into outputs (Burton-Jones & Straub Jr, 2006; Jasperson et al., 2005). Despite the various tasks of users such as payment and learning while accessing focal technologies majority of the UTAUT2 extensions neither mentioned them explicitly as seen from Appendix H nor utilized them as independent variable. However, studies on scientific diffusion (Arcila Calderón et al., 2015) and social networking application (Koohikamali et al., 2015) are exception to this trend with introduction of specific task types “scientific collaboration” and “location disclosure” respectively as determinants of individual technology adoption and use.

The fourth context dimension “Time/event class” comprising “Time” adapted from “when” heuristic of Johns (2006) was extended to include “events” from Weber (2012) to capture the change of attribute states in focal phenomenon over time. UTAUT2 extensions utilized time as relative term with studies examining individual users of technology at three different time intervals such as adoption, initial use and post adoptive use (Jasperson et al., 2005; Johns, 2006). The first stage “adoption” refers to the time right before and after technology implementation/introduction, when individuals make decision of using particular technology based on the information available on trial usage, training, and other secondary facilitating resources (e.g. webinar, YouTube videos, and online communities). The second stage “initial use” refers to the time, when individual users start to engage in technology for accomplishing their tasks at their home/work (Venkatesh et al., 2016). The final stage “post-adoptive use” refers to the time period when individuals apart from engaging in existing features, start to learn new and extended features of technology (Jasperson et al., 2005; Venkatesh et al., 2016). As seen from Appendix H, firstly majority of the researchers focused on users at the “Adoption” stage in as much as 38 studies mostly examining emerging technologies such as mobile payments (De Kerviler et al., 2016; Morosan & DeFranco, 2016b), e-government (Fakhoury & Aubert, 2015; Krishnaraju et al., 2016) and podcasting in higher education (Lin et al., 2013). Secondly, 24 studies examined users of technology both during the adoption and

initial use stage (e.g., Mahfuz et al., 2016; Nguyen et al., 2014c; Pascual-Miguel et al., 2015). Finally there were only three studies (Arcila Calderón et al., 2015; Gerlach et al., 2014; Montash et al., 2015) that examined user of technology at the post adoptive time period. There was a lone exception to this trend i.e. Liew et al. (2014) study that examined consumer use of Facebook at all three stages (Adoption, Initial use and Post-adoptive use) in Malaysia to understand the socio-economic benefits of using technology.

“Location class” the fifth context dimension adapted from “where” heuristic in Johns (2006) refers to research site location (culture, region, industry) of technology acceptance and use. The location class comprising unique attributes such as national culture, industry competition and regional economic status provides rich context for researchers to extend UTAUT2. Majority of the studies extended UTAUT2 through new moderator mechanisms; national culture was the most leveraged attribute of location class followed by regional characteristics with none of the existing studies focusing on industry attributes (Refer Appendix H). For instance, student’s uptake of foreign language courses at three different locations – Hong Kong, China and the USA provided context for Lai et al. (2016) to extend UTATU2 with espoused cultural values as moderators in their research. Meanwhile, research focusing on social-economic benefits of using Facebook in Malaysia included regional attributes such as ethnicity, religion, language, employment, income, education, marital status as moderators (Liew et al., 2014).

“Organization class” the sixth context dimension an adaptation form Johns (2006) social context not only represents technology acceptance and use in formal organisation form such as business division, project team, functional unit, and the whole organisation but also extended to include informal social entities, such as user communities and social networks (Venkatesh et al., 2016). Some of the UTAUT2 extensions leveraged social context attributes in their research focusing on individual technology acceptance and use of specific type of social networking sites such as Facebook (Fakhoury & Aubert, 2015; Lallmahomed et al., 2013; Liew et al., 2014) and Instagram (Järvinen et al., 2016). The higher level attributes functioning at organisational level context usually influence the mechanisms at individual level, majority of the UTAUT2 extensions did not leverage the levels of social context and failed to report data concerning the organisational context as seen from Appendix H. The lone exception to this trend research of Indrawati and Primasari (2016) extended UTAUT2 with organisational level moderators company and product characteristic to evaluate organisation adoption of digital advertising in consumer goods industry.

The remaining two context dimensions rationale class and environment class have huge potential to contribute towards understanding of individual technology acceptance and use research. The environment class adapted from Johns (2006) physical dimensional context at discrete level represents the physical and environmental conditions (e.g., light, building, temperature) of target technology under examination (Venkatesh et al., 2016). The rationale class adapted from Johns (2006) corresponds to the “why” heuristics stating the rationale for undertaking the research or collecting data. Despite the huge potential, it’s apparent from Appendix H that none of the existing UTAUT2 extensions explicitly addressed the roles of both environment and rationale class and failed to leverage on the opportunity in shaping their research models.

In conclusion, the effort to contextualize UTAUT2 extensions reveal the eight context dimensions of classes can serve as framework for synthesising existing research on individual technology acceptance and use (Johns, 2006; Venkatesh et al., 2016; Weber, 2012). In addition, UTAUT2 extensions theoretical analysis based on Weber’s (2012) and Johns (2006) notions

of research context serves as direction for future researchers on under-leveraged classes of dimensions such as environment, organisational, event and location class. To that extent this study provides multi-level framework adapted from Venkatesh et al. (2016) and provides libraries of context at different levels to facilitate the future research on individual technology acceptance and use in the following section.

5. Extended multi-level framework– Mapping UTAUT2 extensions

This study mapped UTAUT2 extensions and extended Venkatesh et al. (2016) multi-level framework of technology acceptance and use based on Weber (2012) theory evaluation and thorough analysis of Johns (2006) context dimensions. The resultant model emerging from literature synthesis of UTAUT2 extensions is depicted in the Figure 2. Five out of seven UTAUT2 exogenous constructs i.e. PE, EE, PV, HM and SI are classified as individual beliefs in the multi-level framework model. The simplified model is aimed to facilitate researchers for making necessary adaptations and omit irrelevant constructs based on the context rather than having obligation to replicate all the constructs in underpinning model/theory (i.e. UTAUT2). For instance, EE is prone to yield non-significant results while examining existing/experienced/specialist users of technology in the developed countries and researchers should be cautious to include the construct in above mentioned scenarios (Rana et al., 2017). Moreover, some attributes cannot coexist in same research model due to adverse impact of one variable on the other. For instance, EE is known to hinder the predictive ability of FC on measuring consumer intention to use technology (Venkatesh et al., 2003). However, the remaining two exogenous constructs – FC and HA – are mapped to both behavioural intention and use as in the original UTAUT2 model. This study also proposed new mediating variables apart from the existing mediating variable BI. UTAUT2 exogenous variables are mapped to the mediating variables apart from the existing dependent variables. The above-mentioned variables constitute the baseline model of UTAUT2 as depicted in the middle part of Figure 2 inside the dotted box to that new outcome mechanism is added as an extension. The evaluation of UTAUT2 theory as a whole revealed its shortcomings in terms of parsimony majorly contributed by higher order moderators and their complex interactions. To that extent the higher order moderation effects of age, gender and experience are excluded from the baseline model constituting only the main effects of UTAUT2.

The baseline model: The extended model comprising new mediators and UTAUT2 main effects should serve as a baseline for future researchers in refining the existing context and/or exploring new context with the desired parsimony.

The existing UTAUT2 extensions mostly focused on the individual level contextual factors as depicted in the lower part of Figure 2. This study merged UTAUT2 moderators (i.e. age, gender and experience) as demographic attributes of user class in line with Venkatesh et al. (2016) framework and mapped them to the baseline model as represented by the double arrows. In addition, this study also extended user class context with mapping of marital status and education as demographic attributes, whereas profession and expertise are mapped as occupational attributes of user class as depicted in Figure 2. Besides user class attributes, the technology, task and event/class attributes acted as major individual level context factors enabling for various extension mechanisms (i.e., new exogenous, endogenous, moderating mechanisms, outcome, mediating, external, and new internal mechanisms) with UTAUT2 as their baseline model. The lone exception to this phenomenon was event class attributes with current extensions not leveraging its attributes as much as in comparison to the rest of the individual class attributes.

The higher-level contextual factors depicted in the upper part of Figure 2 provides promising future research directions for UTAUT2 extension studies. First, the physical environment comprising of attributes such as light, temperature, decor and built environment surrounding the individual users serve as an important context for technology acceptance and use research. The effect of “Weather” a variant of temperature attributes in environment class is widely researched in marketing discipline such as the effect of weather on negative hedonic consumption (Sun et al., 2009), consumer spending (Murray et al., 2010) and retail sales (Heschong et al., 2002) to name a few. Similarly, life sciences researchers has leveraged on the range of environmental factors such as lighting (Wansink, 2004), ambience (Stroebele & De Castro, 2004) and music (Ragneskog et al., 1996) on consumer food intake. Despite the huge potential, none of the existing UTAUT2 extensions has focused on the attributes of environmental class and rationale class focusing on the “why” heuristic providing many opportunities for the future researchers. The remaining two: 1) organisational class comprising of informal social entities, user communities and social networks, and 2) location class comprising attributes (e.g., national culture, economic development) can serve as higher-level contextual factors making impact at the individual level as depicted by double arrows in the Figure 2. To view location/organisation class as higher-level factors, researchers need multi-sample, multi-location research for theorizing the effects of organisation/location attributes in their research model.

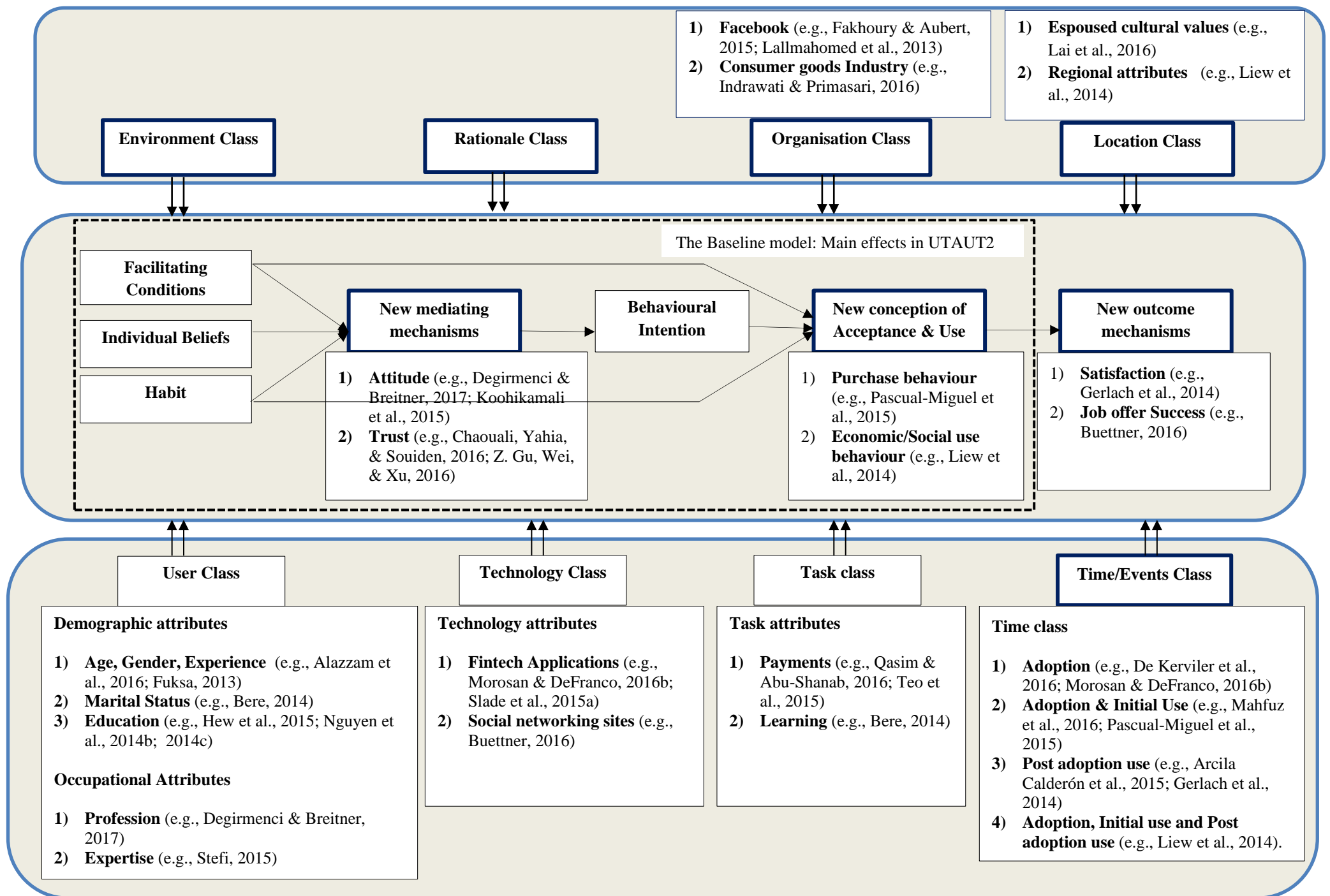


Figure 2: A multi-level research framework for Technology acceptance and use (Source adapted from Venkatesh et al., 2016)

Notes:

1. Single arrow represents the main effects of UTAUT2
2. Double arrow represents the main /moderation effects of contextual factors
3. Bolder boxes represent the important future research directions on UTAUT2

6. Technology acceptance research – Recommendations and future research directions

The extended Venkatesh et al. (2016) multi-level framework of technology acceptance and use depicted in Figure 2 mapped with UTAUT2 extensions can be leveraged to provide fruitful future research directions as shown by the double arrows based on Weber (2012) framework and Johns (2006) context dimensions.

The evaluation of UTAUT2 extensions parts using Weber (2012) revealed majority of the studies added novelty through addition/deletion of constructs and/or new associations focusing on the existing focal phenomenon and failed to make novel contributions by focusing on new focal phenomenon or conceiving the existing focal phenomenon in new way. In addition, Whetten's (2009) research suggests refining effect of current context or identifying new context-effect theories as two significant ways of contribution to cross-context theorizing. Moreover, recent research by Dwivedi et al. (2019) critically examined the predecessor of UTAUT2 (i.e. UTAUT) through meta-analysis and structural equation modelling (MASEM) technique on 162 prior studies and found individual characteristic such as attitude not theorized in the original model can have direct impact on consumer use behaviour apart from acting as mediator between UTAUT exogenous variables and BI. To that extent, the introduction of new mediating attributes (i.e., attitude and trust) based on analysis of UTAUT2 extensions in the multi-level framework is expected to partially mediate the effects of UTAUT2 exogenous variables on BI. The preceding discussion underscores the base line model in the middle part of Figure 2 highlighting three major directions for future research such as refining the current context while focusing on conception of new focal phenomenon and re-establishing individual characteristic as new mediating attributes.

Users accomplish their tasks using technology leveraging its various features usually referred as building blocks or components of a technology (Burton-Jones & Straub Jr, 2006; Jasperson et al., 2005). IS researchers have theorized feature level use of technologies broadly in two categories: 1) Exploitation that refers to the extent which users exploit the features of a technological system to undertake his/her task and 2) exploration refers to individuals search for doing novel or innovative things with technology features for driving their performance outcomes (Burton-Jones & Straub Jr, 2006). Jasperson et al. (2005) found that post adoptive technology use at feature level can produce higher level system work performance. In other words, the performance of technology users improves as they use more features in the work and find novel or innovative ways of using the existing feature. Besides the importance of technology at feature level in improving the performance outcomes of users, the extant literature synthesis on UTAUT2 extensions indicate lack of research on measuring the feature level technology use and individual outcomes. For instance Pascual-Miguel et al. (2015) exploited the risk and trust features of online websites to conceptualize new focal phenomenon of purchase behaviour. Meanwhile, the extension of UTAUT2 with Job offer success as new outcome phenomena involved exploration of new feature in social networking sites such as "number of contacts" (Buettner, 2016). The preceding discussion leads way for the following recommendations for future research:

Recommendation 1: Use UTAUT2 as a baseline model to exploit the technology features for conceptualizing new way of individual technology acceptance and use.

Recommendation 2: Use UTAUT2 as a baseline model to explore new technology features and link the features to individual level outcomes.

In addition to the above, the baseline model in the multi-level framework is extended with new mediating mechanisms. Dwivedi et al. (2019) proposed individual characteristics such as

attitude as an integral part of the UTAUT model based on evidence from extant literature review and MASEM findings. The study also found explicit inclusion of attitude as mediating variable in their research model increased the exploratory power from 21% to 27% of variance in explaining the usage behaviour. To that extent, this study included individual characteristics such as attitude (e.g., Degirmenci & Breitner, 2017; Hajli & Lin, 2016; Koochikamali et al., 2015; Nguyen et al., 2014a) and trust (e.g., Chaouali et al., 2016; Gu et al., 2016) as new mediating mechanisms in the baseline model based on extant literature synthesis of UTAUT2 extensions.

Recommendation 3: Use UTAUT2 as baseline model for measuring individual technology acceptance and use research and explore individual characteristics as mediators for better exploratory power.

Weber (2012) evaluation on parts of theory refers two possible types of associations in a research model as depicted in the Figure 3 and Figure 4. However, the evaluation of UTAUT2 extensions revealed the existing individual technology acceptance mostly focused on Type I associations in the figure 3 with researchers evaluating the associations between the attributes of single class of things of some online information system users (e.g., Alalwan et al., 2015; Escobar-Rodríguez & Carvajal-Trujillo, 2013; Nguyen et al., 2014a; Pascual-Miguel et al., 2015). However, individual adoption of technology does not happen in isolation the adoption and use decision of individual is resultant of association between attributes of different class of things as depicted in figure 4. Only few UTAUT2 extensions has focused on association beyond single class of things such as web personalisation, website quality, company characteristic and product characteristics. In the year 2017, The number individuals using ICT scaled to with 5 billion unique mobile subscribers representing two thirds of global population elevating mobile to the highest scale of consumer technology worldwide (Gsmaintelligence, 2017). In order to understand the idiosyncrasy of consumer’s technology acceptance it is not only enough to focus on individuals attributes but also on the attributes from different context such as what kind of environment is favouring consumers to adopt to these technologies “rationale class”. Moreover, specific events can serve as trigger point for individual adoption of technology such as combination of JIO a mobile network.

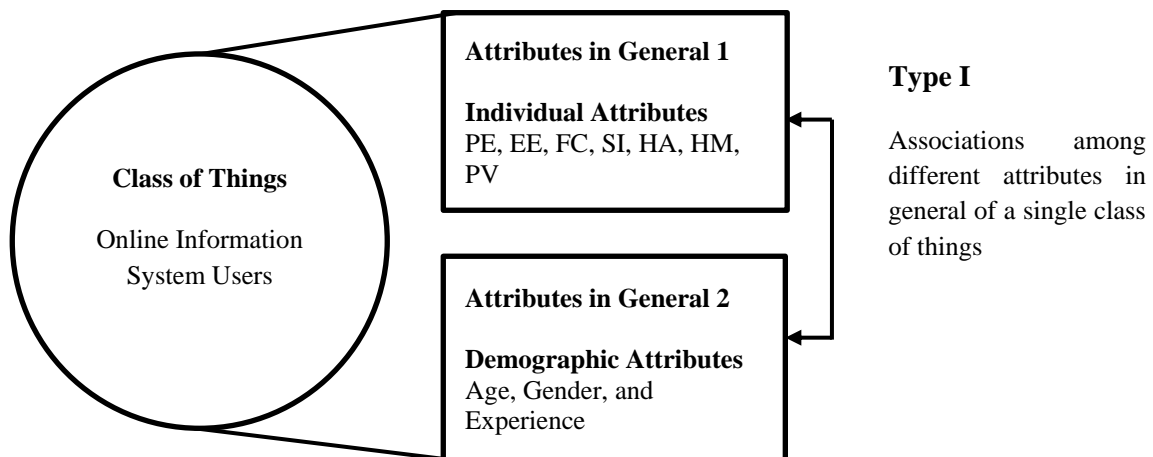


Figure 3. Type I associations (Source: Adapted from Weber, 2012)

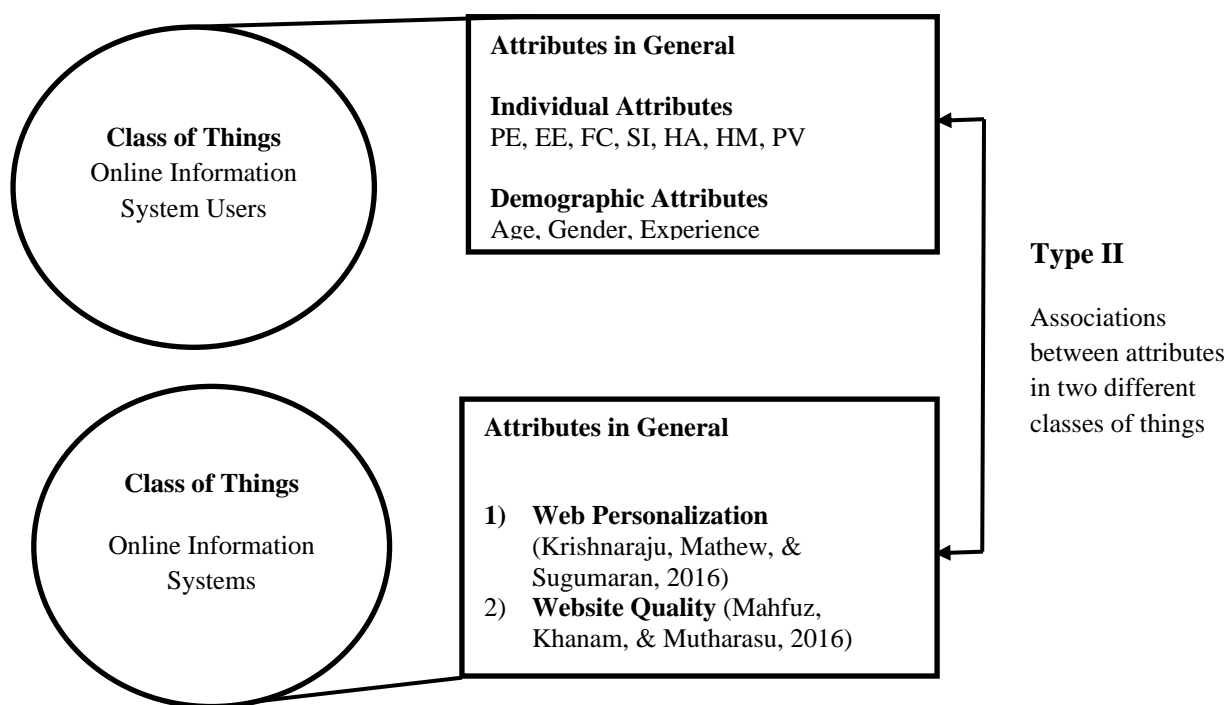


Figure 4. Type II associations (Source: Adapted from Weber, 2012)

Operator offering free data in India and digital awareness created by the government through digital India programme (Croxxson, 2017).

Recommendation 4: Examine the association between attributes of individual class of things and attributes of another class of things through extension of new environment/rational/organisational/location/event class.

7. Conclusion

This study aimed to understand the past, present, and future of technology adoption and use research through systematic review of UTAUT2 literature employing cited reference search method. This resulted in classification of UTAUT2 literature into four types based on its usage: general citation, UTAUT2 application, UTAUT2 integration, and UTAUT2 extensions. The UTAUT2 extensions were found to be most promising for future researchers and further classified into seven types such as: new exogenous, new endogenous, new moderating, new outcome, new mediating, new external and new internal mechanisms. Following this Weber (2012) theory evaluation framework was employed to evaluate UTAUT2 theory and UTAUT2 extensions on both the parameters of the framework i.e., *parts of the theory* and *theory as a whole* to demonstrate the comprehensiveness and status quo of UTAUT2 theory in the IS domain. The evaluation results revealed UTAUT2 as a high quality theory on most dimensions except for few shortcomings such as low parsimony and ill-defined boundary conditions arising from the complex model. Apart from Weber (2012) framework UTAUT2 extensions were also analysed using Johns (2006) context dimension. The analysis of Johns (2006) context dimension revealed UTAUT2 extensions studies lacked focus on rationale and environment class. Finally, this research integrated findings emerging from UTAUT2 theory evaluation and context dimensions to provide promising future research directions and libraries of context;

thereby significantly contributing towards research on individual technology acceptance and use.

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