A meta-analysis of existing research on citizen adoption of e-government

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Abstract

The purpose of this paper is to perform a weight-analysis and to undertake a meta-analysis of findings reported in published research on the adoption and diffusion of e-government. Usable data relating to e-government adoption research were collected from 103 empirical studies. Of those 103 articles, only 63 used a range of different constructs with appropriate correlation values required for performing a weight- and meta-analysis. Diagrammatic representation has been presented using significant as well as non-significant relationships from all 103 publications. A broader analysis of research on adoption and diffusion of e-government also reflects that although a large number of theories and theoretical constructs were borrowed from the reference disciplines, their utilization by e-government researchers appears to be largely random in approach. This paper also acknowledges the theoretical contribution, the limitations of this study, and suggests further research directions for the continued work.

Keywords: E-Government, Citizen adoption, Theoretical constructs, Weight analysis, Meta-analysis

1 Introduction

Electronic government refers to the use of information technology (IT) to advance the competence, effectiveness, intelligibility, and accountability of public government (Kraemer and King, 2003). The implementation of e-government systems is attracting increasing amounts of research interest, and is believed to represent one of the most significant IT implementations and organizational challenges of the coming decade (Warkentin et al., 2002;

Marche and McNiven, 2003). Over the past few years, a small but emerging body of scholarly literature on e-government has emerged (Norris and Lloyd, 2006), but it appears to run the risk of not achieving its maturity (Gronlund, 2005).

Despite the significant impact to date of e-government systems and services on public administrations, organizations, individuals, and society, only a few methodical and comprehensive studies have been undertaken on this subject (Jaeger, 2003; Kraemer and King, 2003). Although, the ongoing trends of different e-government services are being explored across different countries, the authenticity and consistency of the various theoretical approaches being used in e-government adoption research has yet to be examined. No study has, as yet, established the cumulative illustration of the constructs to determine the trend of the citizen adoption of e-government, nor has any attempt been made towards performing a comprehensive meta-analysis of the existing empirical publications to visualize the performance of the constructs and their relevance in the e-government adoption research.

Moreover, despite of more than a decade of research in the field of e-government and the centrality of weight-analysis (Jeyaraj et al., 2006) and meta-analysis (King and He, 2006; Lee et al., 2003) in the IT innovation adoption research to use appropriate procedures to conduct significant quantitative analyses, no such fact finding initiatives and the theoretical rigor for e-government adoption literature have yet been performed. Such studies on e-government research will allow the researchers to identify the theoretical gaps in the existing knowledge and would suggest the further lines of research in this area about the possible pattern of constructs and their overall performance.

Therefore, in order to understand the use and advancement of research models and cumulative performance of the constructs, the aim of this study is to perform a weight-analysis and to undertake a meta-analysis of findings reported in existing research on the adoption and diffusion of e-government. The success of this study is achieved by representing the combined diagrammatic representation for the citizen adoption of e-government, finding the number of significant and non-significant relationships between the leading constructs of these categories, and to use this to evaluate the weight-analysis, and finally perform a comprehensive meta-analysis of the constructs to identify the overall performance of the related constructs.

The paper is structured as follows: In the next section we describe the research methodology used, and follow this with a section presenting our findings based on the combined research diagram presented for citizens, followed by the tabular representation of the 37 most frequently used relationships showing their degree of significance (i.e.,

significant as well as non-significant), and weight for each predictor. The next section describes a table (Table 2) representing the sample size, technology used, type of respondents, and country of research for all such studies on which the meta-analysis has to be performed. A meta-analysis (Table 3) for the 37 most frequently used relationships has been performed with consideration of the sample size and the correlation coefficients (e.g., Pearson's correlation) gathered from the different studies. We then present a discussion of our findings and finally, present our concluding remarks on the implications and limitations of the study, and suggestions for the direction of future research.

2 Research Methodology

Since purpose of this research was to synthesize the findings from existing research on eGov adoption, a combination of review and meta-analysis approach (Dwivedi and Kuljis, 2008; Dwivedi et al., 2009; 2010; 2011a; 2011b; King and He, 2006; Rana et al., 2011; 2012a; 2012b; 2012c) was adopted in order to undertake this research. Our exploration began with a search for articles related to e-government; this was achieved by developing a relevant set of keywords and phrases, such as: 'electronic government', 'e-government', 'e-gov', 'egov', 'digital democracy', 'online government', 'adoption', 'acceptance', 'usage', 'implementation', 'impact', and 'diffusion' in all possible permutations and combinations, (taking into consideration the logical AND, and OR as appropriate), and conducting a corresponding search of the online journal database *ISI Web of Knowledge*®. In addition to these, a number of journals, such as: *Transforming Government: People, Process, and Policy* (TGPPP), *Electronic Government, an International Journal* (EGIJ), and *International Journal of Electronic Government Research* (IJEGR) dedicated to electronic government were also searched. In total, 448 publications were found to be relevant to the area of adoption and diffusion of e-government.

These usable articles were then scanned again for those which have utilized certain variables and constructs to analyze the various electronic government systems. Our focus was on those articles that were empirical in nature. It was determined that of the original 448, just 103 studies used a range of different constructs to investigate e-government scenarios. It was further noted that only 63 of these used various theories, models or frameworks either in their original structure, or in an altered form on which to base their research models. However, we were aiming for all such articles that not only have used the constructs, but also the relevant statistical details that may be useful for performing weight- and meta-analysis of the constructs' relationships in evaluating the cumulative influence of the convergence or divergence of their relationships. The reason to perform weight-analysis for the predictors of e-

government adoption research was based on the fact that weights are the indicators of the predictive power of the independent variables provided that such variables are examined on certain dependent variables more than a few times (Jeyaraj et al., 2006).

Similarly, the meta-analysis was performed on the most-frequently used relationships of e-government adoption research mainly due to the following reasons: firstly, it is a well-known method for incorporating findings of the prior independent studies investigating the same research question (Sharma and Yetton, 2003) such as the performance of the frequently-used independent variables on the dependent variables of e-government adoption research; secondly, it allows previous non-significant or even inconsistent outcomes to contribute to a pooled conclusion (Sabherwal et al., 2006); and finally, it is a suitable method to highlight gaps in the existing knowledge and to propose the further studies on the patterns found in the analysis (Lee et al., 2003). Out of the 103 articles that were based on some research models consisting of the variables and constructs with some form of quantitative details, we identified those studies that could help in establishing a combined diagrammatic representation combining the common constructs, and leaving apart the discrete set of constructs and variables. Our selection process also considered those studies whose appropriate statistical details might be used later in order to find the meta-analysis of the constructs. Considering all these aspects, we identified 63 such studies, which have been found relevant for citizens and whose quantitative details were relevant for the weight analysis and meta-analysis.

After constructing a combined diagram for citizens, we gathered the details of the relationships between all the independent and dependent constructs, which have divided them into significant or non-significant groups. We then listed all 63 studies with their sample size in a table to explore the degree of exhaustiveness, and the level of diversification used for accomplishing the studies. In addition, this also prepares one of the inputs for performing the meta-analysis of the constructs and variables to find the collective impact on their relationships. A weight analysis for each relationship was performed based on the number of significant relationships and total number of relationships analyzed between a set of independent and dependent variables. With the correlation coefficients collected between each pair of constructs from various studies, we then estimated the single cumulative value between all such constructs to establish the prospective trend of convergence or divergence. We used the trial version of the *Comprehensive Meta-Analysis* Software downloaded from the Internet (using the website: www.meta-analysis.com) to perform the meta-analysis. In our meta-analysis, we have selected only those sets of constructs for which the given relationship between the independent and dependent constructs has been explored three or more

times allowing proper correlation coefficients to be obtained. The meta-analysis software not only estimates the cumulative correlation coefficient, but also generates the effect-size (p-value) and Z-value.

3 Findings

Figure 1 portrays a cumulative diagram considering all such constructs and their involved relationships which were used to investigate the e-government adoption issues of citizens. Further analysis indicated that *behavioral intention* is the most widely used dependent variable followed by: *attitude, trust, perceived ease of use, perceived usefulness, and actual use* as other frequently used dependent variables. It is important to note that the variables, such as: *perceived ease of use*, *perceived usefulness*, and *attitude* were the most commonly used independent variables, followed by: *subjective norm, perceived behavioral control, relative advantage, performance expectancy, effort expectancy, social influence, trust, perceived risk, facilitating conditions, information quality, system quality,* and *service quality* as other leading independent variables.

The basic constructs for the technology acceptance model (TAM) model, such as: *perceived ease of use*, *perceived usefulness*, and *intention to use* are some of the most widely used constructs even across e-government literature. Many researchers have found that *perceived usefulness* and *perceived ease of use* explain a large portion of the variance for intention to use an information system (Davis et al., 1989; Gefen et al., 2000). Even in the context of e-government adoption research, a high level of usefulness is likely to increase the user adoption of e-government systems (Sang et al., 2009). The other reasons for these constructs being so frequently used may be the parsimonious nature of the TAM model, and the widely validated survey instrument and measure for undertaking data collection. The analysis of the relationships presented in the diagram also indicates that the relationships of various constructs such as *trust*, *risk*, and *privacy* and *security* with the variables including behavioral intention, use behavior, and attitude, and between themselves (such as trust with risk) represent a new dimension in this research.

Analysing such relationships and evaluating their performance is also very interesting to visualize in context of e-government adoption due to the fact that these variables had essentially no significance as far as the IT innovation adoption research is concerned. This fact becomes evident from the various prominent models of IS/IT adoption including the theory of reasoned action (TRA), the TAM, the extended TAM (TAM2), the theory of planned behavior (TPB), the diffusion of innovation (DOI), and the unified theory of acceptance and use of technology (UTAUT) to name a few, where none of these factors (i.e., *trust*, *risk*, and *privacy* and *security*) have been

assimilated. This point is also supported by Jeyaraj et al. (2006), who reviewed the predictors, linkages, and biases of a large array of variables of IT innovation adoption research without any evidence of these variables (i.e., *trust*, *risk*, and *privacy and security*). The analysis of the cumulative diagram for citizen's adoption of e-government research also indicates that there are range of variables: *uncertainty, time efficiency, price savings, perceived reliability, perceived privacy, perceived empathy, declining cost, perceived lack of need, perceived quality*, and *perceived concerns*, which are used only once and seem to be very specific and quite scattered in nature.

[**Legend for Figure 1.** ACC: Accuracy; AG: Age; ANX: Anxiety; API: Avoidance of Personal Interaction; ASR: Assurance; ASS: Assistance; ATT: Attitude; AU: Actual Use; AVL: Availability; AWR: Awareness; BA: Broadband Access; BEH: Behavior; BEN: Benevolence; BI: Behavioral Intention; CA: Computer Anxiety; CEXP: Citizen Expectation; COM: Compatibility; COMP: Complexity; COMT: Competence; CON: Convenience; CS: Computing Support; CT: Cost; DC: Declining Cost; DMA: Digital Media Access; DME: Digital Media Experience; DMP: Digital Media Preference; DPC: Declining Physiological Condition; DT: Disposition to Trust; ED: Education; EE: Effort Expectancy; EI: External Influence; EGA: E-Government Adoption; EMP: Empathy; EPE: External Political Efficacy; FC: Facilitating Conditions; FD: Future Development; FI: Family Influence; FLX: Flexibility; FP: Family Position; FRI: Friend Influence; FU: Future Use; GEN: Gender; HO: Hedonic Outcome; IC: Internet Competence; ICU: Intention to Continue Using; IE: Internet Experience; II: Interpersonal Influence; IT: Internet Trust; IIT: Innovativeness of IT; IMG: Image; INC: Income; IPC: Internal Political Efficacy; IQ: Information Quality; ISP: Internet Safety Perception; IU: Internet Use; IUWI: Internet Use Web Information; IUWT: Internet Use Web Transformation; INTG: Integrity; JR: Job Relevance; KS: Knowledge Services; MOB: Mobility; MT: Motivators; OB: Optimism Bias; PBC: Perceived Behavioral Control; PC: Perceived Credibility; PCN: Perceived Concerns; PCT: Perceived Cost; PCV: Perceived Convenience; PE: Performance Expectancy; PEN: Perceived Enjoyment; PER: Persuasion; PET: Previous E-Government Transaction; PEOU: Perceived Ease of Use; PES: Perceived Ease of Obtaining Subscription; PHC: Preference for Human Contact; PI: Personal Innovativeness; PIN: Primary Influence; PLN: Perceived Lack of Need; PK: Perceived Knowledge; PNB: Perceived Net Benefit; POT: Perceived Organizational Trustworthiness; PPR: Perceived Personal Relationship; PQ: Perceived Quality; PQT: Functional Value (Perceived/Quality) Perceived in Electronic Channel; PQ: Perceived Quality; PR: Perceived Risk; PRM: Performance; PRT: Perceived Trust; PRV: Privacy; PS: Perceived Security; PSC: Perceived Sacrifice; PSOA: Perceived Strength of Online Authentication; PSON: Perceived Strength of Online Non-Repudiation; PSOP: Perceived Strength of Online Authentication; PT: Perceived Trustworthiness; PTR: Propensity to Trust; PU: Perceived Usefulness; PVP: Functional Value (Price/Value for Money) Perceived in Electronic Channel; RA: Relative Advantage; REL: Reliability; RESP: Responsiveness; RFC: Resource Facilitating Conditions; RP: Risk Perception; RS: Resource Savings; SA: Self-Actualization; SAI: Structural Assurance of the Internet; SBT: Substitutability; SE: Self-Efficacy; SI: Social Influence; SIN: Secondary Influence; SK: Skills; SN: Subjective Norm; SO: Social Outcome; SP: Societal Position; SQ: Service Quality; SRQ: Service Quality; SS: Supply Services; SSI: Secondary Source's Influence; STS: Satisfaction; SVP: Social Value Perceived in Electronic Channel; SYQ: System Quality; TA: Trusting Attitude; TB: Trusting Beliefs; TBS: Trusting Bases; TC: Technology Characteristics; TEF: Trust of the E-Filer; TEG: Trust in E-Government; TEGA: Trust in E-Government Agent; TEGW: Trust in E-Government Website; TFC: Technology Facilitating Conditions; TG: Trust of the Government; TI: Trust of the Internet; TIN: Trusting Intention; TOI: Trust of Intermediary; TRI: Training Impression; TRN: Training; TRST: Trust; TT: Trust in Technology; UB: Use Behavior; UO: Utilitarian Outcome; US: User Satisfaction; VPT: Value Perceived in Traditional Service Delivery Channel; WQ: Website Quality; WU: Website Usefulness; YIE: Years of Internet Experience]. [Types of Relationship Indicator: +: Significant; X: Non-Significant; and *: Mixed Relationship]

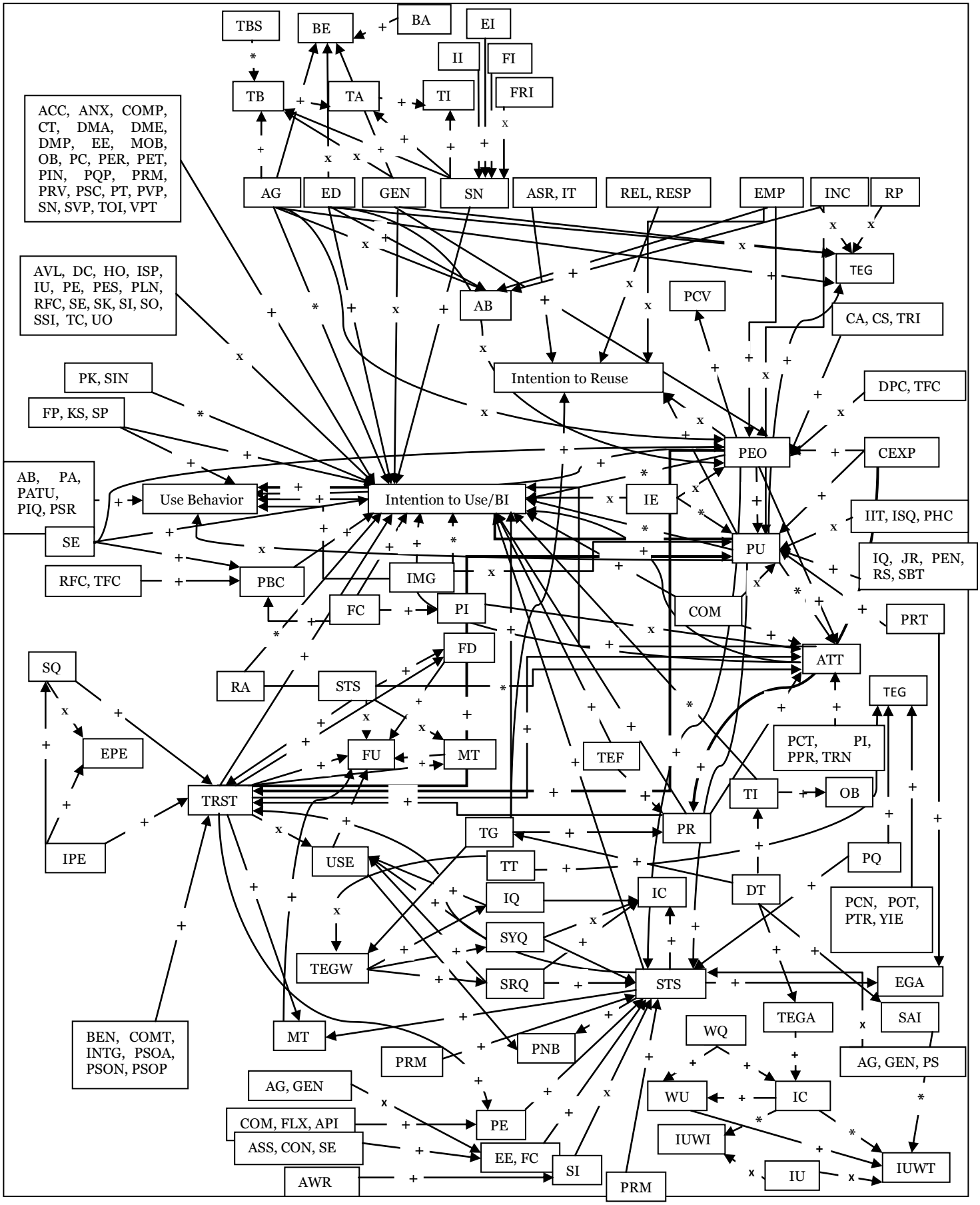

Figure 1 Cumulative Construct Diagram for Citizen's Adoption of E-Gov

3.1 Constructs' Relationships and Weight Analysis

Table 1 presents a brief description of the 37 most frequently used relationships of the e-government adoption research. This includes the number of significant (using abbreviation SIG), non-significant (using abbreviation NS) relationships, a total number of relationships available between each pair of variables, and the weight computed for each pair of variables. The weight evaluation is a technique by which the strength of a predictor (i.e. independent variable) is examined. Such analysis evaluates the predictive power of an independent variable in a given relationship (Jeyaraj et al., 2006). An in-depth analysis reveals that all the relationships of TAM (e.g., *perceived ease of use-behavioral intention*, *perceived usefulness-behavioral intention*, and *perceived ease of use-perceived usefulness*) were the most frequently used relationships. Although, the unified theory of acceptance and use of technology (UTAUT) has been a fast-growing technology acceptance theory, its construct relationships have not fully explored with among the research studies of e-government adoption. Moreover, out of total 37 frequently used relationships illustrated, *behavioral intention* has been visualized as a dependent variable in the majority (C=17) of them. To examine the degree of effectiveness of the relationships, Jeyaraj et al. (2006) analyzed the weight for each relation.

Table 1 Weight analysis of the most frequently used relationships (Approach adapted from: Jeyaraj et al., 2006)

Independent Variable	Dependent Variable	SIG	NS	Total	Weight
Perceived Ease of Use	Behavioral Intention	16	11	27	0.59
Perceived Usefulness	Behavioral Intention	21	3	24	0.88
Perceived Ease of Use	Perceived Usefulness	18	2	20	0.90
Trust	Behavioral Intention	19	3	22	0.86
Attitude	Behavioral Intention	15	1	16	0.94
Perceived Usefulness	Attitude	12	2	14	0.86
Perceived Ease of Use	Attitude	11	2	13	0.85
Behavioral Intention	Actual Use	10	0	10	1.00
Subjective Norm	Behavioral Intention	9	0	9	1.00
Performance Expectancy	Behavioral Intention	8	1	9	0.89
Social Influence	Behavioral Intention	8	1	9	0.89
Effort Expectancy	Behavioral Intention	7	2	9	0.78
Perceived Behavioral Control	Behavioral Intention	8	0	8	1.00
Relative Advantage	Behavioral Intention	5	3	8	0.63
Compatibility	Behavioral Intention	6	2	8	0.75
Perceived Risk	Behavioral Intention	4	3	7	0.57
Self-Efficacy	Behavioral Intention	5	2	7	0.71
Compatibility	Attitude	6	1	7	0.86
Trust	Perceived Risk	4	2	6	0.67
Compatibility	Perceived Usefulness	4	2	6	0.67
Facilitating Condition	Behavioral Intention	3	2	5	0.60
System Quality	Satisfaction	3	2	5	0.60
Service Quality	Satisfaction	4	1	5	0.80
Job Relevance	Perceived Usefulness	3	2	5	0.60
Facilitating Conditions	Perceived Behavioral Control	4	0	4	1.00

Self-Efficacy	Perceived Behavioral Control	3	1	4	0.75
Relative Advantage	Attitude	4	0	4	1.00
Image	Behavioral Intention	1	3	4	0.25
Image	Perceived Usefulness	2	1	3	0.67
Information Quality	Satisfaction	2	1	3	0.67
Primary Influence	Behavioral Intention	3	0	3	1.00
Facilitating Condition Resources	Behavioral Intention	3	0	3	1.00
Trust	Attitude	1	2	3	0.33
Perceived Ease of Use	Satisfaction	2	1	3	0.67
Self-Efficacy	Perceived Ease of Use	3	0	3	1.00
Information Quality	Perceived Usefulness	3	0	3	1.00
Perceived Risk	Attitude	2	1	3	0.67

[Legend for Table 1. SIG: # of significant relationships, NS: # of non-significant relationships]

In order to recognize the most effective predictors, Jeyaraj et al. (2006) classified independent constructs into two types: 'well-utilized', which is examined five or more times, and 'experimental' that was examined in less than five relationships. Hence, the benchmark for the "best predictor" was set as a weight for the independent variable to be greater than or equal to 0.80, and would have been observed five or more times. In order to expose the strength of the relationship between a given set of independent and dependent constructs, two facets are taken into consideration. Firstly, how many times a particular relationship between constructs is examined, and secondly, how many of these relationships are significant. Dividing the second data value by the first (e.g., for the most frequently used relationship *perceived ease of use-behavioral intention*, Weight=16/27=0.59) provides the weight significance of a relationship between the constructs.

The weight '1' indicates that the relationship between two variables is significant throughout all studies, whereas '0' indicates this relationship to be non-significant across all studies examined (Jeyaraj et al., 2006). Following the definition for the best predictor from Jeyaraj et al. (2006), it was found that many predictors representing the corresponding relationships including: *perceived usefulness* on *behavioral intention, perceived ease of use* on *perceived usefulness, trust* on *behavioral intention, attitude* on *behavioral intention, perceived usefulness* on *attitude, perceived ease of use* on *attitude, social influence* on *behavioral intention, behavioral intention* on *actual use, subjective norm* on *behavioral intention, performance expectancy* on *behavioral intention, perceived behavioral control* on *behavioral intention*, and *service quality* on *satisfaction* fall under this category, as they were explored five or more times with a weight of greater than or equal to 0.80.

The analysis of variables used across the most frequently used relationships indicates that the well-utilized predictors of: *behavioral intention* on *actual use* (examined 10 times, significant all 10 times), *subjective norm* on *behavioral intention* (examined 9 times, significant all 9 times), and *perceived behavioral control* on *behavioral*

intention (examined 8 times, significant all 8 times) were found significant across all the investigations. Hence, their weights were computed as '1', as per the technique of Jeyaraj et al. (2006), and therefore they hold a significant place in e-government adoption research. However, the relationships with the predictors such as: *facilitating conditions* on *perceived behavioral control* (examined 4 times, significant all 4 times), *relative advantage* on *attitude* (examined 4 times, significant all 4 times), *personal innovativeness* on *behavioral intention* (examined 3 times, significant all 3 times), *facilitating condition resources* on *behavioral intention* (examined 3 times, significant all 3 times), *self-efficacy* on *perceived ease of use* (examined 3 times, significant all 3 times), and *information quality* on *perceived usefulness* (examined 3 times, significant all 3 times) are considered as *promising predictors* of their corresponding dependent constructs with a weight of '1', even though they were examined in less than five relationships (Jeyaraj et al., 2006). *Promising predictors* are defined as independent variables that have been examined by researchers less than 5 times and have weights equal to '1' (Jeyaraj et al., 2006). Although such relationships were found to be significant every time they were examined, Jeyaraj et al. (2006) suggest that such variables (also known as experimental variables) would require more testing to qualify as the best predictor, and thus they encourage researchers to examine such promising predictors in the future.

Although none of the relationships were found to be non-significant across all their investigations, some of them being well-utilized independent variables and still visualized as least effective predictors including: *perceived ease of use* on *behavioral intention* (examined 27 times, significant 16 times), *relative advantage* on *behavioral intention* (examined 8 times, significant 5 times), *perceived risk* on *behavioral intention* (examined 7 times, significant 4 times), *trust* on *perceived risk* (examined 6 times, significant 4 times), *compatibility* on *perceived usefulness* (examined 6 times, significant 4 times), *facilitating conditions* on *behavioral intention* (examined 5 times, significant 3 times), *system quality* on *satisfaction* (examined 5 times, significant 3 times), and *job relevance* on *perceived usefulness* (examined 5 times, significant 3 times) were not found to be the worst predictors of their dependent variables as far as e-government adoption research is concerned.

Thus, Jeyaraj et al. (2006) suggested that researchers should find convincing reasons to continue with such predictors. However, we think that it would be premature to make decisions about not using such relationships in the context of e-government adoption research for a number of reasons: firstly, e-government adoption research is still immature as far as the empirical aspects and solid theoretical foundations of this research is concerned; secondly, these variables have performed as expected as far as IS adoption research is concerned; and lastly because weight

analysis may not be the sufficient condition for any predictor to be discarded from further analysis. Out of the total 37 most frequently used relationships only 24 have been found to be analyzed five or more times. This indicates that e-government adoption based empirical research is still not as developed as IS/IT adoption research, where a range of predictors with five or more analyses are present, as has been shown in the analysis by Jeyaraj et al. (2006).

Figure 2 presents a comprehensive model of e-government adoption research by considering the most frequently used 37 relationships. The weight of each predictor is also mentioned to show its strength, and to demonstrate the most effective predictors (Jeyaraj et al., 2006). This diagram is a concise form of the combined diagram presented in Figure 1 and places the 37 relationships (shown in Table 1) into a diagrammatic representation.

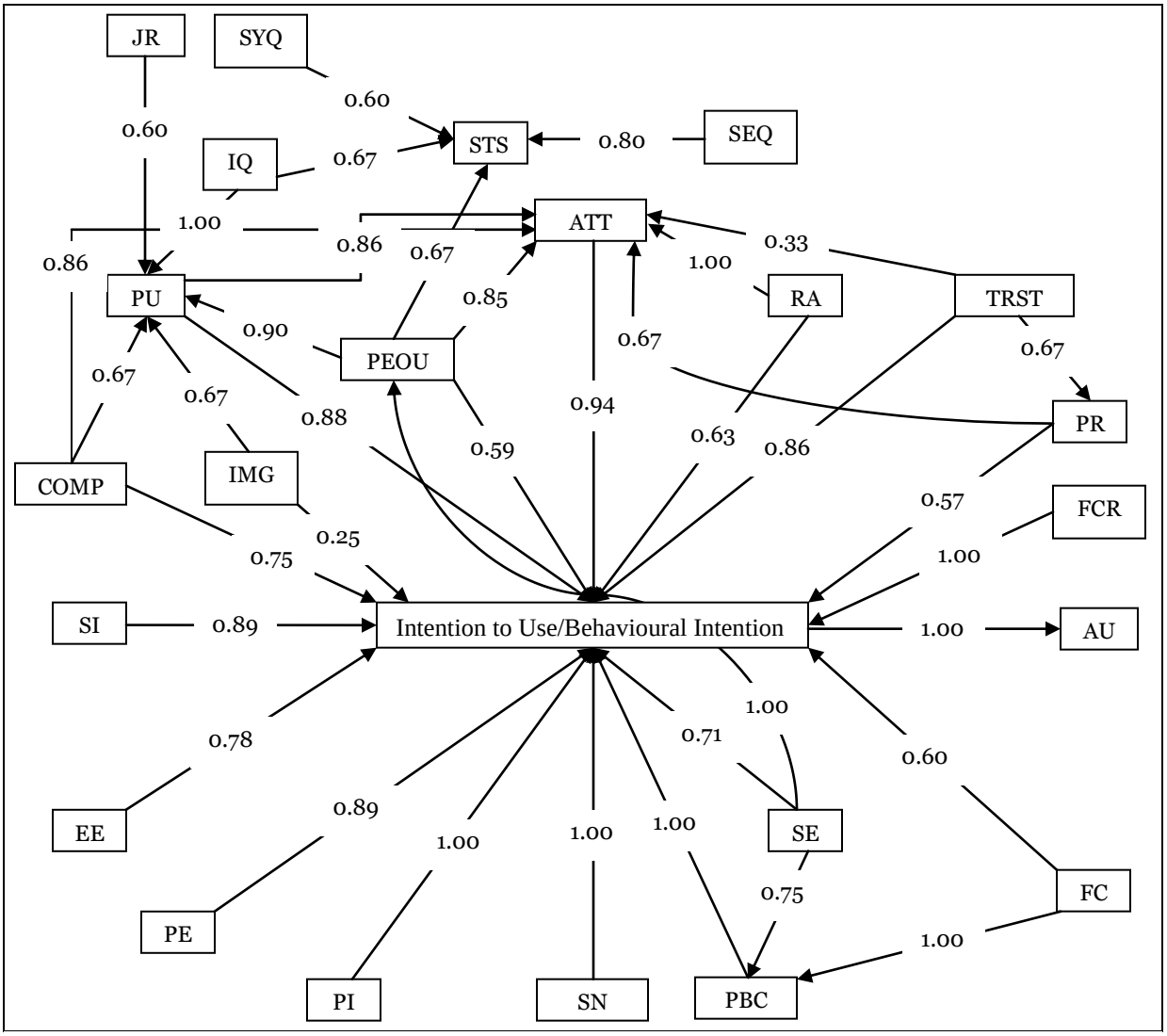

Figure 2 Parsimonious E-Gov Adoption Model with Most Frequently Used Relationships and Weights

[**Legend for Figure 2.** ATT: Attitude, AU: Actual Use, BI: Behavioral Intention, COMP: Compatibility, EE: Effort Expectancy, FC: Facilitating Conditions, FCR: Facilitating Condition Resources, IMG: Image, IQ: Information

Quality, IU: Intention to Use, JR: Job Relevance, PBC: Perceived Behavioral Control, PE: Performance Expectancy, PEOU: Perceived Ease of Use, PI: Personal Innovativeness, PR: Perceived Risk, PU: Perceived Usefulness, RA: Relative Advantage, SE: Self Efficacy, SEQ: Service Quality, SI: Social Influence, SN: Subjective Norm, STS: Satisfaction, SYQ: System Quality, TRST: Trust]

3.2 Details of Meta-Analytic Studies

Table 2 presents the details, such as: technology being used, the user type, sample size, and the country of research for the 63 studies for which the weight of the predictors has been measured and the meta-analysis has been performed. The studies have considered citizens from various walks of life in performing their research. The number of significant relationships and the total number of relations are counted for each relationship to measure the weight for the leading predictors in this research. Similarly, the sample size and the corresponding correlation coefficients (i.e., Pearson's Correlation) have been considered for analyzing the cumulative performance of the relationships.

Table 2 Studies used in the meta-analysis (Approach adapted from: Schepers and Wetzels, 2007)

Study	Sample/Technology	Respondents	Country
Wang (2002)	E-Filing Systems	260 citizens	Taiwan
Lau (2004)	E-Government Services	198 citizens	Hong Kong
Chu et al. (2004)	E-Tendering System	158 users	Taiwan
Seyal and Pijpers (2004)	Internet Systems	100 executives	Brunei
Tung and Rieck (2005)	E-Government Services	128 users	Singapore
Carter and Belanger (2005)	E-Government Services	105 citizens	USA
Phang et al. (2005)	E-Withdrawal System	99 citizens	China
Fu et al. (2006)	Electronic Filing System	27208 taxpayers	Taiwan
Hung et al. (2006)	Online Tax Filing System	1099 public	Taiwan
Kim and Holzer (2006)	Digital Democracy	895 officers	South Korea
Sun et al. (2006)	E-Official-Doc System	631 managers	Taiwan
Phang et al. (2006)	Information Systems	139 citizens	China
Yao and Murphy (2007)	Electronic Voting System	453 citizens	USA
Hung et al. (2007)	E-Kiosk System	244 citizens	Taiwan
Dwivedi et al. (2007b)	Broadband System	237 citizens	Pakistan
Khoumbati et al. (2007)	Broadband System	237 citizens	Pakistan
Lee and Lei (2007)	E-Government System	226 citizens	China
Sahu and Gupta (2007)	E-Government System	163 users	India
Dwivedi and Weerakkody (2007)	Broadband System	138 users	Saudi Arabia
Lau and Kwok (2007)	E-Commerce System	87 professionals	Hong Kong
Dwivedi et al. (2007a)	E-Services System	70 citizens	Bangladesh
van Dijk et al. (2008)	Internet Services	1225 citizens	Netherlands
Tan et al. (2008)	Website Application	647 citizens	USA
Colesca and Dobrica (2008)	E-Government Services	481 citizens	Romania
Li et al. (2008)	Information Systems	443 students	USA
Pinho and Macedo (2008)	E-Declaration System	351 accountants	Portugal
Belanger and Carter (2008)	E-Government System	214 citizens	USA
Teo et al. (2008)	E-Government Website	214 students	Singapore
Vathanophas et al. (2008)	Internet Systems	124 naval officers	Thailand
Wang and Liao (2008)	E-Government System	119 citizens	Taiwan
Carter (2008)	E-Government System	105 citizens	USA
Gotoh (2009)	Online Tax Filing System	824 users	Japan
Yeow and Loo (2009)	ATM Systems	500 citizens	Malaysia

Tang et al. (2009)	E-Government Portal	385 citizens	China
Ojha et al. (2009)	Online Tax Filing System	310 students	India
Chiang (2009)	E-Voting System	281 students	Taiwan
Wang and Shih (2009)	E-Kiosk System	244 citizens	Taiwan
Hung et al. (2009)	E-Document System	186 citizens	Taiwan
Gumussoy and Calisir (2009)	E-Reverse Auction	156 employees	Multi-Countries
Lean et al. (2009)	E-Government Services	150 citizens	Malaysia
Sang et al. (2009)	E-Government System	112 public officers	Cambodia
Al-Shafi and Weerakkody (2009)	Wi-Fi Systems	54 citizens	Qatar
Teerling and Pieterson (2010)	Electronic Channels	893 citizens	Netherlands
Lu et al. (2010)	Online Tax Filing System	422 taxpayers	Taiwan
Hussein et al. (2010)	E-Filing Systems	411 teachers	Malaysia
Sambasivan et al. (2010)	E-Procurement System	358 users	Malaysia
Floropoulos et al. (2010)	Tax Information System	340 taxpayers	Greece
Liu and Zhou (2010)	E-Government System	304 citizens	China
Schaupp and Carter (2010)	E-Filing Systems	260 students	USA
Schaupp et al. (2010)	E-Filing Systems	260 students	USA
Karavasilis et al. (2010)	E-Government System	230 teachers	Greece
Dorasamy et al. (2010)	E-Filing Systems	200 taxpayers	Malaysia
Sang et al. (2010)	E-Government System	112 public officers	Cambodia
Rokhman (2011)	E-Government System	751 users	Indonesia
Orgeron and Goodman (2011)	Website Application	648 citizens	USA
Al-Sobhi et al. (2011)	E-Government System	626 citizens	Saudi Arabia
Susanto and Goodwin (2011)	SMS based E-Gov System	589 citizens	Indonesia
Styven et al. (2011)	e-Services Systems	422 citizens	Sweden
Carter et al. (2011)	Online Tax Filing System	304 taxpayers	USA
Lin et al. (2011)	E-Government Services	146 citizens	Gambia
Zhang et al. (2011)	Information Systems	121 students	China
Hu et al. (2011)	E-Gov Technology	40 field officers	USA
Sipior et al. (2011)	T-Government System	37 users	USA

3.3 Meta-Analysis of Constructs' Relationships

Meta-analysis is a statistical literature synthesis method that provides an opportunity to visualize the research background by blending and investigating the quantitative outcomes of various empirical publications (Glass, 1976). It is a thorough alternative to a qualitative and descriptive literature analysis (Rosenthal and DiMatteo, 2001; Wolf, 1986). It has been praised by many researchers for being better than a literature analysis (e.g., Hunter and Schmidt, 1990; Rosenthal, 1991). Table 3 presents the meta-analysis of the 37 most frequently used relationships that have occurred three or more times across the 63 studies. In addition to the independent and dependent variables, the table portrays the number of times a specific relation was examined, total sample size, average beta, effect size (p-value), standard normal deviations (Z-value), 95% lower and upper confidence interval, which support the correlation value likely to fall in this interval.

The findings indicated that the cumulative effect of relationship between a pair of variables: *perceived risk-behavioral intention, self-efficacy-behavioral intention, facilitating condition-behavioral intention, image-*

behavioral intention, information quality-perceived usefulness, service quality-satisfaction, perceived ease of use-satisfaction, perceived risk-attitude, trust-attitude, and trust-perceived risk were found to be non-significant, whereas all other relationships were quite significant. A further analysis of the relationships indicates that the impact of the relationships were largely investigated on the dependent variables, such as: *behavioral intention* (17 times), *attitude* (six times), *perceived usefulness* (five times), *satisfaction* (four times), and *perceived behavioral control* (two times).

The meta-analysis of the relationships indicates that 24 out of the 37 relationships were found to be significant. The correlations between: *perceived usefulness* and *behavioral intention, attitude* and *behavioral intention, performance expectancy* and *behavioral intention, perceived ease of use* and *perceived usefulness*, *compatibility* and *perceived usefulness*, *perceived ease of use* and *attitude*, *relative advantage* and *attitude*, *self-efficacy* and *perceived behavioral control*, *behavioral intention* and *actual use*, and *self-efficacy* and *perceived ease of use* are particularly very strong.

However, the correlations between: *perceived ease of use, trust, subjective norm, effort expectancy, social influence, perceived behavioral control, relative advantage, compatibility, personal innovativeness, facilitating condition resources* and *behavioral intention, job relevance* and *perceived usefulness*, *information quality* and *perceived usefulness*, *system quality* and *satisfaction*, *information quality* and *satisfaction*, *perceived usefulness* and *attitude*, *compatibility* and *attitude*, *facilitating conditions* and *perceived behavioral control*, and *image* and *perceived usefulness* are less significant, and together explain only 25% of the variance on the various dependent constructs (i.e., *behavioral intention, perceived usefulness, satisfaction, attitude*, and *perceived behavioral control*).

The 95% confidence interval for the correlations between: *perceived ease of use, perceived usefulness, trust, social influence, relative advantage, compatibility, personal innovativeness, facilitating condition resources* and *behavioral intention, perceived ease of use* and *perceived usefulness, compatibility* and *perceived usefulness, job relevance* and *perceived usefulness, facilitating conditions* and *perceived behavioral control* indicates their range difference (i.e., 95% High (β) – 95% Low (β)) of less than two, which reveals that the range is narrow enough to provide one confidence to the level of variance that could be explicated, and in the majority of the cases that the sample is large enough to approximate such parameters.

Table 3 Summary of zero-order random correlations (Approach adapted from: King and He, 2006)

I.V.	D.V.	#	T.S.S.	Avg (β)	p (ES)	Z-value	95% L(β)	95% H(β)
PEOU		27	62067	0.165	0.000	7.087	0.120	0.209

PU		24	32377	0.411	0.000	6.730	0.300	0.510
TRST		22	7554	0.214	0.000	7.192	0.157	0.270
ATT		16	5975	0.457	0.000	5.822	0.316	0.578
SN		9	29957	0.279	0.000	5.809	0.188	0.366
PE		9	3826	0.532	0.009	2.605	0.146	0.777
EE		9	3826	0.144	0.004	2.845	0.045	0.240
SI		9	3190	0.207	0.000	5.806	0.138	0.274
PBC	BI	8	2895	0.323	0.000	4.981	0.200	0.436
RA		8	2007	0.211	0.000	5.138	0.132	0.287
COMP		8	2257	0.258	0.000	4.890	0.157	0.353
PR		7	55738	0.036	0.115	1.578	-0.009	0.080
SE		7	28839	0.080	0.137	1.486	-0.026	0.184
FC		4	1158	-0.591	0.440	-0.773	-0.984	0.779
IMG		4	1577	0.044	0.311	1.013	-0.042	0.130
PI		3	544	0.235	0.000	5.466	0.152	0.314
FCR		3	544	0.276	0.000	6.542	0.196	0.352
PEOU		20	31705	0.393	0.000	8.281	0.310	0.470
COMP	PU	6	54827	0.439	0.000	8.137	0.343	0.526
JR		5	504	0.221	0.000	4.970	0.135	0.304
IQ		3	1381	0.300	0.078	1.764	-0.034	0.574
SYQ		5	2128	0.152	0.009	2.628	0.039	0.261
SEQ	STS	5	1655	0.399	0.161	1.401	-0.167	0.767
PEOU		3	1678	0.280	0.104	1.625	-0.059	0.560
IQ		3	1185	0.351	0.000	4.156	0.192	0.493
PU		14	3255	0.343	0.000	4.939	0.213	0.462
PEOU	ATT	13	3425	0.402	0.001	3.220	0.165	0.595
COMP		7	2458	0.327	0.000	4.774	0.197	0.445
RA		4	585	0.472	0.023	2.272	0.070	0.742
FC	PBC	4	2032	0.243	0.000	7.874	0.184	0.300
SE		4	2032	0.627	0.000	4.641	0.402	0.781
PR	ATT	3	1918	-0.084	0.143	-1.466	-0.194	0.028
TRST		3	1515	0.132	0.320	0.994	-0.128	0.375
BI	AU	10	1705	0.403	0.000	4.869	0.250	0.537
TRST	PR	6	1484	-0.188	0.240	-1.176	-0.469	0.127
IMG	PU	3	323	0.239	0.005	2.816	0.074	0.391
SE	PEOU	3	949	0.420	0.000	6.296	0.299	0.527

[**Legend for Table 3**. #: Number of relationships between I.V. and D.V., ATT: Attitude, AU: Actual Use, Avg (β): Average (Beta), BI: Behavioral Intention, COMP: Compatibility, D.V.: Dependent Variable; EE: Effort Expectancy, FC: Facilitating Conditions, FCR: Facilitating Conditions Resources, H(β): Highest (Beta); IMG: Image, IQ: Information Quality, I.V.: Independent Variable, JR: Job Relevance, L(β): Lowest (Beta); p(ES): Estimated value of p (p-Value); PBC: Perceived Behavioral Control, PEOU: Perceived Ease of Use, PR: Perceived Risk, PU: Perceived Usefulness, PE: Performance Expectancy, PI: Primary Influence, RA: Relative Advantage, STS: Satisfaction, SE: Self-Efficacy, SEQ: Service Quality, SI: Social Influence, SYQ: System Quality, SN: Subjective Norms, TRST: Trust, T.S.S.: Total Sample Size]

4 Discussion

Considering a number of studies in e-government adoption research using constructs, theories, and models with proper quantitative justifications, it becomes very significant and appropriate to discuss and analyze their collective findings.

There is a closer relation between the weight analysis and meta-analysis for the determinants or predictors on their corresponding dependent variables. The higher the weight of a predictor, the more likely it has registered as significant on the corresponding dependent variable and greater the probability it stands significant in performing the meta-analysis. This correlation has occurred quite often for the given relationships. For example, the best predictors, such as: *subjective norm*, *perceived behavioral control* on *intention*, and *behavioral intention* on *actual use* demonstrated the perfect weight of '1' whilst being analyzed adequately across e-government adoption research. All three correlation effect sizes were found to be significant with these variables together demonstrating a variance of 33.5%, which is not strong enough, but quite acceptable when such predictors are used quite often as in this research. Moreover, the 95% confidence intervals for *subjective norm* and *perceived behavioral control* on *behavioral intention* have been found in the range of 0.188 to 0.436, which is concise enough to give one confidence for the cumulative variance (i.e., 33.5%) obtained for these predictors. However, the 95% confidence interval for *behavioral intention* on *actual use* is little more extended (0.250 to 0.537), although still satisfies the variance evaluated for these best predictors with having a perfect weight of '1'. McFadzean et al. (1997) argued that a "random effects" model assumes a dissimilar essential impact for each study, and takes this as an added source of variation that corresponds to a rather wider confidence interval than the "fixed effects" model. Moreover, it can be argued that the confidence interval width of the individual studies depends to a larger extent, on their sample size. Furthermore, it has also been stated that the width of the confidence interval for a meta-analysis depends on the accuracy of the individual study as well as the number of cumulative studies. Following these arguments, we also believe that as the cumulative sample size for *behavioral intention* on *actual use* is found to be 1705 for 10 different studies, this would have resulted in the slightly larger variations in the 95% confidence interval. Nevertheless, all three relationships were found to be significant at the end.

It has been found that the majority of the other best predictors (i.e., with 0.80<= weight <1.00) of e-government adoption research including: *perceived usefulness, trust, attitude, performance expectancy, effort expectancy,* and *social influence* on *behavioral intention*, *perceived ease of use* on *perceived usefulness,* and *perceived usefulness, perceived ease of use,* and *compatibility* on *attitude* have performed in synchronization as far as their weight analysis and meta-analysis are concerned. However, the 95% confidence interval for *performance expectancy* on *behavioral intention* and *perceived ease of use* on *attitude* (0.146 to 0.777 and 0.165 to 0.595, respectively) were found to be surprisingly large. This large confidence interval may have been due to large scale heterogeneity in the

individual correlation coefficients of a considerable number of the studies. However, even though the cumulative analysis of correlation of *service quality* on *satisfaction* identifies it as the best predictor, it has been found to be non-significant overall with an even wider 95%-confidence interval (i.e., -0.167 to 0.767). This might be the consequence of increasing heterogeneity, which results in decreasing accuracy (leading to non-significance) and also to widening of the confidence interval. However, such relationships could still be potential candidates for further examination through other such relationships from different studies and finally through the primary data. This is due to the fact that the number of studies (only five) examining this relationship, although qualifying for best predictor criteria, is still not enough to reach further certain conclusions.

Similarly, there are certain worst predictors (i.e., analyzed five or more times and with weight < 0.80) of e-government adoption research, such as: *perceived ease of use*, *relative advantage* and *compatibility* on *behavioral intention*, *job relevance* on *perceived usefulness*, and *system quality* on *satisfaction*, which result in overall significant relationships. That means the cumulative influence of all significant relationships is even stronger than those of non-significant relations. Their cumulative variance together explains only about 20% variance, which is extremely low. Nonetheless, the examination of such predictors through more secondary data and validation with primary data could further reveal their potential towards e-government adoption research. In addition, we found that meta-analysis of the relationships that occurred four or less times in e-government adoption research were found to produce mixed results. Following Jeyaraj et al. (2006), all such predictors are called 'experimental' independent variables. Out of 13 such relationships, nine were found to be significant, whereas only four were found to be non-significant. Their weight may not be representative of the number of times that they have been analyzed. They need to become 'well-utilized' predictors before their weight and meta-analysis can be used to reach any conclusions.

It is too early to call them the best or worst predictors of e-government adoption research, although, their further analysis is always encouraged. We eliminated studies that performed a different analysis to the meta-analysis technique. The meta-analysis technique is therefore less ideal as we were forced to eliminate those studies (i.e., those that do not report first-order correlations or chi-squares). Thus, we were not able to use the findings of several-studies in the meta-analysis (Tornatzky and Klein, 1982). However, we can argue that all the predictors and their relationships should be validated with the primary data, which have proved their worth in both of the analyses performed.

Those relationships (e.g., *perceived risk, self-efficacy, and facilitating conditions* on *behavioral intention*, and *trust* on *perceived risk*) that have been found as the non-significant relations with their independent variables and as the worst predictors of e-government adoption research could be discarded from further analysis because they are less likely to perform to the expected level of suitability.

5 Conclusions

The purpose of this study was to undertake a meta-analysis of findings reported in existing research on citizen's adoption of e-government. The aim of the study was achieved by: representing the combined diagrammatic representation for citizens, representing their refined diagram considering more frequent relationships, identifying the number of significant, non-significant relationships between the constructs, and evaluating the weight for the most frequently used predictors, collating the sample size, technology used, types of respondents, and the country of research for all 63 potential studies for performing the weight- and meta-analysis. The following prominent facts can be drawn from the findings and discussion of the study: the analysis of empirical studies on e-government adoption research indicates that the constructs used in this research are quite scattered in nature and have been borrowed by and large from the contemporary IS discipline. This is evident from the fact that out of 178 various unique predictors of e-government adoption research, only 24 have been examined five or more times with certain dependent variables.

As far as the most frequently used relationships were concerned, 36 of them were used for weight and meta-analysis whereas only 14 (*perceived usefulness, trust, attitude, subjective norm, performance expectancy, effort expectancy, social influence*, and *perceived behavioral control* on *behavioral intention*, *perceived ease of use* on *perceived usefulness*, *service quality* on *satisfaction*, *perceived usefulness*, *perceived ease of use*, *compatibility* on *attitude*, and *behavioral intention* on *actual use*) were found to perform satisfactorily under both weight-analysis and meta-analysis. In fact, some of the best predictors, such as: *subjective norm* and *perceived behavioral control* on *behavioral intention* and *behavioral intention* on *actual use* with a perfect weight of '1', were found to more profoundly influence their corresponding dependent variables with a narrow enough confidence interval. The best predictors (i.e., analyzed in five or more cases and with a weight >=0.80) with non-significant meta-analytic results (e.g., *service quality* on *satisfaction*), and the worst predictors (i.e., analyzed in five or more studies with a weight

<0.80) with significant meta-analytic outcomes (e.g., *perceived ease of use* on *behavioral intention*) need further exploration, and their validation through the use of primary data to assess their real performance.

Moreover, no firm conclusions can be drawn from the thirteen predictors that have been used rather less frequently (i.e., they were examined less than five times with respect to a given dependent variable), with either significant or non-significant meta-analytic outcomes (e.g., *perceived risk* on *attitude*). However, promising predictors with significant meta-analytic outcomes (e.g., *relative advantage* on *attitude* with relatively strong zero-order correlations effect-sizes) are more likely to qualify as the best predictors, and can be considered for further analysis in the e-government adoption research. So far as the sample sizes of the studies are considered, six studies (Al-Shafi and Weerakkody, 2009; Dwivedi et al., 2007b; Lau and Kwok, 2007; Reddick, 2006; Reddick, 2008; Seyal and Pijpers, 2004) used a relatively small sample size of less than or equal to 100. It has been visualized that smaller samples may not be the right representatives of their outcomes and may be a cause of concern for their individual effects. Therefore, variables' collective correlation might also be influenced due to the biased individual consequences.

5.1 Implications for Theory and Practice

This study offers several implications for research and practice. The researchers can gain an idea about the type of variables to be selected for analyzing the citizen's perspective of e-government adoption research. The frequently and under-represented variables can guide the researchers to make a careful decision about the appropriate selection of variables. The weight analysis and meta-analytic trends of constructs can work as a guideline for the upcoming constructs, and can be analyzed further to visualize their performance. The concurrent weight- and meta-analysis of constructs and their relationships allow the researchers to visualize the point of convergence and divergence in some circumstances. Such analysis brings forward the further research questions to be answered in the general perspectives. For example, at one hand, this study highlights the issues of the worst predictor qualifying for the overall significant impact on the dependent variable; on the other hand, even the best predictor shows the non-significant relationships.

A non-significant meta-analytic outcome of constructs such as perceived risk, self-efficacy, facilitating conditions, and image on behavioral intention to adopt the specific information systems or technology raise relevant points for governments as well. The governments implementing the e-government systems for the stakeholders should ensure that they are provided appropriate training and adequate technical infrastructure to use the system. Such initiative

would allow the users to enhance their skills on the appropriate system and will result in minimizing risk and better image toward its use. In other words, merely implementing the e-government system is not enough, rather governments should also ensure its successful diffusion to the target users by considering the relevant measures from this research.

The overall higher average correlations of perceived usefulness, attitude, and performance expectancy with behavioral intention indicate that respondents with positive attitude and perceiving that e-government systems are useful and can enable them to accomplish task quickly are more likely to adopt this innovation. The concept of perceived usefulness and performance expectancy suggests that if e-government systems are useful and users of the system think that it can help them expediting their task done, when compared to the traditional means, then this technological advancement will be diffused throughout the society. Considering the significance of this concept, it is crucial that the governments make the citizens aware of the benefits and usefulness of e-government services. Carter and Weerakkody (2008) compared the e-government adoption of the UK and the USA and revealed that local government in the UK informs citizens of the advantages of e-government services. The significant but weaker relationships of perceived ease of use and effort expectancy toward the intention to use the e-government systems indicate that the government should turn instead to the demand-side orientation and develop benchmark criteria for measuring demand. This suggests that governments should take initiatives to make sure that the designed system is so easier and flexible to handle that it can enhance the users' intention to use it.

The factors such as trust and risk play a significant role as far as any e-government system is concerned. The meta-analytic outcome of these two variables displays a non-significant relation. Prior research has indicated that once trust is lost, achieving adoption of an e-government system is impossible because the provider has lost its credibility (Schaupp and Carter, 2010). So, the governments implementing any such system should make sure that users perceive and genuinely realize the trust on the digital services provided by them. Such trust would help in minimizing corresponding risk by establishing an opposite significant relation with it, and ultimately results into successful adoption of the system. More precisely, an understanding of meta-analytic relationships provides the governments to consider the needs and perceptions of their citizens (Mirchandani et al., 2008) and deliver services exactly as per the expectations of the end users. For example, enhancing the quality, demand, and efficiency of an e-government system might encourage more citizens to utilize such services (Mirchandani et al., 2008).

5.2 Limitations

The meta-analysis technique considered in this research to analyze the performance of the variables may not be a complete solution, because such analysis is based only on the certain statistical facts, such as: correlations including Pearson correlation or Spearman's correlation, T-Test of group mean differences, F-Test, and does not take into consideration those empirical studies that are based on certain other statistical analysis techniques such as path coefficients, β-value, or t-value. Similarly, the weight analysis technique used in this research is not complete in itself to provide a comprehensive picture about the performance of a predictor. Moreover, although weight and meta-analysis together perform some of the most profound analyses for the variables in this research, some questions are left unanswered. For example, even if the best predictor including *service quality* on *satisfaction*, and other predictors such as *perceived risk*, *self-efficacy*, and *facilitating conditions* have fairly more number of significant than non-significant relationships with *behavioral intention*, their meta-analytic outcomes were found to be quite non-significant.

However, the predictor such as *perceived ease of use* is one of the largely encountered variables on *behavioral intention* and appeared as the weakest predictor showed the significant meta-analytic impact on *behavioral intention* to use a system. The answers for such questions need to be explored rationally. Moreover, the question of whether the scope of meta-analysis technique can be further extended by assimilating those studies which are otherwise discarded due to their irrelevant statistics (e.g. path coefficients, β-value, or t-value) would give better picture of such relationships. These questions can be decisively answered only when more such relationships are validated using the primary data. In other words, one cannot be confident about the performance of the constructs' relationships through the analysis performed in this research alone.

5.3 Future Research Directions

Future research should develop some other analysis technique apart from meta-analysis, which can incorporate other empirical studies that are out of the realms of meta-analysis. The analysis of all the relevant variables' relationships could be performed through the primary source of data collected from surveys of citizens from all walks of life. This analysis could provide a clearer picture of the constructs based on solid theoretical foundations. In addition, future research has already been planned to validate the most frequently utilized IS adoption models, to see whether there are any other relationships that have not yet been used in e-government adoption research and could have potential.

Such a comprehensive analysis of IS adoption models using the data gathered on e-government applications would provide a model for this research, which could be integrated in nature.

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