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Review Article

The Unified Model of Electronic Government Adoption (UMEGA): A Systematic Literature Review with Meta-Analysis

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ABSTRACT

The unified Model of Electronic Government Adoption (UMEGA) was developed to bring novel insight into the context of citizen adoption of e-government services. As UMEGA is a recently evolved model, it demonstrates unequivocally the necessity for evaluating this model tailored to adopting e-government from the citizens' perspective. The current study aims to perform a systematic literature review on the empirical validation of the UMEGA accomplished in several countries since its inception in 2017 by following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. PRISMA is performed to synthesize the findings and analyze the performance of the constructs of the UMEGA. The systematic literature review encompassed the general characteristics, overall descriptive statistics, and synthesis of the constructs, analytical tools, and findings of the selected empirical articles. In the present study, the meta-analysis offered a strong confidence and prediction interval and significant combined effect size, suggesting that the constructs of the UMEGA, namely, performance expectancy, social influence, perceived risk, and facilitating conditions, significantly influenced attitude and behavioral intention to use e-government services. The association between attitude and behavioral intention is also found to be significant. The heterogeneity of the true effect of behavioral intention among empirical studies was partially explained by subgrouping in terms of sampling techniques, and E-government Development

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Index (EGDI) moderated the association between attitude and behavioral intention. The current study's findings can serve as a solid foundation for knowledge expansion, easing the way for theoretical development and helping the government understand what aspects need to be considered while establishing initiatives to enhance the utilization of e-government services.

Keywords: E-government adoption, meta-analysis, systematic literature review, UMEGA

INTRODUCTION

E-government ensures IT-based government operations. E-government, also known as electronic government, provides citizens with online government services and considerably impacts individual attitudes that lead to e-government services (Zahid & Din, 2019). E-governance has been crucial in developing and evolving how governments reach and serve their citizens. E-government aspires to increase government answerability and efficacy by offering quicker and more cost-effective services and empowering people via inclusive governance (Agangiba & Kabanda, 2016). The United Nations E-Governance Development Index (EGDI) is the most extensively used metric for monitoring e-governance advancement.

Scholars of information systems have used known technology adoption models in various empirical studies to evaluate the adoption of e-government over time. For example, Al-Hujran et al. (2015); Asmi et al. (2016); Demirdoven et al. (2020); Nofal et al. (2021); and Billanes and Enevoldsen (2021) employed the Technology Acceptance Model (TAM) model, Motohashi et al. (2012); Rokhman (2011); and Ismailova and Muhametjanova (2018) used the Diffusion of Innovations (DOI) model, Li et al. (2010) and Soufiane and Ibrahim (2018) used the Technology-Organization-Environment (TOE) model. In addition, Ibrahim and Zakaria (2016), Kurfalı et al. (2017), and Verkijika et al. (2018) used the Unified Theory of Acceptance and Use of Technology (UTAUT) model in the context of e-government adoption.

The existing previous IS/IT models indicated the insufficiency of providing a clear insight into the appropriate background due to the difficulties of e-government adoption. It was advocated that researchers develop a theory that fits into the e-government complications independently but is based on the core notions of IS/IT theories (Dwivedi et al., 2012). In this process, Dwivedi et al. (2017) designed the Unified Model of Electronic Government Adoption (UMEGA) in India as the most current e-government adoption model and a significantly plain model that achieves a compromise between model intricacy and predictive power. The validated UMEGA outperformed other models, including the UTAUT, because it used better-suited measurements for the UTAUT variables in e-government rather than relying on its original measures, which were based on technology adoption in the organizational context (Dwivedi et al., 2017).

UMEGA is a recently evolved model; hence, it demonstrates unequivocally the necessity for evaluating this model tailored to adopting e-government from the citizens' perspective. Literature is insufficient on the systematic literature review of the Unified Model of E-government Adoption since its development in 2017. In congruent with this effort, the current study presents a systematic literature review of the UMEGA following the PRISMA guidelines (Moher et al., 2009). This study will utilize a quantitative approach to perform a systematic literature review of the relevant previous studies by investigating the empirical validation of the Unified Model of E-government Adoption in several countries and exploring the factors influencing citizens' behavioral intention to utilize E-Government services. Thus, the main objectives of this study are to (1) conduct a systematic review of the empirical validation of UMEGA, (2) present the empirical evidence on the predictive validity of UMEGA in e-government contexts that have been collected thus far, and (3) incorporate and analyze the magnitude of the effect size using meta-analysis methods (King & He, 2006). More particularly, the study aims to utilize meta-analysis to identify and observe the overall magnitude of the relationship between behavioral intention to use e-government services while undertaking the Unified Model of E-Government Adoption and its antecedents.

UNIFIED MODEL OF ELECTRONIC GOVERNMENT ADOPTION

Dwivedi et al. (2017) established the UMEGA model, the most recent e-government acceptability model illustrated in Figure 1. Twenty-nine alternative constructs were discovered and tested, and nine renowned theoretical models of adopting information technology were analyzed, namely, the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), the Technology Acceptance Model (TAM) (Davis, 1989), Social Cognitive Theory (SCT) (Compeau et al., 1999), Innovation Diffusion Theory (IDT) (Rogers, 2003), Diffusion Of Innovation (DOI) (Rogers, 2003), Decomposed Theory of Planned Behaviour (DTPB) (Taylor & Todd, 1995), Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991), and Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003). Although the fundamental UTAUT has also been utilized in little research coupled with e-government-specific dimensions like trust and risk (Carter & Schaupp, 2009; Schaupp et al., 2010), the model has not performed as well as anticipated. It demonstrates unequivocally the necessity for a uniform methodology specifically tailored to study the adoption of e-government. Dwivedi et al. (2017) created and validated the unified electronic government adoption (UMEGA) model based on the UTAUT model's core idea to close this research gap.

Performance expectancy, effort expectancy, perceived risk, and social influence, according to the UMEGA, are likely to directly influence attitudes toward adopting e-government. In contrast, positive behavioral intention is expected to be influenced by

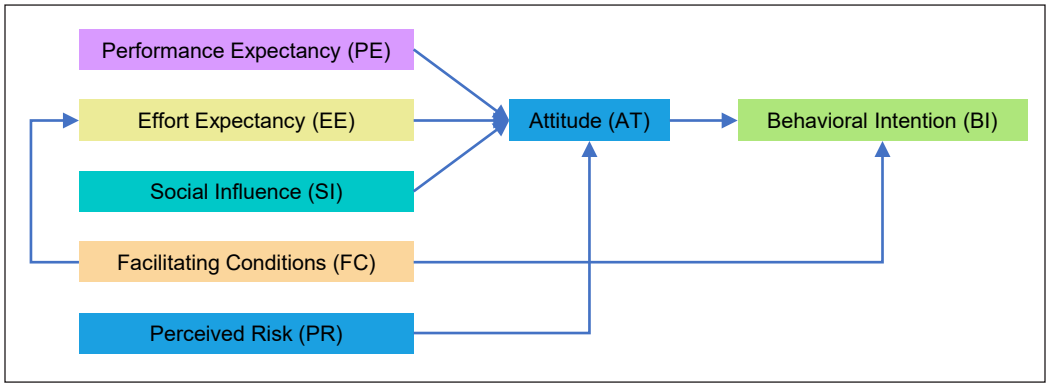

Figure 1. UMEGA research framework
Source: (Dwivedi et al., 2017)

attitude. Furthermore, the facilitating conditions are expected to impact behavioral intention and effort expectancy. According to its validation, UMEGA surpassed the rest of the models in describing behavioral intention to utilize e-government services (Dwivedi et al., 2017). The constructs of the UMEGA are described as follows:

Performance Expectancy

According to Venkatesh et al. (2003), performance expectation is the user's conviction that adopting certain technology would help or enable them to accomplish a given task performance. It is one of the antecedents of the Unified Theory of UTAUT paradigm, which has attracted significant attention from multiple academics in various sectors of human effort (Bugembe, 2010; Khayati & Zouaoui, 2013; Venkatesh et al., 2003). According to their findings, performance expectation is a crucial element influencing information system adoption and eventual usage. This aspect is comparable to TAM's perceived utility, relative benefit (from the DOI and IDT), and outcome expectancies (from the SCT). According to previous studies, performance expectancy significantly influences the propensity to use e-government services (AlAwadhi & Morris, 2008; Bhuasiri et al., 2016; Lu & Nguyen, 2016).

Social Influence

The term "social influence" relates to how much an individual's opinions of others impact their choice to embrace a new system (Venkatesh et al., 2003). Social influence is one of the constructs of the UTAUT model and analogous to the encapsulation of other constructs, namely, subjective norms from the TRA and the TPB and social factors from MPCU (Venkatesh et al., 2003). In terms of e-government, social influence is how citizens assess the value of other people's perceptions while determining whether to implement

e-Government (Venkatesh et al., 2003, 2012). Several previous studies explored the significant impact of social influence on e-government adoption (Bhuasiri et al., 2016; Dwivedi et al., 2017).

Perceived Risk

Perceived risk refers to the dismay or apprehension of using a certain information system due to projected results (Slade et al., 2015). Perceived risk is often used to describe a user's perception of the likelihood that their interests are at risk when using innovative technology, especially one that involves new technologies or methods. In e-government, perceived risk refers to citizens' belief that they will face some type of difficulties and loss while adopting e-government services, mainly since e-government services must be accessed via the internet system, which has its own set of risks and obstacles (Verkijika & Wet, 2018). This apprehension can constrain citizens' interactions with e-government services (Verkijika & Wet, 2018).

Facilitating Conditions

According to Davis (1989) and Venkatesh et al. (2003), facilitating conditions refer to a person's view of the technical resources and the organizational infrastructure required to operate the intended system. This definition encompasses perceived behavioral control, enabling conditions, and adaptation. It incorporates ideas from other root constructs, such as perceived behavioral control (from the TPB and the DTPB), enabling conditions (from the PC use model), and compatibility (from IDT). Several researchers have found that FC is the most critical factor influencing e-government adoption by individuals in various countries (Kurfalı et al., 2017; Lallmahomed et al., 2017; Rodrigues et al., 2016).

Effort Expectancy

Effort expectation defines the "degree of ease associated with customers' technology usage" (Komba & Ngulube, 2015; Venkatesh et al., 2012). It measures how individuals expect less mental or physical effort to perform specific tasks when using technology. In other words, effort expectancy refers to the effort people think they will have to use technology (Venkatesh et al., 2016). The idea of effort expectancy is summarized by the TAM's perceived ease of use, DOI's complexity, and IDT's ease of use (Venkatesh et al., 2003). It is a critical component of the UTAUT model and is widely used to examine people's intentions toward new technology (Venkatesh et al., 2012). Several studies suggested that effort expectancy is connected to behavioral intention by mediating the individual's beliefs about adopting a given technology (Alshare & Lane, 2011; Pynoo et al., 2011; Šumak & Šorgo, 2016).

Attitude And Behavioral Intention

Attitude relates to how a unit of adoption feels about the subject. According to Yang & Yoo (2004), attitude comprises affective and cognitive components. The affective component describes how much a person enjoys the object of thinking, whereas the cognitive part describes an individual's precise ideas about the thing of thought (Yang & Yoo, 2004).

Behavioral intention is critical when researching e-government adoption since it reflects citizens' attitudes toward utilizing the system. People who give a good rating or appraisal to a G2C system are more likely to embrace it, and vice versa. A previous study has found that attitudes influence behavioral intentions significantly to use e-government services (Alomari et al., 2012; Dwivedi et al., 2017; Susanto & Goodwin, 2013).

METHODOLOGY

A systematic literature review (SLR), as recommended by Kitchenham (2004), is used as the research methodology in this paper. The systematic literature review (SLR) explores, critically evaluates, and synthesizes all the literature on a certain issue using a set of thorough and rigorous criteria (Salahuddin & Ismail, 2015). The core purpose of the SLR approach is to minimize the risk of bias and maximize openness at every level of the review process by depending on clear, systematic processes to remove bias in research selection and inclusion, as well as to assess and summarize the quality of studies that are included objectively (Liberati et al., 2009; Petticrew, 2001). In addressing the knowledge gap and the numerous possible sources of bias in locating, selecting, synthesizing, and reporting primary studies, researchers advocated that the review process be treated as a scientific process in and of itself, which evolved into the SR process (Dixon-Woods, 2010). This study follows the PRISMA guidelines for systematic reviews and meta-analyses, containing four phases: identification, screening, eligibility, and inclusion (Figure 2).

Article Identification

A comprehensive literature search for citations was undertaken to utilize a range of well-known online scientific databases, including Scopus, ScienceDirect, Web of Science, and EBSCOhost (Academic Search Complete) Publications, following the PRISMA criteria. These databases were chosen because they contain the most significant and high-impact journals and general conference proceedings on information systems and explicitly respect e-government services. While searching for literature, the following keywords were used; UMEGA or "Unified Model of Electronic Government Adoption." The research papers were published between January 1, 2012, and December 31, 2021. The study titles and abstracts were evaluated to conduct the first extraction of all research. The search included peer-reviewed articles, conference proceedings, and book chapters. In the beginning, this search yielded 51 related papers.

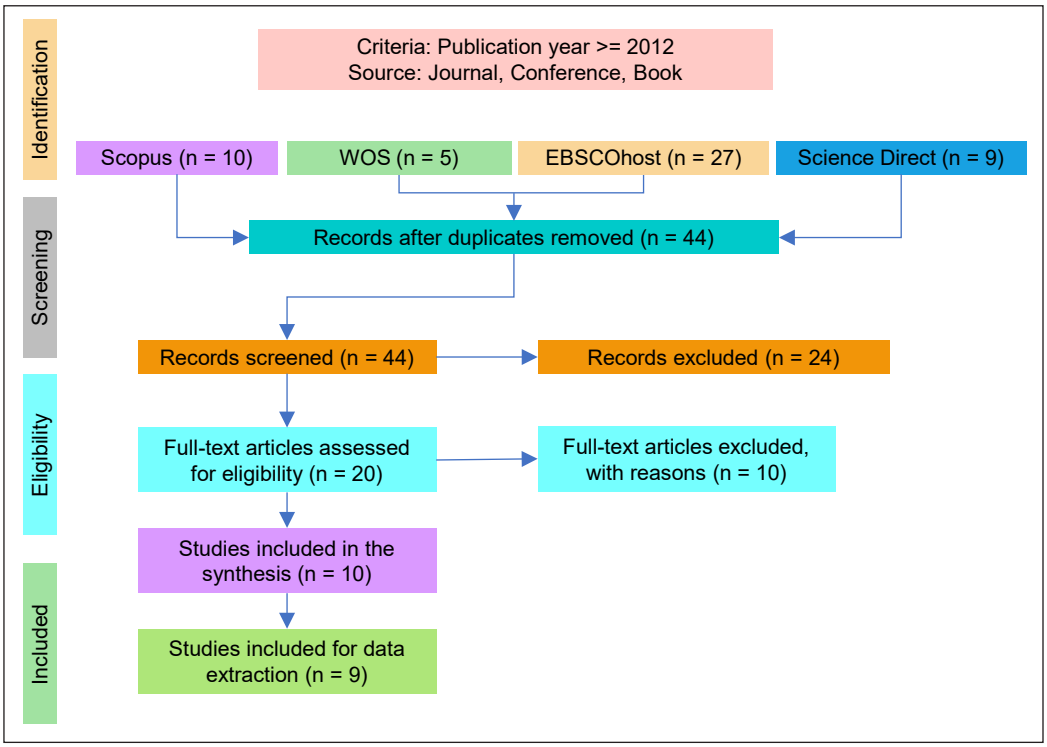

Figure 2. Flowchart diagram for SLR using PRISMA

Article Screening

Screening the selected documents is the second step of the PRISMA guidelines. As a result, the authors screened the retrieved documents based on each document's title, abstract, and keywords (if needed). After removing the duplicates, a total of 44 documents were taken among 51 documents for the further screening process. Later, 24 documents were excluded, and 20 were retained for further exploration based on the title, abstract, and keywords.

Article Eligibility

According to the PRISMA checklist, several criteria for article eligibility were applied to assure the quality and consistency of the selected publications. The content of the selected literature was reviewed for relevance to the following inclusion criteria by looking at the title, abstract, and text; (1) it had investigated the validation of UMEGA in several countries, (2) it was penned in the English language, (3) presented in peer-reviewed journals, conference papers, and book chapters, and (4) the methodology, path coefficients, and confidence intervals were reported. After skimming through the title and abstract, 24 papers were excluded as not complying with the inclusion criteria. The full text of the remaining 20 papers was assessed and summarized. In this stage, nine more articles were excluded as

not fitting one or more of the inclusion criteria, and one paper (Syaifuddin et al., 2022) was excluded as the original UMEGA was distorted to a large extent by making the mediator attitude an independent variable, resulting in a total of 10 eligible papers, aligned with the objectives of the study. Finally, as structural model analysis or path co-efficient was not reported, one more paper (Alawadhi et al., 2021) was excluded, thus yielding nine papers (Table 1) being reviewed finally and analyzed in this systematic literature review.

Table 1
List of the selected articles obtained from SLR

No.	Title	Source
1	Adoption of Transactional Service in Electronic Government – A Case of Pak-Identity Service	(Khurshid et al., 2019)
2	Taxpayer Behavior in Using E-Vehicle in Indonesia	(Zubaidah et al., 2021)
3	E-Government Adoption in Uzbekistan: Empirical Validation of the Unified Model of Electronic Government Acceptance (UMEGA)	(Avazov & Lee, 2020)
4	E-government adoption in sub-Saharan Africa	(Verkijika & Wet, 2018)
5	Empirical validation of a unified model of electronic government adoption (UMEGA)	(Dwivedi et al., 2017)
6	Identifying Factors Affecting the Acceptance of Government-to-Government System in Developing Nations – Empirical Evidence from Nepal	(Rai et al., 2020)
7	E-Government Services Adoption: An Extension of the Unified Model of Electronic Government Adoption	(Mensah et al., 2020)
8	Adoption of Cloud-Based Accounting Practices in Turkey: An Empirical Study	(Altin & Yilmaz, 2021)
9	Determinants of citizen's intention to use online e-government services: A Validation of UMEGA Model	(Burhanudddin et al., 2019)

Data Extraction

From the previously selected nine review studies, each article was extracted by delving into the complete text, including article characteristics (paper title, publication year, name of the journal, reference domain, context, sampling technique, and sample size), synthesis of the model's constructs (research framework, dependent variables, independent variables, and mediating factor), and statistical insights (quantitative statistical analysis tools, methods for reliability and validity, statistical software, path co-efficient of the constructs, and significance level). The data was stored in Microsoft Office Excel 2016.

RESULTS AND DISCUSSION

The upcoming sections shed some light on the general characteristics, overall descriptive statistics, and synthesis of the constructs, analytical tools, and findings of the selected nine review papers. Finally, the meta-analysis, subgroup, moderator analysis, and publication

bias conforming to the PRISMA guideline will be presented to synthesize the insights and analyze the performance of the constructs of the UMEGA.

General Characteristics of Included Studies

First, an overview of the included studies' features is presented, including publication year, researched countries, and journals. The distribution of publications by year is depicted in Figure 3. The minimal number of articles could be due to the UMEGA being proposed by Dwivedi et al. (2017).

After 2017, one journal article was published in 2018, one journal paper and one conference paper were published in 2019, one conference and two journal papers were published in 2020, and finally, two journal articles were published in 2021. Journal publications comprised most of the papers in this systematic literature review, accounting for about 77.78% of the total. The conference proceedings are in the second position regarding contribution with 22.22%, and no book chapters are in the inclusion phase. Figure 4 represents the world distribution of the empirical validation of the UMEGA. As shown in Figure 4, most research studies were conducted in developing and least developing countries and confined to only two continents: Asia and Africa. Perhaps the UMEGA being first proposed in India inspired the researchers to choose the adjacent geographical regions and countries with similar e-government infrastructures and facilities.

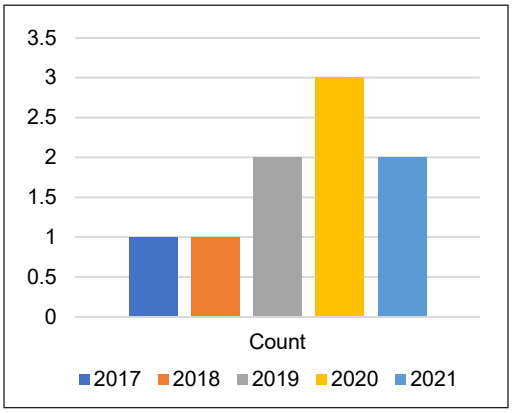

Figure 3. Publication trend

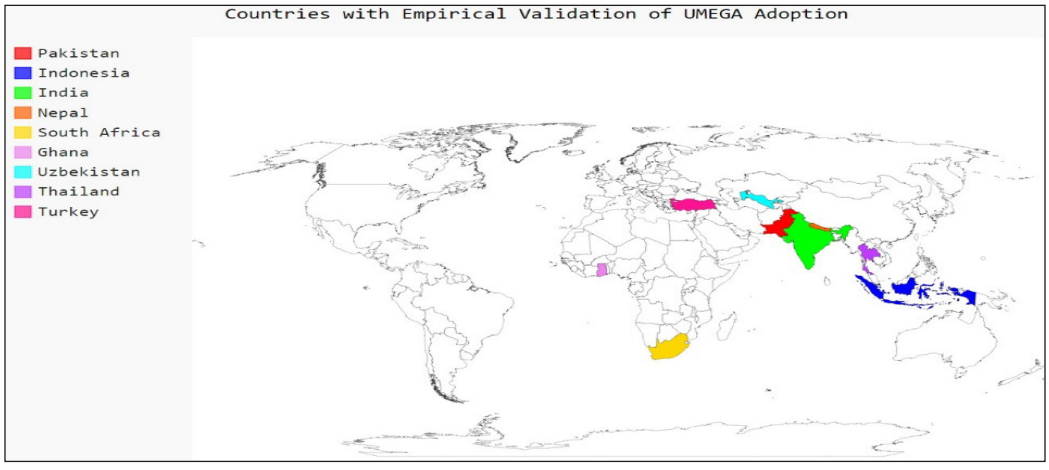

Figure 4. Countries with empirical validation of UMEGA adoption

Descriptive Statistics

There were 63 fundamental associations among dependent and independent constructs of the UMEGA discovered in these nine publications. Table 2 summarizes respondents, domains, contexts, sample size, and publication year, as mentioned in the nine publications in the current study, along with the corresponding EGDI of the respective countries. The descriptive statistics revealed that all the studies were conducted in the context of Asian and African countries, and citizens who are familiar with or are a part of e-government services were the respondents. Among all the studies, the highest number of participants were from India, and the maximum number of articles (03) with empirical validation of UMEGA was published in 2020.

Asia continent (Pakistan, Indonesia, Uzbekistan, India, Nepal, Turkey, and Thailand) accounts for 79.20% of responders, while Africa (Sub Sahara Africa and Ghana) accounts for 20.80% (Figure 5). The UNDP (2022) report suggests that UMEGA is empirically validated in the context of developing countries only.

Table 2
Descriptive statistics of the empirical validation of UMEGA adoption studies

Sources	Respondents	Domain	Context	Sample Size	EGDI	Year
(Khurshid et al., 2019)	Citizens	Pak-Identity, an e-government transactional service system	Pakistan	441	0.387	2019
(Zubaidah et al., 2021)	E-Samsat users	e-Samsat (e-vehicle tax) services	Indonesia	233	0.750	2021
(Avazov & Lee, 2020)	Students and Govt. Employees	Single Portal of Interactive Public Services	Uzbekistan	216	0.666	2020
(Verkijika & Wet, 2018)	E-government service users	e-government services	Africa	282	0.662	2018
(Dwivedi et al., 2017)	Citizens from different cities covering different demographics	Online Permanent Account Number (PAN) card registration system (OPCRS)	India	474	0.859	2017
(Rai et al., 2020)	Govt. Officials	G2G e-services	Nepal	234	0.369	2020
(Mensah et al., 2020)	Citizens within ministries and their environs	e-government services	Ghana	345	0.631	2020
(Altin & Yilmaz, 2021)	Employees of accounting departments of businesses	Cloud-based accounting applications	Turkey	391	0.893	2021
(Burhanudddin et al., 2019)	Taxpayer Citizens	Govt. Tax Portal	Thailand	396	0.713	2019

Overall Review of Selected Studies

Concerning UMEGA, most studies empirically validated the original model or its extended variation by tuning one or more independent variables. Nevertheless, only data about the original model has been emphasized in this review. Table 3 summarizes the evidence for behavioral intention to use e-government services while adopting UMEGA, as gathered from the reviewed empirical studies.

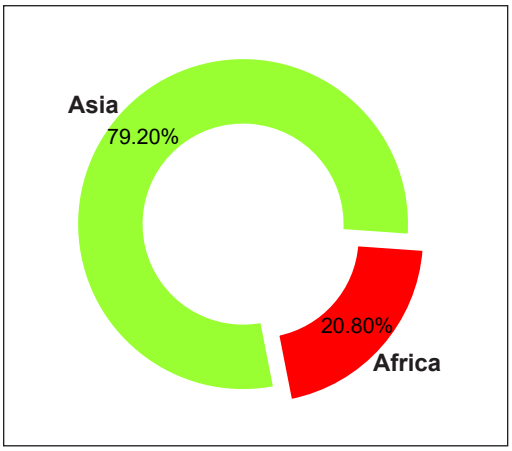

Figure 5. Distribution of respondents

Khurshid et al. (2019) used UMEGA to understand the adoption of Pak-Identity, a governmental transactional service system released by Pakistan's national database and registration authority, by including four new constructs, namely, trust, herd behavior, price value, and grievance redressal. They investigated that facilitating conditions influenced effort expectancy directly, but effort expectancy, facilitating conditions, social influence, and perceived risk had no significant impact on e-government adoption.

Rai et al. (2020) empirically validated the Unified Model for E-Government Acceptance (UMEGA) by going through focus group meetings with government officials of the ministries of Nepal. They dropped two constructs of the UMEGA, namely, perceived risk and social influence, and added three new constructs: awareness among leadership, commitment from leadership, and transparency. They noticed that

Table 3
Synthesis of the constructs of the reviewed empirical studies

Source	Dependent Variable	Performance Expectancy	Effort Expectancy	Social Influence	Facilitating Conditions	Perceived Risk	Attitude
(Khurshid et al., 2019)	Behavioral Intention	√					√
(Zubaidah et al., 2021)	Taxpayer Behavior	√	√		√	√	√
(Avazov & Lee, 2020)	In Using E-Vehicle	√	√		√		√
(Verkijika & Wet, 2018)	Behavioral Intention	√	√	√	√	√	√
(Dwivedi et al., 2017)	Behavioral Intention	√	√	√	√	√	√
(Rai et al., 2020)	Behavioral Intention	√	√		√		√
(Mensah et al., 2020)	Behavioral Intention				√	√	√
(Altin & Yilmaz, 2021)	Behavioral Intention	√		√		√	√
(Burhanudddin et al., 2019)	Behavioral Intention						√

performance expectancy, effort expectancy, facilitating conditions, attitude, and the newly added constructs, strongly influenced the behavioral intention to use G2G E-government services. Avazov and Lee (2020) empirically validated the UMEGA by investigating the factors influencing citizens' behavioral intention to use e-government services named Single Portal of Interactive Public Services (SPIPS) in Uzbekistan. They discovered that all constructs' relationships were consistent with the original UMEGA study. Nonetheless, neither social influence nor perceived risk was a significant determinant of behavioral intention.

Mensah et al. (2020) tested an extended version of the UMEGA to identify the determinants that affected the intention of the citizens to use e-government services by incorporating two new constructs: perceived service quality and trust in government. They observed that facilitating conditions impacted effort expectancy significantly and behavioral intention to use e-government services. Nevertheless, surprisingly, performance expectancy, effort expectancy, and social influence failed to predict the attitude toward the behavioral intention. However, the newly added perceived service quality and trust in government had been found to have a significant impact on the behavioral intention by adding two new independent variables, namely, trust in technology and trust in government, and subsequently figured out that all the constructs of the original UMEGA, but social influence, and the newly added variables had a strong prediction toward intention to use e-Samsat services.

Altin and Yilmaz (2021) empirically validated the UMEGA to investigate the influencing factors that affected the behavioral intention of the employees of accounting departments of businesses in Turkey to use cloud-based accounting services. They dropped facilitating conditions and effort expectancy of the original UMEGA, incorporated computer self-efficacy, trust in government, and trust in the internet as independent variables, and slightly tuned the associated perceived risk with the mediator and dependent variable. They deduced that computer self-efficacy, social impact, and performance expectations had a positive and crucial effect, whereas perceived risk negatively impacted attitude.

Table 4 summarizes the selected empirical papers' sampling techniques, instruments, analysis methods, and tools. The outcome reveals that among all the studies, four studies employed random sampling, three studies utilized convenience sampling, and two adopted non-probabilistic sampling to collect data by online questionnaire through e-mail or paper-based. Most studies followed a quantitative research strategy along with a positivist research paradigm. Whereas few articles used structural equation modeling with SmartPLS, and a few employed AMOS to do statistical analysis and carried out reliability and validity analysis through Cronbach's alpha, Composite reliability, Factor loadings, Fornell-Larcker criterion, and the Heterotrait-Monotrait ratio (HTMT).

Table 4
The approaches used in the empirical studies of UMEGA

Study	Sampling Technique	Instrument	Reliability & Validity	Analysis Methods
(Khurshid et al., 2019)	Random	Online Questionnaire	Cronbach's Alpha, composite reliability, convergent validity, average variance extracted (AVE), and discriminant validity using the Fornell-Larcker criterion	Partial least squares Structure equation modeling using SmartPLS 3.0
Zubaidah et al., 2021)	Random	Questionnaires, Interviews	Cronbach's Alpha, composite reliability, convergent validity using outer loading, and average variance extracted (AVE)	Partial least squares Structure equation modeling using SmartPLS 3.0
(Avazov & Lee, 2020)	Convenience	Survey	Cronbach's Alpha, composite reliability, and average variance extracted (AVE)	Structure equation modeling
(Verkijika & Wet, 2018)	Random	Questionnaires	Cronbach's Alpha, composite reliability, convergent validity using factor loading, discriminant validity using the Fornell-Larcker criterion, and the heterotraitmonotrait ratio (HTMT)	Structure equation modeling using SmartPLS
(Dwivedi et al., 2017)	Convenience	Survey Questionnaires	Standardized factor loadings, Cronbach's Alpha, composite reliability, and average variance extracted (AVE)	Confirmatory factor analysis and Structure equation modeling using AMOS
(Rai et al., 2020)	Non-probabilistic	Paper-based Survey	Cronbach's Alpha, composite reliability, convergent validity using factor loading, and discriminant validity using the Fornell-Larcker criterion	Structure equation modeling
(Mensah et al., 2020)	Random	Research Questionnaire	Composite reliability, Average variance extracted (AVE), Cronbach's Alpha, factor loadings, and discriminant validity using the Fornell-Larcker criterion	Structure equation modeling using SmartPLS 3.0
(Altin & Yilmaz, 2021)	Non-probabilistic	Survey via E-mail	Cronbach's Alpha, composite reliability, convergent validity using factor loading, and discriminant validity using the Fornell-Larcker criterion	Structure equation modeling using SmartPLS
(Burhanudddin et al., 2019)	Convenience	Self-administrative	Cronbach's Alpha, composite reliability, Factor loading, Average variance	Structure equation modeling using SmartPLS

Meta-Analysis

Meta-analysis is the systematic strategy for combining quantitative data from various empirical research addressing the effect of an independent variable (or determinant, intervention, or treatment) on a specific outcome. As a result, a metric to measure their consequences is required (Bowman, 2012). The correlation and regression coefficients are examples of effect size measures utilized (Cooper et al., 2010). Because most papers suitable for meta-analysis indicated correlational effects, Pearson's r was utilized as the primary effect size metric for the studies. R and its variance were obtained from correlation coefficients and sample sizes published in original publications whenever feasible. The statistical analyses and graphics were done using Meta-Essentials (Hak et al., 2016). The E-Governance Development Index (EGDI) was taken as a basis for meta-analysis because of its representative power on the ICT infrastructure and e-participation of the citizens of a country (UNDP, 2022).

Forest Plot

A forest plot depicts the meta-analysis in graphical form (Hak et al., 2016). The effect sizes and the forest plot of the meta-analysis of the cluster of the chosen reviewed papers are depicted in Table 6 and Figure 6, respectively.

The meta-analysis used the random-effects model to combine the retrieved effects, suitable for research with significant heterogeneity. The effect size is displayed on the

Table 6
R^2 of behavioral intention

Study	r	95 % CI		Weight
		Lower Limit	Upper Limit	
1	0.40	0.32	0.48	11.25%
2	0.63	0.55	0.70	10.95%
3	0.44	0.32	0.54	10.91%
4	0.65	0.57	0.71	11.06%
5	0.80	0.76	0.83	11.28%
6	0.50	0.40	0.59	10.96%
7	0.78	0.73	0.82	11.16%
8	0.56	0.49	0.62	11.21%
9	0.79	0.75	0.82	11.22%
Combined Effect Size				

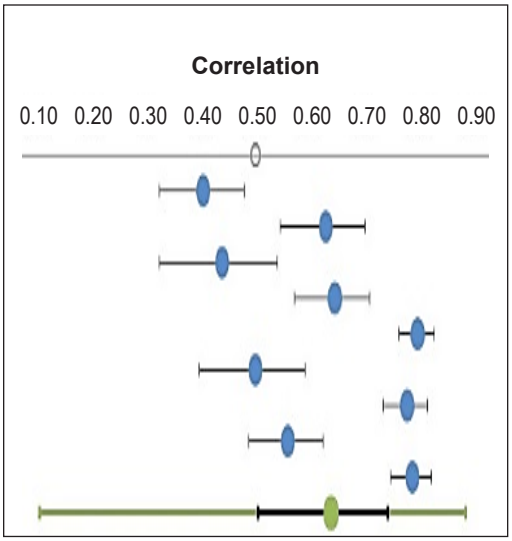

Figure 6. Forest Plot (R^2 of behavioral intention)

(Table 6 sources of study; 1: Khurshid et al., 2019; 2: Evi et al., 2021; 3: Avazov & Lee, 2020; 4: Verkijika & de Wet, 2018; 5: Dwivedi et al., 2017a; 6: Kirat Rai et al., 2020; 7: Mensah et al., 2020; 8: Altin & Yilmaz, 2021; 9: Burhanudddin et al., 2019)

X-axis. The blue circles of each row refer to the effect size for each association between behavioral intention to use e-government services and its constructs. While adopting UMEGA, the green circle on the bottom row represents the "combined effect size." Table 5 enumerates the combined effect size (0.64), confidence, and prediction interval values.

Table 5
Combined effect size: Behavioral intention to use

Combined Effect Size (95% CI)	
Correlation	0.64
Confidence interval LL	0.51
Confidence interval UL	0.74
Prediction interval LL	0.10
Prediction interval UL	0.89

As shown in Figure 6, the confidence interval of the combined effect size lies on the right side of zero; hence the meta-analytic true effect between dependent and independent variables of the UMEGA in the empirical studies is statistically significant ($p = 0.000 < 0.05$; $Z = 8.67$). However, heterogeneity analysis ($Q = 200.76$, $I^2 = 96.02\%$, T^2 (z) =0.07) for the selected studies revealed that the variability of the effect inconsistency was extremely substantial (Higgins et al., 2003), justifying the use of subgroup analysis and meta-regression for searching moderators.

The effect sizes and the forest plot of the mediator named attitude are presented in Table 7 and Figure 7, respectively. The combined effect size of attitude is 0.54, which is significant according to Cohen's (1983) recommendation. The confidence interval of the combined effect size also lies on the right side of zero, i.e., the true effect between the mediator and independent variables of the UMEGA in the empirical studies is statistically

Table 7
R^2 of attitude

Study	r	Lower Limit	Upper Limit	Weight
1	0.65	0.59	0.70	11.29%
2	0.22	0.10	0.34	10.91%
3	0.60	0.51	0.68	10.85%
4	0.18	0.06	0.29	11.05%
5	0.49	0.42	0.56	11.32%
6	0.47	0.36	0.56	10.92%
7	0.63	0.56	0.69	11.17%
8	0.67	0.61	0.72	11.24%
9	0.72	0.67	0.77	11.24%
Combined Effect Size				

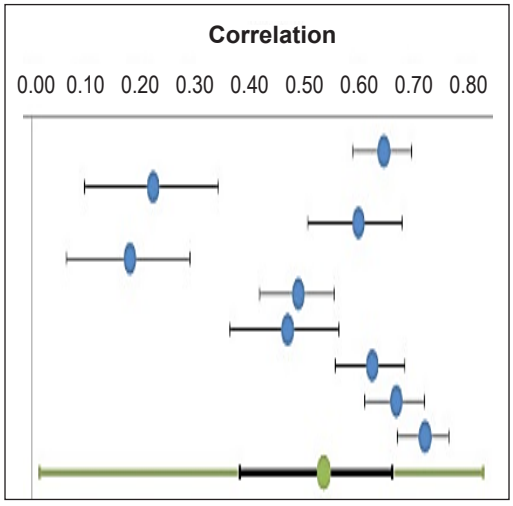

Figure 7. Forest Plot (R^2 of attitude)

(Table 7 sources of study; 1: Khurshid et al., 2019; 2: Evi et al., 2021; 3: Avazov & Lee, 2020; 4: Verkijika & de Wet, 2018; 5: Dwivedi et al., 2017a; 6: Kirat Rai et al., 2020; 7: Mensah et al., 2020; 8: Altin & Yilmaz, 2021; 9: Burhanudddin et al., 2019)

significant ($p = 0.000 < 0.05$; $Z = 7.03$) as well. The minimum and maximum limits of the confidence interval are 0.38 and 0.66, respectively. Furthermore, the prediction interval ranges from 0.01 to 0.83. Nevertheless, heterogeneity analysis ($Q = 158.47$, $I^2 = 94.95\%$, T^2 (z) =0.06) for the selected studies revealed that the observed inconsistency of the effects was large (Higgins et al., 2003).

Finally, the effect sizes and forest plots depicting the association between attitude and behavioral intention are illustrated in Table 8 and Figure 8, respectively. As the confidence interval of the combined effect size (0.49) lies on the right side of zero, the true effect between the mediator and dependent variables of the UMEGA is statistically significant ($p = 0.000 < 0.05$; $Z = 5.07$) (Burhanudddin et al., 2019). The confidence interval lies between 0.28 and 0.65, and the prediction interval ranges from -0.24 to 0.87. Like the previous two forest plots, its heterogeneity analysis ($Q = 277.32$, $I^2 = 97.12\%$, T^2 (z) =0.10) also revealed that the variability of the effect inconsistency was extremely substantial (Higgins et al., 2003).

Table 8
R^2 of association between attitude and behavioral intention

		95 % CI		
Study	r	Lower Limit	Upper Limit	Weight
1	0.33	0.25	0.41	11.21%
2	0.39	0.27	0.49	11.00%
3	0.27	0.14	0.39	10.96%
4	0.37	0.26	0.46	11.08%
5	0.77	0.73	0.80	11.23%
6	0.12	0.01	0.25	11.00%
7	0.65	0.59	0.71	11.15%
8	0.75	0.70	0.79	11.18%
9	0.46	0.38	0.54	11.19%
Combined Effect Size				

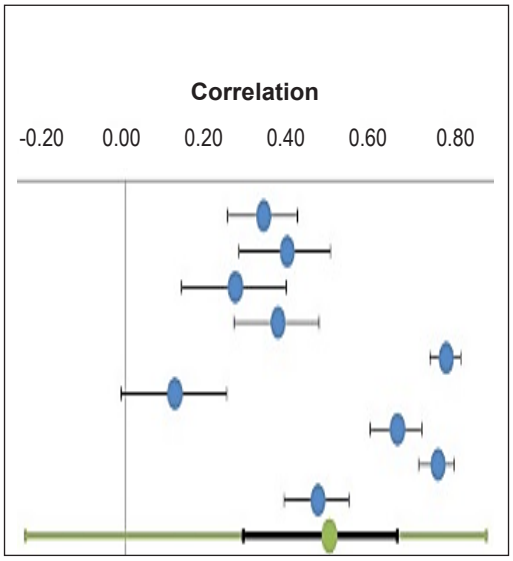

Figure 8. Forest Plot (association between attitude and behavioral intention)

(Table 8 sources of study; 1: Khurshid et al., 2019; 2: Evi et al., 2021; 3: Avazov & Lee, 2020; 4: Verkijika & de Wet, 2018; 5: Dwivedi et al., 2017a; 6: Kirat Rai et al., 2020; 7: Mensah et al., 2020; 8: Altin & Yilmaz, 2021; 9: Burhanudddin et al., 2019)

Subgroup Analysis

Following the dataset's high level of heterogeneity (Figure 6), we did a subgroup analysis to see if the degree of heterogeneity diminished. The three groups were categorized based on sampling techniques, namely, random sampling, non-probabilistic sampling, and convenience sampling. The comparison of the effect sizes of the empirical reviewed

studies is presented in Table 9–each of the three studies employed these three sampling techniques. The corresponding forest plot is depicted in Figure 9.

The random-effect model was used to determine and compare the effect size for each subgroup. The result indicated that non-probabilistic ($Q = 0.57$, $I^2 = 00.00\%$, T^2 (z) =0.00) and random sampling subgroups ($Q = 2.21$, $I^2 = 9.51\%$, T^2 (z) =0.00) had produced an estimate of the same "true" effect size in a homogeneous population and the observed inconsistency of the effects belonging to the convenience sampling ($Q = 3.51$, $I^2 = 42.96\%$, T^2 (z) =0.07) was low (Higgins et al., 2003). Thus, subgrouping in terms of sampling techniques explained the heterogeneity of the combined effect size (behavioral intention) across the empirical studies.

Table 9
Subgroup Analysis (based on sampling techniques)

Study	r	95 % CI Lower Limit	95 % CI Upper Limit	Weight
1	0.63	0.55	0.70	28.84%
2	0.65	0.57	0.71	32.42%
3	0.56	0.49	0.62	38.74%
CS[1]	0.61	0.48	0.71	33.14%
4	0.80	0.76	0.83	39.05%
5	0.78	0.73	0.82	28.36%
6	0.79	0.75	0.82	32.59%
NPS[2]	0.79	0.77	0.81	33.57%
7	0.40	0.32	0.48	47.84%
8	0.44	0.32	0.54	25.11%
9	0.50	0.40	0.59	27.06%
RS[3]	0.44	0.31	0.55	33.30%
Combined	0.65	0.34	0.84	

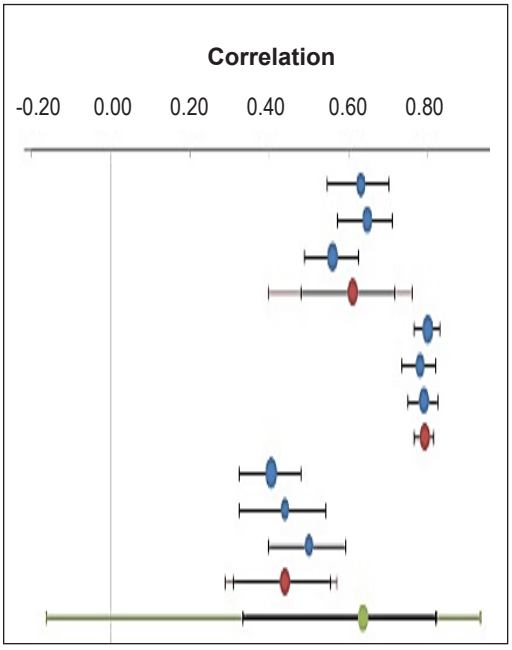

Figure 9. Forest Plot of subgroup analysis (based on sampling techniques)

Note. CS[1] = Convenience Sampling, NPS[2] = Non probabilistic Sampling, RS[3] = Random Sampling, r = Correlation (Table 9 sources of study; 1: Evi et al., 2021; 2: Verkijika & De Wet, 2018; 3: Altin & Yilmaz, 2021; 4: Dwivedi et al., 2017a; 5: Mensah et al., 2020; 6: Burhanudddin et al., 2019; 7: Khurshid et al., 2019; 8: Avazov & Lee, 2020; 9: Kirat Rai et al., 2020

Moderator Analysis

Apart from an endeavor to explain the dataset's high level of heterogeneity (Figure 6) with subgroup analysis, moderator analysis was performed (random effect model) by testing meta-regression of the effect sizes (behavioral intention) based on EGDI (Table 1) of the respective researched countries in the publishing year (Figure 10). The combined effect

size (0.76) is significant (Cohen, 1983), but there was no evidence that EGDI moderated the effect sizes of the behavioral intention (Q=2.32, p = 0.128 > 0.05, β = 0.51, df = 1), accounting for 26.24% of the between-study variance.

However, while performing the same meta-regression of the correlation between the mediator named attitude and behavioral intention based on EGDI (Figure 11), it was found that EGDI moderated the association strongly (Q=9.84, p = 0.002 < 0.05, β = 0.76, df = 1), resulting in 57.45% of the between-study variance and significant combined effect size (0.54) (Cohen, 1983).

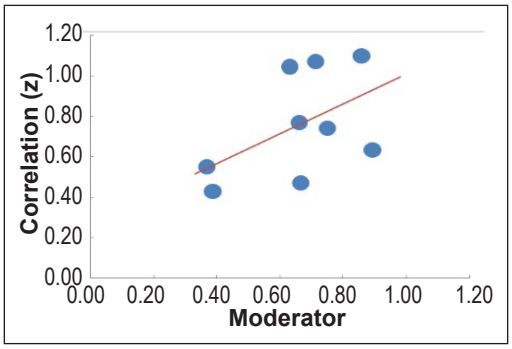

Figure 10. Meta-Regression of Behavioral Intention on EGDI

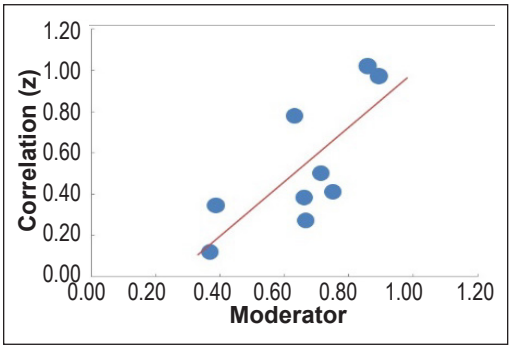

Figure 11. Meta-Regression of Attitude → BI association on EGDI

Publication Bias

Visual inspections of funnel plots and Egger's test were conducted to determine whether there was any publication bias (Egger et al., 1997). We constructed a dataset from our list of selected papers for a publishing bias test. The dataset includes research that has produced r values for the association between behavioral intention and the remaining constructs of the UMEGA [independent-dependent variable association] (Figure 6). As shown in Figure 12, the pattern of findings reported in these analyses was unaffected by Duval and Tweedie's (2000) trim and fill bias, implying that no studies were missing. Following this, Egger's test also suggested no evidence of publication bias (p = 0.22) (Egger et al., 1997). However, according to Cochrane's recommendation, as there were a small number of studies (k<10), publication bias might be unreliable (Higgins et al., 2019). Over time, this bias can be rechecked with more studies published on the empirical validation of the Unified Model of Electronic Government Adoption.

DISCUSSION

The summary of the findings from the systematic literature review, including meta-analysis, the theoretical and practical implications, and the limitations of the study, are illustrated in the following sections.

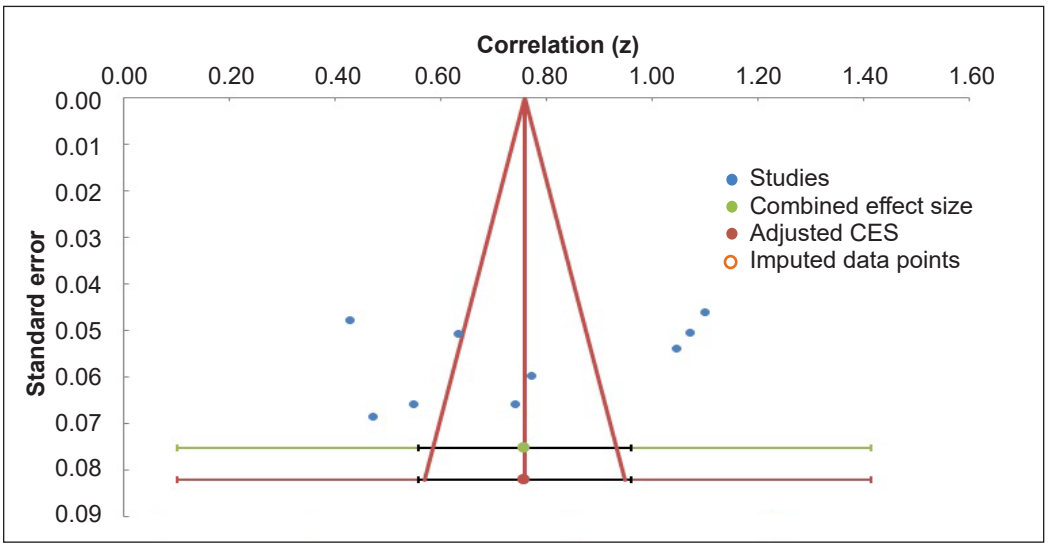

Figure 12. Funnel plot for behavioral intention effect sizes

Findings and Discussion

This study has the novelty to perform a systematic literature review, including meta-analysis, to analyze the empirical validation of the unified e-government adoption model, thus meeting the first objective. The nine publications in our work analyzed a wide range of respondents, domains, contexts, and constructs, offering a complete picture of the UMEGA components from which impact estimates on this connection could be extracted.

Since UMEGA was developed in 2017 in India, it has been validated in only two continents, Asia and Africa, where the former predominates. In all of the articles, the synthesis of the constructs revealed that the mediating role of attitude and the association between attitude and behavioral intention was positive and significant. The studies employed three types of sampling techniques, namely, random sampling, convenience sampling, and non-probabilistic sampling, to collect data by online questionnaire via e-mail or paper-based. Most studies followed a quantitative research strategy and a positivist research paradigm. They used structural equation modeling with SmartPLS, and a few employed AMOS to do statistical analysis and carried out reliability and validity analysis with the help of Cronbach's alpha, Composite reliability, Factor loadings, and Fornell-Larcker criterion, and the Heterotrait-Monotrait ratio (HTMT). Hence, a systematic literature review synthesizes findings presented in primary quantitative articles on the UMEGA model and puts an endeavor to conform to the second objective.

Along with SLR, the meta-analysis also provided the significance level, heterogeneity I^2 of the dataset, subgroup, and moderator analyses, and the biasedness among the publication utilizing the forest plot and funnel plot. The study included three meta-

analyses by emphasizing the true effect of (1) behavioral intention, (2) attitude, and (3) the association between attitude and behavioral intention. It was observed that the true combined effect size of behavioral intention was 0.64. The confidence interval was between 0.51 and 0.74, and the prediction interval ranged between 0.1 and 0.89. In terms of the mediator attitude, the true effect was 0.54. The confidence interval came up in the range of 0.38 to 0.66, and the prediction interval was between 0.01 and 0.83. Finally, the combined effect size of the association between the mediator and the independent variable was 0.49, whereas the confidence interval and prediction interval were between 0.28 and 0.65 and -0.24 and 0.87, respectively. All true effects were significant per Cohen's recommendation (Cohen, 1983).

Nevertheless, all three meta-analyses produced large heterogeneity, suggesting the necessity of a quest for sub-group and moderator analysis. The subgroup analysis of the true effect of behavioral intention was further carried out using the random effect model based on the sampling techniques. The result indicated that non-probabilistic ($Q = 0.57$, $I^2 = 00.00\%$, T^2 (z) =0.00) and random sampling subgroups ($Q = 2.21$, $I^2 = 9.51\%$, T^2 (z) =0.00) had lower I^2, whereas that of convenience sampling was moderate (Higgins et al., 2003), thus explaining the heterogeneity of the meta-analysis of behavioral intention to some extent.

Subsequently, the moderator analysis following the random-effect model was performed in two phases: (1) meta-regression of the effect sizes (behavioral intention) based on EGDI, and (2) meta-regression of the effect sizes of the association between behavioral intention and attitude based on EGDI. It was found that EGDI did not moderate the effect sizes of the behavioral intention ($Q=2.32$, $p = 0.128 > 0.05$, $\beta = 0.51$, $df = 1$), yielding a combined effect size of 0.76 and 26.24% of the between-study variance, whereas EGDI moderated the association between behavioral intention and attitude strongly ($Q=9.84$, $p = 0.002 < 0.05$, $\beta = 0.76$, $df = 1$), resulting in 57.45% of the between-study variance and significant combined effect size (0.54).

Finally, the funnel plot suggests that the pattern of findings reported in these analyses was unaffected by Duval and Tweedie's trim and fill bias (Figure 12) (Duval & Tweedie, 2000), implying that no studies were missing. Following this, Egger's test has also indicated no evidence of publication bias (Duval & Tweedie, 2000). However, due to the high degree of heterogeneity ($I^2= 0.962$) in the dataset (Hak et al., 2016), the funnel plot analysis did not prove publication bias precisely (Borenstein et al., 2009). Therefore, the meta-analysis analyses the performance of the constructs of the UMEGA obtained from the assessment of the empirical validation found in nine articles published since UMEGA was proposed in 2017. In particular, meta-analysis sheds some light on the combined effect size of the mediator and dependent variable and confirms the third objective of the study, which reveals the significant predictive power of attitude and behavioral intention while implementing UMEGA.

Implications

This article contributes theoretically and practically. From the theoretical perspective, a thorough systematic literature review can be served as a solid foundation for knowledge expansion, easing the way for theoretical development and highlighting areas that require more study. Second, we provide a clearer knowledge of the current trends and patterns in applying theoretical constructs and models, particularly for the most recent research model of e-government adoption, UMEGA. All the insights extracted from the SLR and meta-analysis of this study will pave the way for considering UMEGA or identifying the constructs of the desired model for e-government adoption, especially in the context of developing countries. The results of this study can be used by researchers as a strong base for a more precise and effective selection of constructs in an analysis of the adoption of e-participation, offering additional criteria for whether to include or not a variable in the research model. The study's findings significantly impact governments looking to establish e-participation platforms. It indicates that governments must pay close attention to measures that maintain citizens' good attitudes and perceptions of the platform's value.

Limitations

Limited sources were used to compile the results of this systematic literature review. Future research might look at other databases and journals. Most selected studies had a cross-sectional survey, indicating that this subject of study is currently in its early phases of development. As a result, no inferences can be drawn about the direction or cause of the associations among the latent constructs. Regarding exclusion criteria, research not written in any other language besides English was eliminated because of the lack of translation resources. The removal of unpublished research may have influenced the review's accuracy due to the 'file drawer' phenomenon. Irrespective of these methodical considerations, the meta-analyses having inconsequential selection bias show that any file drawer bias may not have notably influenced the outcomes found in the current study.

Due to the very recent development of the UMEGA and quality article screening following the PRISMA method, this study included only nine studies, failing to meet the minimum required dataset of studies for publication bias to be assessed (Sterne et al., 2011). Following suggestions to utilize this meta-analysis method while adding a few more studies to increase control over the likelihood of type I errors, Hedges' methodology was employed to adjust all effect sizes in the analyses (Field, 2003).

Additional sub-group and moderator analyses might have been conducted to look at systematic differences across methodological quality studies. However, these were deemed unacceptable due to the small number of studies and the consequently decreased range in quality of the study. In some articles, we could not delve deeper into the type of responses for various levels of e-participation due to a lack of clear descriptions. Moderator

factors (such as cultural aspects or demographics and second-order constructs) were rarely employed in the quantitative papers. As a result, this study did not consider subsequent moderator or second-order constructs analysis.

CONCLUSION

In summary, this is the first of its type in the Unified Model of E-government Adoption reviews, and it aims to summarize a wide variety of investigations. Because the research is still in its early phases, caution offers the findings. We reviewed numerous theoretical and methodological difficulties that might have been biased in the existing literature and the implications for future studies. Nonetheless, the data gathered for this research reveals a significant association of behavioral intention with the mediator named attitude and the independent latent constructs of the model. It is suggested that further study be conducted in this area to improve our understanding of this relationship. Furthermore, a country's policymakers may use the findings to build ICT infrastructure while attempting to implement the UMEGA as a framework.

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