TECHNOLOGY ACCEPTANCE: A META-ANALYSIS OF THE THEORETICAL MODELS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF INFORMATICS OF
THE MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN
THE DEPARTMENT OF INFORMATION SYSTEMS

FEBRUARY 2015

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

TECHNOLOGY ACCEPTANCE: A META-ANALYSIS
OF THE THEORETICAL MODELS

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February 2015, 149 Pages

Technology Acceptance Model (TAM) has been among the most pervasive models which attempted to elucidate the dynamics of technology acceptance. The constructs of both TAM and its operative successors including TAM2, TAM3 and UTAUT (Unified Theory of Acceptance and Use of Technology) have been tested through several primary studies, however, the question is that there exists a limited number of secondary studies which aim the assessment of construct relationship variation among those primary studies. Through conducting a validated search on six digital libraries and online databases as the main sources of past empirical studies, this study performed a set of random-effects meta-analyses on 12 construct relationships of the TAM, UTAUT, and variants. 84 primary studies which comprise an aggregate sample size of 27387 were selected and meta-analyzed. The effect sizes were dispersed in each of the meta-analyses. With respect to the effect of perceived usefulness on behavioral intention to use, a significant (alpha = 0.1) difference was observed between the mandatory users of the technology and those who use the technologies voluntarily.

Keywords: Technology Acceptance Model, Meta-Analysis, Publication Bias, Moderator Analysis, Information Systems

ÖZ

TEKNOLOJİ KABULÜ: KURAMSAL MODELLER ÜZERİNE
BİR META-ANALİZ ÇALIŞMASI

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Şubat 2015, 149 Sayfa

Teknoloji Kabul Modeli (TAM) teknoloji kabulündeki etmenlerin açıklanmasında en çok başvurulan kuramsal modellerden biri olagelmiştir. Teknoloji Kabul Modeli ve onun TAM2, TAM3 ve UTAUT (Birleştirilmiş Teknoloji Kabul ve Kullanım Modeli) gibi ardıllarına ait bileşenler ve bileşenler arası ilişkisel yapıların çok sayıda birincil çalışmayla test edilmiş olduğu görülmektedir. Diğer yandan bir başka gözlem, bu çalışmaların model bileşenleriyle bileşenler arası ilişkilere yönelik bulgularının ne ölçüde farklılık gösterdiğini saptamaya odaklanan ikincil çalışmaların sınırlı sayıda olduğudur. Altı sayısal kütüphane ve veri tabanında doğrulanmış yöntemlere dayalı bir araştırma gerçekleştiren bu çalışma, TAM, UTAUT ve bunları temel alan kuramsal modellerden alınan 12 yapı ilişkisini inceleyen bir grup rassal etkiler meta-analizi uygulamıştır. Toplam 27387 elemanlı bir örneklem büyüklüğü olan 84 birincil çalışma meta-analizde kullanılmıştır. Çalışma etki büyüklükleri her bir meta-analizde dağınık konumdadır. Algılanan yararlılığın davranışsal kullanım niyeti üzerindeki etkisi bakımından teknolojiyi zorunlu olarak kullanan kişiler ile gönüllü olarak kullanan kişiler arasında anlamlı (alfa = 0,1) bir fark olduğu saptanmıştır.

Anahtar Kelimeler: Teknoloji Kabul Modeli, Meta-Analiz, Yayın Yanlılığı, Düzenleyici Etkisi, Bilişim Sistemleri

to free flying Lokum with love

ACKNOWLEDGMENTS

Writing a thesis has been a deep phenomenon of my personal history: Being able to ask the right questions, following the true path to find the right answers, and presenting the implications of such a work reasonably. Dr. Sevgi Özkan Yıldırım has not only been a supervisor who provided the what-to-do and how-to-do knowledge within this period but my invaluable mentor by continuously helping me overcome the psychological barriers and giving me insight into the scientific method. I would like to express my deepest gratitude to you for your trust, patience, and support.

Dr. Yasemin Yardımcı Çetin taught me from where to begin as a multidisciplinary student from the very beginning, and made me acquire a real perspective on the program domains. I greatly appreciate and thank for the wise and tactful guidance Dr. Yardımcı always provided. I am also grateful to Dr. Zeynep Onay for kindly accepting me as a progressing student, and motivating me on studying by the additional means of management notion. I would also like to express my most sincere gratitude to Dr. Soner Yıldırım and Dr. Aysu Betin Can for their valuable understanding and support. The kind and incessant helps of Dr. Ali Arifoğlu and Dr. Yasemin Çetin Kaya before and during the study have been the assets to me that should definitely be appreciated.

Finally, I would like to extend my profound thanks to Sibel Ergin and M. Hakan Güler for their crucial guidance. I cannot express how appreciative I am for the total support my business associate Gökberk Hamurcu and my family provided; and my special thanks are to my wife, Duygu, for her priceless generosity and love.

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LIST OF ABBREVIATIONS

ACM	Association for Computing Machinery
ATT	Attitude towards Behavior
BI	Behavioral Intention to Use
CANX	Computer Anxiety
CMA	Comprehensive Meta-Analysis
CPLAY	Computer Playfulness
CSE	Computer Self-Efficacy
C-TAM	Combined Technology Acceptance Model
DIAD	Design and Implementation Assessment Device
EE	Effort Expectancy
ENJ	Perceived Enjoyment
FC	Facilitating Conditions
HM	Hedonic Motivation
HT	Habit
IEEE	The Institute of Electrical and Electronics Engineers
IMG	Image
MBA	Master of Business Administration
MM	Motivational Model
MPCU	Model of PC Utilization
OQ	Output Quality
PE	Performance Expectancy
PEC	Perceptions of External Control
PEU	Perceived Ease of Use
PU	Perceived Usefulness
PV	Price Value
REL	Job Relevance
RES	Result Demonstrability

SI	Social Influence
SN	Subjective Norm
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TRU	Trust
U	Actual Use
UTAUT	Unified Theory of Acceptance and Use of Technology

CHAPTER 1

INTRODUCTION

This part provides a demonstration of the motivation behind this study (i.e. Section 1.1), and continues with the presentation of the outline of the thesis in Section 1.2.

1.1. Motivation and Background

Technology Acceptance Model (TAM) has been among the most pervasive models which attempted to elucidate the dynamics of technology acceptance. The constructs of both TAM and its operative successors including TAM2, TAM3, UTAUT (Unified Theory of Acceptance and Use of Technology), and UTAUT2 have been tested through several primary studies, however, the question is that there exists a limited number of secondary studies which aim the assessment of construct relationship strength variation among those primary studies. Through conducting a validated search on six digital libraries and online databases as the main sources of past empirical studies which embodied input data, this study aims to perform a quantitative meta-analysis of the TAM as well as its revisions and successors with respect to shared or preselected construct relationships. The objective of the meta-analytic assessment is to derive the effect sizes from each member of the defined set of past primary studies, and to find out whether the associative findings of these studies vary significantly, insomuch that some upgrades and/or extensions to relationships might be proposed.

1.2. Research Questions

Both TAM and UTAUT as well as their variants have plenty of pairwise relationships as their constructs are considered, and conducting meta-analyses for each and every relationship require more than one in-depth study in order to be effective and elucidative. What is more, the further tests including the examination of the moderating effects (e.g. sample demographics etc.), publication bias etc. make such systematic reviews even more exhaustive. Therefore, in order to embody the scope of this study, a set of research questions has been identified and these are listed in Table 1.1 below.

Table 1.1 Research questions of the study

No	Research Question
1a	What is the predictive ability of perceived usefulness of a technology on attitude toward its use?
1b	To what extent does the predictive ability of perceived usefulness of a technology on attitude toward its use vary among studies?
2a	What is the predictive ability of perceived usefulness of a technology on behavioral intention to use?
2b	To what extent does the predictive ability of perceived usefulness of a technology on behavioral intention to use vary among studies?
2c	Does the predictive ability of perceived usefulness of a technology on behavioral intention to use vary by voluntariness of use?
3a	What is the predictive ability of perceived ease of use of a technology on attitude toward its use?
3b	To what extent does the predictive ability of perceived ease of use of a technology on attitude toward its use vary among studies?
4a	What is the predictive ability of perceived ease of use of a technology on behavioral intention to use?
4b	To what extent does the predictive ability of perceived ease of use of a technology on behavioral intention to use vary among studies?
4c	Does the published predictive ability finding of perceived ease of use of a technology on behavioral intention to use vary by the type of publication (i.e. journal articles and conference proceedings)?

5a	***Table 1.1 (cont.)*** What is the predictive ability of perceived ease of use of a technology on perceived usefulness?
5b	To what extent does the predictive ability of perceived ease of use of a technology on perceived usefulness vary among studies?
5c	Does the predictive ability of perceived ease of use of a technology on perceived usefulness vary by the occupation (i.e. student, non-student, and mixed/unknown) of the survey participants?
6a	What is the predictive ability of behavioral intention to use of a technology on actual use?
6b	To what extent does the predictive ability of behavioral intention to use of a technology on perceived usefulness vary among studies?
7a	What is the predictive ability of subjective norm on behavioral intention to use of a technology?
7b	To what extent does the predictive ability of subjective norm on behavioral intention to use of a technology vary among studies?
8a	What is the predictive ability of subjective norm on perceived usefulness of a technology?
8b	To what extent does the predictive ability of subjective norm on perceived usefulness of a technology vary among studies?
9a	What is the predictive ability of performance expectancy on behavioral intention to use of a technology?
9b	To what extent does the predictive ability of performance expectancy on behavioral intention to use of a technology vary among studies?
10a	What is the predictive ability of effort expectancy on behavioral intention to use of a technology?
10b	To what extent does the predictive ability of effort expectancy on behavioral intention to use of a technology vary among studies?
11a	What is the predictive ability of social influence on behavioral intention to use of a technology?
11b	To what extent does the predictive ability of social influence on behavioral intention to use of a technology vary among studies?
12a	What is the predictive ability of facilitating conditions on actual use of a technology?
12b	To what extent does the predictive ability of facilitating conditions on actual use of a technology vary among studies?

As can be seen in Table 1.1 above, the study attempts to gather findings on twenty seven identified research questions in total, and it suggests future studies in Section 6.2, for example, meta-analyses on the other unexamined pairwise relationships of the models, and also meta-analyses on the existing pairwise relationships above regarding which this study has relatively small samples.

1.3. Thesis Outline

Chapter 1 introduces the thesis subject by presenting the motivation behind the study and the background of interest in Section 1.1, specifies the research questions in Section 1.2, and provides an outline of the entire thesis report in this section, i.e. Section 1.3.

Chapter 2 presents a bilateral review of literature related to the method of "meta-analysis" and the theoretical models on "technology acceptance" domain in Section 2.1 and Section 2.2, respectively. Following these two sections, Section 2.3 provides a classified look at a set of predecessor meta-analytic efforts on technology acceptance.

Chapter 3 clarifies the research design pursued in this thesis: Section 3.1 explains the way of defining sources which embodied the input needed for the study; Section 3.2 gives information about what strategy was used to utilize these sources effectively; Section 3.3 presents the criteria used during information retrieval and study selection for meta-analysis; Section 3.4 provides the basis for how effect sizes were obtained and/or deduced from the studies subject to meta-analysis, and demonstrates how the choice was made between the fixed-effect and random-effects meta-analysis models; and Section 3.5, as a transition part to the data analysis, makes an introduction to the data extraction process by presenting the study level coding protocol of the meta-analysis.

Chapter 4 is framed by the core meta-analysis study. Section 4.1, as an umbrella section following the Data Analysis title, comprises information about the effect size level coding protocol (Section 4.1.1), the characteristics of the selected primary studies in terms of data and context (Section 4.1.2), and the core synthesis processes which focus on the relationships of the theoretical models (Section 4.1.3).

Chapter 5 provides the results of the study and discusses the results in analytical way: Section 5.1 takes a collective look at Section 4.1.3's meta-analysis results through the examination of the heterogeneity in Section 5.1.1, the moderator analysis in Section 5.1.2, and the investigation of the publication bias in Section 5.1.3.

Chapter 6 provides the findings of the study at a glance as well as how they can be interpreted with respect to defined research questions in Section 6.1, and suggests paths for further systematic review studies in the field of technology acceptance in Section 6.2.

CHAPTER 2

LITERATURE REVIEW

In this chapter, Section 2.1.1 introduces the method of meta-analysis by making definitions and describing the areas of use of meta-analysis. Section 2.1.2 introduces the term “effect size”; Section 2.1.3 mentions the critical points of view on meta-analysis; and the text introduces the theoretical models on technology acceptance in Section 2.2. In the following section, i.e. Section 2.3, the past meta-analysis studies which focus on the domain of technology acceptance are explained.

2.1. A Review of the Concept “Meta-Analysis”

This section brings a general view to meta-analysis by defining it and exhibiting the uses of it; introducing the “effect size” as a core statistic which constitutes the input for a meta-analysis study; and summarizing the diverging points of view on the meta-analysis concept, respectively.

2.1.1. What is Meta-Analysis for?

Meta-analysis refers to the method, or the set of techniques, which combines and evaluates the empirical findings summary of two or more primary studies so as to find answer(s) to prespecified research question(s). The word “prespecified” seemed appropriate because meta-analysis, as Lipsey and Wilson [1] emphasized, requires the researcher to identify the point of interest in order to justify the criteria employed during the inclusion and exclusion processes of the reviewed studies.

Cooper [2] counts the introduction of meta-analysis as the third greatest advance which influenced the research synthesis; the other two are the growth in research and the rapidly increasing computerization of retrieval systems. The importance attributed to meta-analysis is, to a large extent, because the growth in research synchronically required some standard for the summation and interpretation of the study findings, and the approach of "narrative review" could not fill this gap which was subsequently filled by meta-analysis as a quantitative practice. According to Borenstein et al., the limitations that narrative reviews had including subjectivity, diversity in selection criteria, unsystematic evaluation of studies, lack of transparency, inability to review the big data etc. made meta-analysis a substantial substitute for narrative review in various disciplines [3].

Meta-analysis, as a term, was first used (actually, coined) by Glass [4] in 1976 in an attempt to characterize the method conducted during the study of Smith and Glass [5] which investigated the effectiveness of psychotherapy. They did this by aggregating a massive set of empirical findings which could be used to obtain "effect sizes" directly or indirectly from the articles of the related literature. In fact, according to Rosenthal and DiMatteo [6], even though not denominated a "meta-analysis", the first meta-analysis was conducted by Pearson [7] in 1904 and aimed at finding answer to a research question in the field of medicine by clustering several correlation coefficients from the previous studies. Indeed, as the literature grew rapidly, the fields of medicine such as epidemiology, pharmacology etc. needed and utilized the meta-analysis practices much more frequently. Some researchers suggested that this popularity partially arisen from the fact that the huge information generated from the studies of such disciplines required methods for the synthesis of this information [6]. One other probable factor is that the studies such as clinical trials, considering the costs and per se conditions (e.g. accessibility to a limited number of respondents for a very specific research problem), led to relatively smaller sample sizes. Everitt [8] states that this arises the need for an attempt to derive empirical evidences which are more powerful statistically and better in terms of precision. Inevitably, since other disciplines appreciate such gains of meta-analysis, too, the usage of the method diffused into other fields of research such as psychology, education, business, and into several branches of behavioral and social sciences in the course of time. For instance, in parallel within the scope of this study, Section 2.2.4 touches generally on the prior meta-analyses which were conducted regarding the technology acceptance domain.

2.1.2. The Core Statistic: Effect Size

A selected primary study is mainly represented by its effect size in a meta-analysis. Cohen [9] defined the term "effect size" as the extent to which the null hypothesis of the study is rejected. Cooper [2] stated that an agreed indication of effect size, that is, the value which is specifically addressed with one of the metrics such as *magnitude of difference*, *relationship strength* etc., is essential for getting response to "how much?" question.

Among several (e.g. odds ratio, standardized mean difference etc.), one appropriate metric for this study, and also for a significant part of studies which investigates technology acceptance, is *r*-index, i.e. the Pearson product-moment correlation coefficient. The appropriateness of correlation coefficient as a metric arises from, for instance, that studies on acceptance models address the relationships among constructs in the form of continuous variables; e.g. the relationship between the intention to use and actual usage. The r value of such a relationship constitutes the effect size, and the magnitude of this value indicates whether the relationship is strong, in fact, whether the effect size is small or large.

Some primary studies might not present the effect size values that can be directly used in meta-analysis, and even so, the needed effect size values can still be estimated by using some other empirical data (e.g. t-test value) of these studies. Additionally, in order to ensure the normalization of values distribution, *r*-index values can be converted to *z*-scores prior to meta-analysis.

Independent from the attempts of direct collection, indirect estimation and conversion of effect size values of each single study, one essential step and goal of meta-analysis is the integration and averaging of these effect sizes to obtain a summary effect size. The weighting of the effect sizes during the averaging process is based on the samples sizes of each primary study as a generally accepted practice [2]. Besides, as the summary effect is reported, the value is presented with the *p*-value and a precision measure [3]. The phases of individual effect sizes collection and the approaches used to achieve the summary effect size for this study is described in Section 3.4 and Section 4.1.

2.1.3. Critical Points of View on Meta-Analysis

The validity of the meta-analysis practices were questioned by several researchers at the same time that these practices are gaining acceptance and becoming widespread among various disciplines.

Combining the findings of studies which are different in respect to populations, variables etc. was referred to with a quite well-known analogy of "mixing apples and oranges", according to Sharpe [10]. Borenstein et al. [3] state that the basis of the criticism was that the study differences are being overlooked during the process of summary effect determination, and respond to this criticism with the counter-argument that meta-analysis may be trying to ask a question about the broader subject, that is, fruit. Furthermore, Moayyedi [11] emphasizes the positive side of this criticized combining practice in such a way that the researcher does not only reach a combined summary effect by this way but also gathers deeper information by investigating the heterogeneity among findings. Differently from the "fruit scope" counter-argument, Tamim [12] also expresses a meta-analysis practice as mixing only apples but with different characteristics: e.g. taste, color, etc.

The proverbial "garbage in – garbage out" axiom has been used as another statement to question the validity of meta-analysis by Eysenck [13]. The usage of the term implied that a combined effect size cannot be credited as long as it is derived from the primary studies which have questionable methodological quality. In fact, "garbage in – garbage out" criticism importantly draws attention to the problematic meta-analytic attempts where an intensely inclusive approach (i.e. propensity to include as much studies as possible with less strict selection criteria) is used for study selection. On the other hand, as meta-analysis methods became parts of several fields of scientific research and made progress, this criticism was set aside to address more of the early Glassian meta-analyses. For instance, as a successor approach, the "study effect meta-analysis" is based on the rigorous selection of studies which have some specified methodological quality [12]. Moreover, standards and influent frameworks such as Valentine and Cooper's [14] Study Design and Implementation Assessment Device, also known as Study DIAD, were introduced to systematize the assurance of the targeted input quality. In any case, a well-planned meta-analysis tries to obtain findings which are beyond a single combined effect size, e.g. the interpretation of dispersion, and even low quality studies can be included and utilized as long as their quality levels are specified.

Another important drawback for meta-analysis is discussed under the term of "file drawer problem" of Rosenthal [15], who remarked the omitted effect of studies which are kept in the file drawers, that is, not published. As a factor involving any type of research synthesis and irrespective of being qualitative or quantitative, file drawer problem implies a bias in the combined effect with the presupposition of that studies with relatively significant findings tend to be published while those with insignificant findings remain unpublished. Indeed, when one considers the finite number of channels of publication and distribution, especially during the pre-internet era, it is not unjustifiable to assume that, ceteris paribus, the primary study with low statistical significance has a lower chance of being reported and published, hence, a lower chance of being detected and selected for meta-analysis. Such drawback of selection leads to publication bias since the entire set of studies (i.e. published and unpublished) which is relevant to the specified research question is not included in the selection pool. To make an analogy, just as excluding the negative and/or unexpected results from a primary research is not appropriate, excluding the unpublished, hence, possibly and hypothetically insignificant, studies makes a meta-analysis biased and less defensible. Ideally, the best way to avert publication bias is to check all the drawers in addition to published journals, but this is usually not possible in practical terms. Therefore, artificial but effective instruments are developed to determine the existence of publication bias in a meta-analysis and to estimate the impact of this bias on the summary effect, and these instruments were utilized in our study, as well (see Section 5.1.3). In this sense, the file drawer problem has not been an insoluble obstacle for meta-analysts.

In the last instance, the criticisms, some major of which were mentioned above, have contributed to the validation progress of meta-analysis methods. Meta-analysis needs to be compared to its alternatives such as narrative reviews in order to be evaluated justly, and the fact is that most critical remarks of meta-analysis are also true of narrative reviews. That is, the aforementioned criticisms are usually not exclusive to meta-analysis and they do not eliminate the necessity of its applications in science.

2.2. Theoretical Models on Technology Acceptance

Schepers and Wetzels [16] remarks that with the purpose of improvement in the utilization of information technologies, both researchers and organizations made attempts to identify the factors of technology acceptance. This section makes a summation of the theoretical models which are built to understand the dynamics of user acceptance of technology by firstly introducing the *Technology Acceptance Model* (abbreviated as TAM) of Davis [17], and its successors, TAM2 of Venkatesh and Davis [18], and TAM3 of Venkatesh and Bala [19], respectively. Following the summation of TAM and its two chronological and contextual variants, another influential acceptance model of Venkatesh et al. [20], i.e. *Unified Theory of Acceptance and Use of Technology* (abbreviated as UTAUT) is introduced with its recent variant, UTAUT2 of Venkatesh et al. [21], as well.

2.2.1. Davis' TAM: An Evolution through TRA

Technology Acceptance Model (TAM) was proposed by Davis [17] in 1989. In fact, regarding its initial development, the model can date back to Davis' doctoral dissertation [22]. TAM derived its roots from the Theory of Reasoned Action (TRA) of Fishbein and Ajzen [23], which suggests that the attitude towards behavior and *subjective norm* (abbreviated as *SN*) act on the behavioral intention, and that the behavioral intention is what drives the actual behavior. TAM embraced these theoretical links to elucidate the mechanism of technology acceptance, hence, concretized the mechanism with the technology-specific construct-relationship structure presented in Figure 2.1.

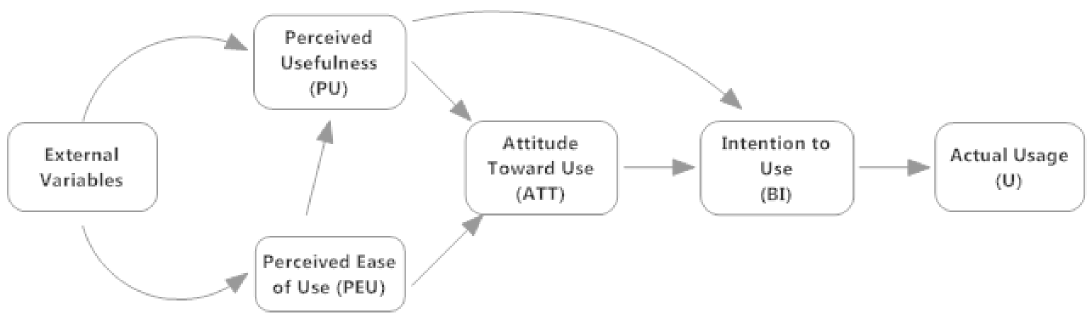


Figure 2.1 Technology Acceptance Model (TAM) of Davis [17]

After conducting a longitudinal study with 107 students who are in the MBA program, Venkatesh and Davis [24] reached a conclusion which led to the removal of *attitude toward use (ATT)* construct from the original TAM. The revision stemmed from the finding of that ATT could only partially mediate *perceived ease of use (PEU)* and Chandio [25] states that *perceived usefulness (PU)*, and that a structure with three constructs, i.e. PU, PEU, and *intention to use (BI)*, was more powerful regarding the prediction and explanation of user behavior. The revised model is illustrated in Figure 2.2.

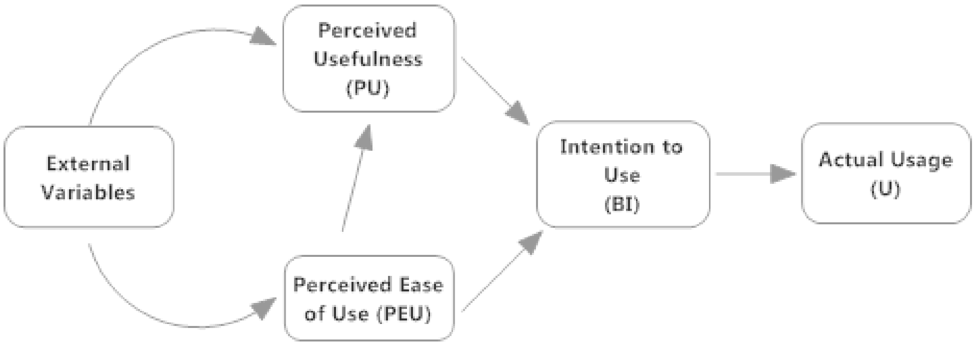


Figure 2.2 The revised Technology Acceptance Model (TAM) of Davis et al. [26]

The two characteristic constructs of TAM are *perceived usefulness* and *perceived ease of use*; the former of which is abbreviated as PU and the latter of which is abbreviated as PEU in this study. Davis [17] defines PU as the extent to which the user perceives the technology in question as an improving factor of his or her performance on the job, and PEU as the extent to which the user perceives the technology in question as effortless to use. What is noteworthy in the model is that the so-called "external variables" which consisted of a group of factors and were elaborated in subsequent model revisions were all mediated by PU and PEU with regard to their impacts on *actual usage* (U). Moreover, PU is also affected by PEU itself, as well, and this is because TAM suggests that, ceteris paribus, the more effortless the user perceives the use of a system, the more useful the system is perceived to be.

TAM, as a robust predictor of user acceptance, has been one of the most influential models not only in the technology acceptance domain but also in the overall IS literature throughout the years. The well-known article in which Davis [17] introduces TAM was cited more than three thousand times in Web of Knowledge, a recognized academic citation indexing platform provided by Thomson Reuters, and this is an influence which few scientific studies could attain.

2.2.1.1. TAM2

In 2000, Davis' TAM were added particular determinants of PU and BI, and the proposed model was referred to as TAM2 by Venkatesh and Davis [18]. This extended model replaced the single general construct, i.e. external variables, of TAM by two sets of determinants, one of which is named *social influence processes* and the second of which is named *cognitive influence processes*. The first set included subjective norm, image, and voluntariness and the second set included job relevance, output quality, and result demonstrability as extensions. Besides, PEU of TAM was also incorporated into the set of cognitive influence processes. TAM2 can be seen in Figure 2.3.

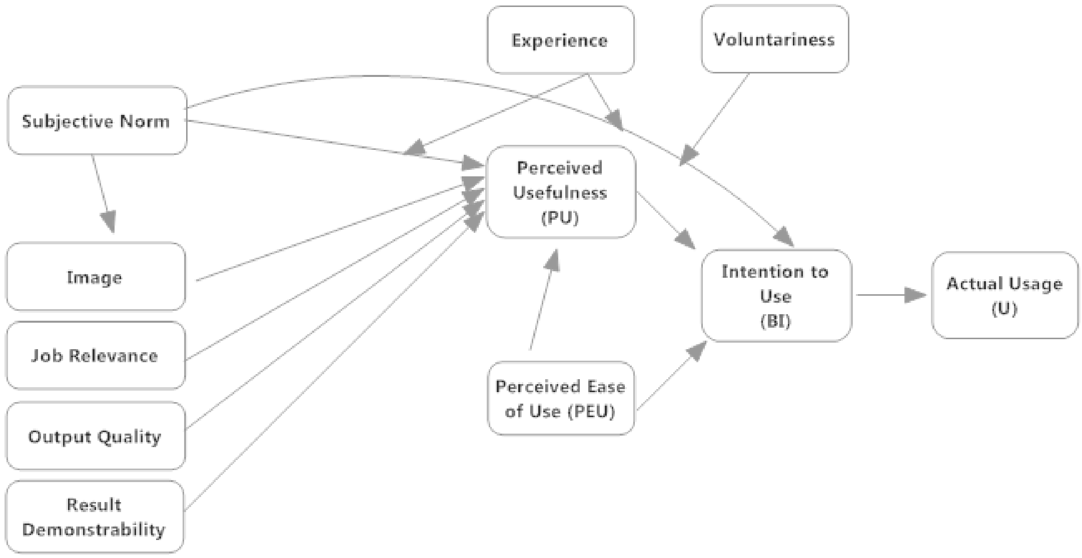


Figure 2.3 The extended Technology Acceptance Model (TAM2) of Venkatesh and Davis [18]

As seen from Figure 2.3, in TAM2, voluntariness was posited as a moderator which acts on the effect of subjective norm on BI. In addition, experience was proposed as an attenuating moderator for the effect of subjective norm on both BI and PU.

The work in which TAM2 is proposed was comprised of four studies with three empirical tests at different time periods, and these studies had a total sample size of 156. Findings of Venkatesh and Davis [18] pointed out that both social influence processes and cognitive instrumental processes had impact on user acceptance, and that a variance around 34 percent-52 percent for BI could be explained by means of TAM2.

2.2.1.2. TAM3

Venkatesh and Bala [19] extended the question of user acceptance of technology into a managerial decision making and organizational acceptance context by proposing a theoretical framework (see Figure 2.4) based on prior TAM research, and developed TAM3 by combining a revised TAM2 with additional determinants of PEU proposed in [25].

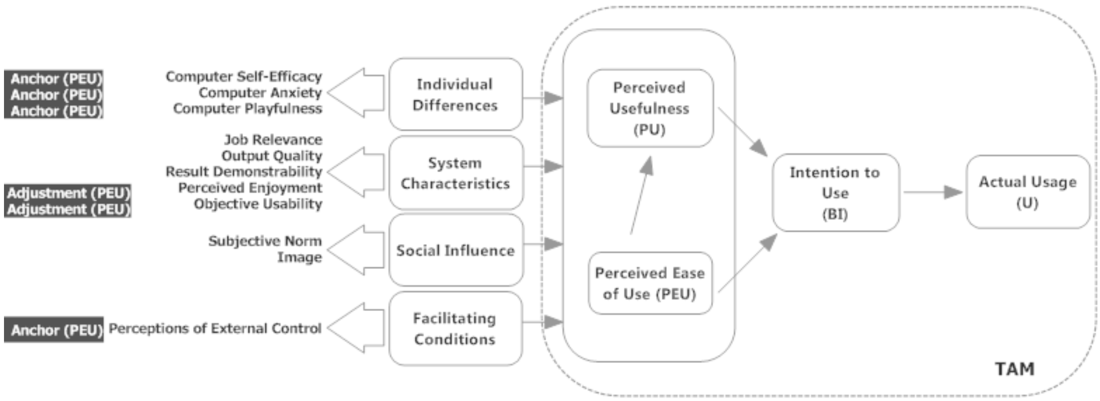


Figure 2.4 The theoretical framework developed by Venkatesh and Bala [19]

Figure 2.4 depicts the categories of determinants (i.e. individual differences, system characteristics, social influence, and facilitating conditions) of PEU and PU in the proposed framework. Each category covered specific determinants which were illustrated then as the constructs of TAM3 (see Figure 2.5).

TAM3, as seen in Figure 2.5, introduces *computer self-efficacy* (abbreviated as *CSE*), *perceptions of external control* (abbreviated as *PEC*), *computer anxiety* (abbreviated as *CANX*), and *computer playfulness* (abbreviated as *CPLAY*) constructs as “anchors” (i.e. starting points to make early judgments about PEU), all of which were indicated as the determinants of PEU previously in [25]. Two of the system characteristics determinants, i.e. *perceived enjoyment* (abbreviated as *ENJ*) and *objective usability*, were defined as "adjustment" (from early judgment) constructs of TAM3 on PEU. This "anchor-adjustment" labeling addressed to the well-known decision making process concept of anchoring and adjustment which was proposed by Tversky and Kahneman [26].

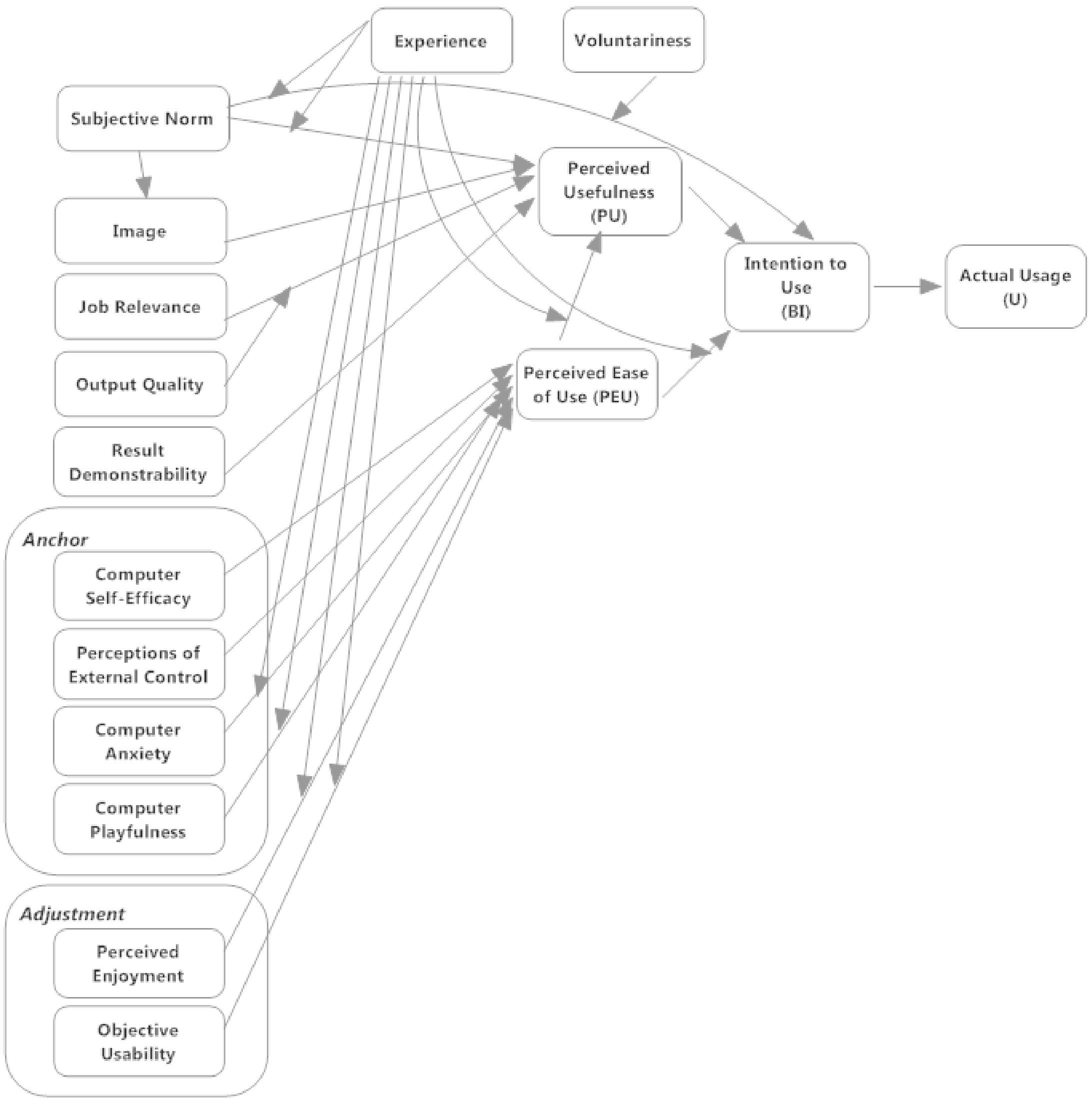


Figure 2.5 Technology Acceptance Model 3 (TAM3) of Venkatesh and Bala [19]

Differently from TAM2, TAM3 accepted output quality as a moderator which enhances the effect of job relevance on PU. Next, in contrast to the limited moderating effect of experience in TAM2, TAM3 posited that experience moderates not only the influences of subjective norm on PU and BI, but also moderates the influences of PEU on PU and BI, and the computer anxiety, computer playfulness, perceived enjoyment, and objective usability determinants of PEU, as well.

2.2.2. Unified Theory of Acceptance and Use of Technology

Venkatesh et al. [20] proposed a unified model which is called the Unified Theory of Acceptance and Use of Technology (UTAUT) in their study of 2003. The model, as its name implies, unified eight models by integrating elements from each. The set of models was comprised of the Technology Acceptance Model (TAM) of Davis [17] as well as the extended Technology Acceptance Model (TAM2) of Venkatesh and Davis [18], the Theory of Reasoned Action (TRA) of Fishbein and Ajzen [23], the Motivational Model (MM) of Vallerand [27], the Theory of Planned Behavior (TPB) of Ajzen [28] which is actually an extension of TRA, the Combined TAM and TPB (C-TAM-TPB) of Taylor and Todd [29], the Model of PC Utilization (MPCU) of Thompson et al. [30] which is actually derived from the Theory of Interpersonal Behavior of Triandis [31], the Innovation Diffusion Theory of Rogers [32], and the Social Cognitive Theory of Bandura [33] which was subsequently extended to computer use context by Compeau and Higgins [34]. Regarding users' behavioral intention to use, the explained variance was some 17-53 percent via the use of these models, and UTAUT was found to be performing better than any of these single models with an explained variance (adjusted R^2) of 70 percent according to the study of [20]. UTAUT is depicted in Figure 2.6.

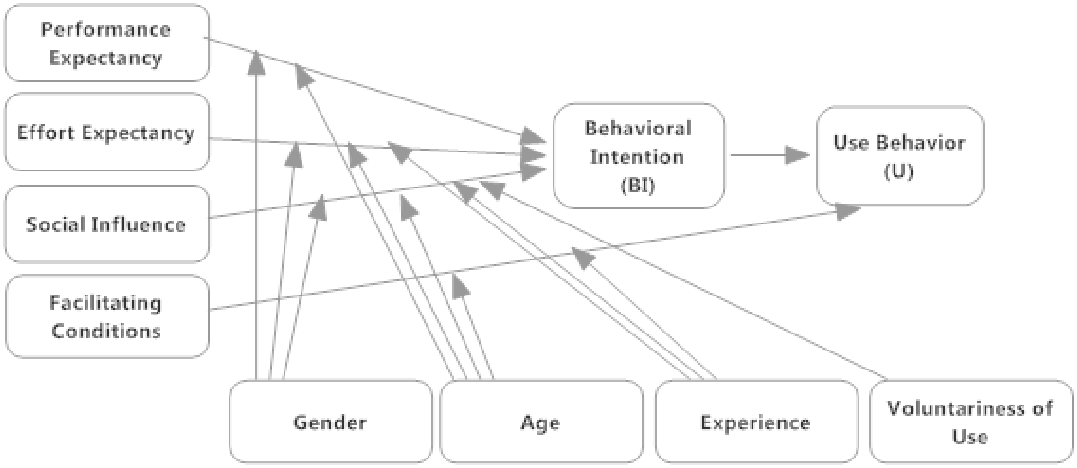


Figure 2.6 Unified Theory of Acceptance and Use of Technology (UTAUT) of Venkatesh et al. [20]

The unified model, as seen in Figure 2.6, consists of four constructs which have effects on behavioral intention to use or directly on use behavior. These constructs are labeled *performance expectancy* (abbreviated as *PE*; referred to as the extent to which the technology will bring benefits to specified activities), *effort expectancy* (abbreviated as *EE*; referred to as the extent of ease with respect to the use of that technology), *social influence* (abbreviated as *SI*; referred to as the extent to which the user perceives her social circle thinks she should use that technology), and *facilitating conditions* (abbreviated as *FC*; referred to as the extent to which the user believes the conditions that facilitate the use of that technology exists) [20]. Dwivedi et al. [35] draw attention to the analogousness of performance expectancy and effort expectancy constructs of UTAUT to perceived usefulness and perceived ease of use constructs of TAM, respectively, in terms of what they express.

What differentiates the FC construct in the model is that it directly affects on the use behavior under the moderating influences of age and experience while the other three affect on the behavioral intention to use. Among these three, regarding their associations with behavioral intention to use, the effect of PE is moderated by gender and age, the effect of EE is moderated by gender, age, and experience, and the effect of SI is moderated by all the moderating variables (i.e. gender, age, experience, and voluntariness of use) specified.

2.2.2.1. UTAUT2

Nine years later, UTAUT2, a context-based revision of the original UTAUT model, was presented by Venkatesh et al. [21], and the originators demonstrated one important distinguishing feature of the new research model by its extension from an "organizational" context to a "consumer" context. The UTAUT2 structure is provided in Figure 2.7.

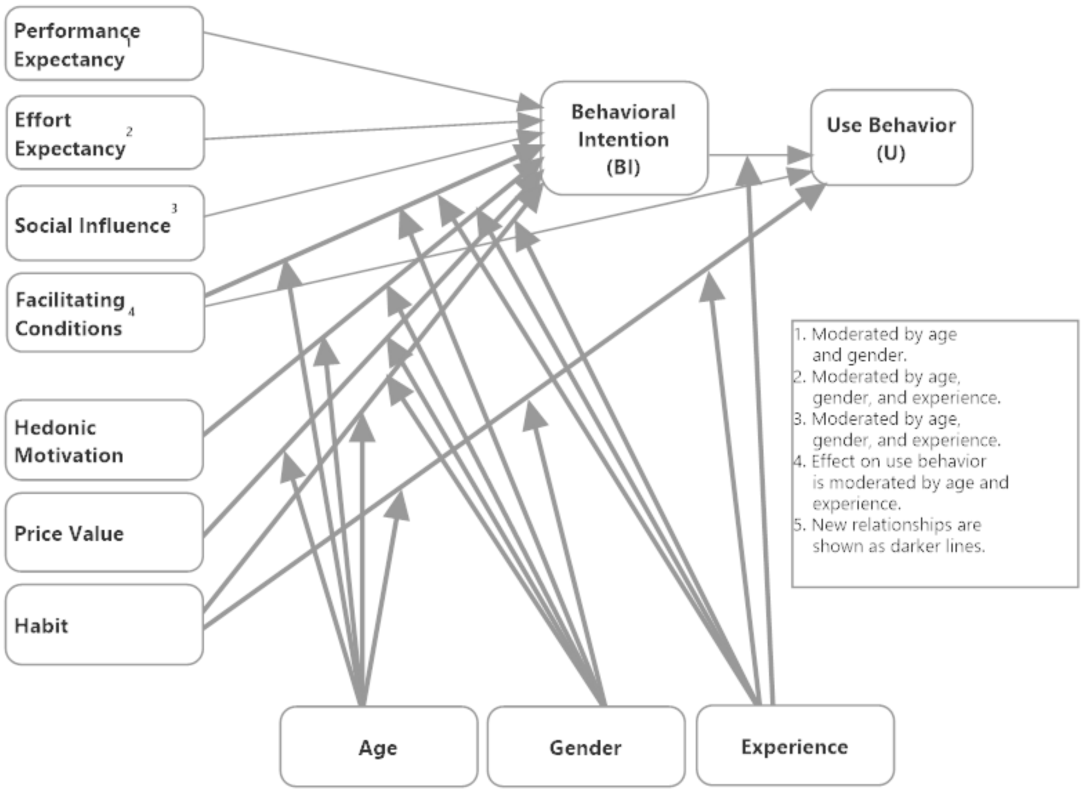


Figure 2.7 The extended Unified Theory of Acceptance and Use of Technology (UTAUT2) of Venkatesh et al. [21]

In the UTAUT2 model, additional constructs, i.e. *hedonic motivation* (abbreviated as *HM*), *price value* (abbreviated as *PV*), and *habit* (abbreviated as *HT*), were introduced as the new predictors of behavioral intention to use. Besides, habit had an effect on use behavior directly, as well. Unlike its predecessor, the UTAUT2 model removed the moderating effect of voluntariness completely while shifting the effects of the remaining moderators (i.e. gender, age, and experience) away from the originally proposed constructs (i.e. PE, EE, SI, and FC) towards HM, PV, and HT. Considering its newer context, in general terms, the UTAUT2 model differed in a way that it comprised consumers' "cost" concerns which are not actually some criteria for office workers, for instance. In fact, such consumer (hence, voluntary user *per se*) perspective of the successor model led became the root cause of the removal of voluntariness moderator.

One other notable revision in the model was the proposal of gender as the moderating factor on facilitating conditions and BI relationship. Through all these revisions, Venkatesh et al. [21] state that the newer model could explain the variance in BI better (74 percent instead of 56 percent).

2.3. Meta-Analysis Efforts on Technology Acceptance

A number of meta-analysis studies were conducted in attempt to find out the predictive and explanatory power of the theoretical models on technology acceptance, of which a vast scale is TAM and its variants. It is notable that most of these efforts handled the models from different dimensions and with different meta-analytic procedures even in case of identical model and similar primary study group selection: For example, King and He [36] based their analysis on core TAM constructs and the investigation of the moderating effects of user and usage types by applying Hedges and Olkin [37] procedures while Turner et al. [38] focused on the influences on actual use by employing the vote-counting procedures. Stated in other words, rather than being repetitious meta-analysis attempts, almost all of these studies have been distinctive and complementary for the understanding of technology acceptance.

Table 2.1 lists a group of influent meta-analyses conducted previously. Considering the scope of this study, studies on TAM variants and UTAUT were summarized in the list.

Table 2.1 Prior meta-analyses conducted on TAM and UTAUT

Author	Year	Model	Size	Subject	Inclusion and Exclusion Criteria	Constructs	Procedures	r Corrected	Findings (in part)
Wu et al. [39]	2011	TAM	128	Impact of trust on TAM and investigation of subject and context type moderators	INCLUDE - Empirical research / INCLUDE - Research methodology allows to evaluate context type and subject type used / INCLUDE - Presence of correlation matrix and variable reliabilities	PU PEU ATT BI TRU	Hedges and Olkin / Hunter and Schmidt	Yes	Trust has impact on TAM constructs / Relationships are affected by subject type and context type moderators
Sumak et al. [40]	2011	TAM	42	Role of user types and e-learning types on e-learning technology acceptance	***	PU PEU ATT BI U	***	***	The casual paths of TAM are moderated by user and technology related factors / Equally for different user and technology types, PU and PEU affect on attitude toward use of an e-learning technology
Dwivedi et al. [35]	2011	UTAUT	27	Meta-analysis of UTAUT constructs	***	PE EE SI FC BI U	***	***	Subsequent studies employing UTAUT could reach less significant relationships in reference to original article that proposed UTAUT / Combined effect was found to be significant / Reliability measurements of constructs were consistent across studies

Table 2.1 (cont.)

Turner et al. [38]	2010	TAM	79	TAM's prediction power on actual use	(with multi-staged elimination) INCLUDE - Empirical studies that apply TAM or a revision of TAM to any technology / INCLUDE - Objective or subjective measurement of U / INCLUDE - Presence of measures for U as well as PU and/or PEU with relationship to U is reported / INCLUDE - Presence of measure for BI with the report of BI-U relationship / INCLUDE - The most complete study among duplicates / EXCLUDE - Non-independent studies with same participants / EXCLUDE - Absence of report for the relationship of TAM with U / EXCLUDE - Study is not empirical / EXCLUDE - Full text of study cannot be accessed.	PU PEU BI U	Vote-counting	***	BI is likely to be correlated with U whereas PU and PEU are less likely to be correlated with U

Table 2.1 (cont.)

Wu and Lederer [41]	2009	TAM	71	Role of environment-based voluntariness in information technology acceptance	INCLUDE - PEU, PU, and BI/U is operationalized / INCLUDE - Presence of variable reliabilities / INCLUDE - Environment-based voluntariness measure could be coded with the given information / INCLUDE - Presence of sample sizes / INCLUDE - Presence of correlations (or convertible values) among PEU, PU, and BI/U	PU PEU BI U	Hedges and Olkin / Hunter and Schmidt	Yes	Environment-based voluntariness moderates the effects of PEU and PU on BI whereas it does not moderate the effects of PEU and PU on U and the effect of PEU on PU
Schepers and Wetzels [16]	2007	TAM	63	Role of SN and moderators (type of respondents, type of technology, culture) on TAM	INCLUDE - Empirical studies that apply TAM / INCLUDE - Clarification of the research methodology / INCLUDE - Presence of the correlation matrices of the used constructs	SN PU PEU ATT BI U	Hedges and Olkin / Hunter and Schmidt	Yes	SN significantly affects on PU and BI / Relationships with PU are stronger than relationships with PEU / Most of the pairwise relationships were stronger for students and non-microcomputer setting in comparison to non-students and microcomputer setting, respectively / In Western studies, SN has stronger influence on BI

Table 2.1 (cont.)

Yousafzai et al. [42]	2007	TAM	95	Meta-analysis of TAM constructs	INCLUDE - Empirical studies which test at least one of the original TAM relationships	PU PEU ATT BI U	Hedges and Olkin / Hunter and Schmidt	Yes	Subject, method, technology, and usage types are studied as moderators / ATT-U and PU-ATT relationships are stronger for non-student participants / BI-U relationship is stronger for self-reported use
King and He [36]	2006	TAM	88	Meta-analysis of TAM constructs including the analysis of user types and usage types as moderators	INCLUDE - Studies which report correlation coefficients, standardized regression coefficients, or covariance or correlation matrices of TAM / INCLUDE- Studies which includes standardized regression coefficients and models which can be converted to core TAM with PEU, PU, and BI constructs	PU PEU ATT BI U	Hedges and Olkin	***	PEU, PU, and BI measures are highly reliable / Effect of PU on BI is confirmed / For Internet applications, PEU has high influence on BI / In comparison to professionals, general users have larger effect sizes / It is valid to use students as surrogates for professionals / High variability of PEU-BI relationship addresses the need for larger samples

Table 2.1 (cont.)

Ma and Liu [43]	2004	TAM	26	Meta-analysis of TAM constructs	INCLUDE - Empirical studies that apply TAM / INCLUDE - Studies report sample sizes / INCLUDE - Studies report TAM correlation coefficients or values that can be converted to correlations / INCLUDE - Studies are published after 1989	PU PEU TA	Hedges and Olkin / Hunter and Schmidt	***	PU-TA and PEU-PU relationships are strong / PEU-TA relationship is weak
Legris et al. [44]	2003	TAM	22	Meta-analysis of TAM constructs	INCLUDE - Empirical studies that apply TAM / INCLUDE - Protection of the integrity of TAM / INCLUDE - Clarification of the research methodology / INCLUDE - Availability and completeness of the research results	PU PEU ATT BI U	***	***	In TAM models, significant factors are not totally included / TAM needs to include social and organizational processes for more predictive power

PU: perceived usefulness; PEU: perceived ease of use; ATT: attitude toward use; BI: intention to use; TRU: Trust; U: actual use; SN: subjective norm; TA: technology acceptance

****: The relevant information is either not manifested explicitly or not a part of the study.*

Table 2.1 summarizes the studies regarding some of their general properties, i.e. the number of primary studies meta-analyzed, the subject of the analysis, criteria used for study selection, model constructs investigated, procedures employed, usage of corrected or uncorrected correlation coefficients, and some part of study findings.

One among the ten meta-analyses, i.e. the study of Dwivedi et al. [35], is based on UTAUT constructs. This aspect, in fact, is not inconsistent with the fact that fewer studies were conducted in attempt to review (meta-analytically or narratively) the validity and robustness of UTAUT and of the other models on technology acceptance.

CHAPTER 3

RESEARCH METHODOLOGY

Chapter 3 elaborates the research methodology process. In Section 3.1 the sources are defined; in Section 3.2 the search strategy is explained; Section 3.3 clarifies the inclusion and exclusion criteria, Section 3.4 describes the rationale behind the choices of type of effect size and the meta-analytic model, and Section 3.5 provides the preliminary data extraction steps.

3.1. Defining the Sources

In order to compile the required input for the meta-analysis, a comprehensive preliminary search study was conducted by determining and utilizing six digital libraries / online databases as the main sources: IEEE Xplore (published by the Institute of Electrical and Electronics Engineers), ScienceDirect (published by Elsevier B. V.), Web of Science (published at Web of Knowledge portal and by Thomson Reuters), JSTOR (published by ITHAKA Publications), ACM Digital Library (published by the Association for Computing Machinery and owned by ACM, Inc.), and CiteSeerX (former CiteSeer, published by the College of Information Sciences and Technology, The Pennsylvania State University). Google Scholar, as a bibliographic database and a search engine, was added as the seventh component into the set with the motivation of that its citation indexing feature could serve the work by directing the researcher to other external commercial databases in which additional relevant studies can be found. In addition, the Middle East Technical University (METU) Library student membership has been used for the access to Springer eBook

Collections (which included conference proceedings collections published by Springer Science+Business Media) purchased by the library.

3.1.1. Utilized Software Tools

Because of the subscription-based access models of the selected digital libraries (except Google Scholar) and in order to gain access to the full texts of the studies, METU Library Off-Campus Web Caching Service was used as a proxy server.

As a comprehensive and systematic research synthesis which included the review of a large set of citations, the meta-analysis study required a tool to enable the overall management, categorization, elimination, record, and storage in compliance with the systematic nature of the study. RefWorks Web Based Bibliographic Management Software (developed by RefWorks-COS, ProQuest, LLC), as a browser based solution, satisfied this need during the literature review, coding, and study selection phases, and its functional integration with the major digital libraries such as IEEE Xplore and ScienceDirect was used to export citations directly to RefWorks database.

Zotero Standalone (version 3.0.11.1; developed by the Center for History and New Media, George Mason University) was used as an intermediary bibliography organizer for the other digital libraries (e.g. Web of Science) which does not provide the direct export function of RefWorks. During the study, the citations were saved (and also backed up) to Zotero Standalone with the suitable file format, and again exported into RefWorks in order to form a whole, single literature of the study.

Zotero Connector (version 3.0.8.1) add-on for Google Chrome browser was used to save the citations listed in Google Scholar results directly from the browser to Zotero Standalone in one standardized format.

Microsoft Excel (version 14.0.6129.5000) component of Microsoft Office Standard 2010 was used to create the study level and effect size level coding schemes of the meta-analysis, to store the raw coding protocol data of the primary studies, to form the model construct decomposition structure, and to tabulate the output of the search processes.

Comprehensive Meta-Analysis (version 2.2.064; developed by Biostat, Inc.; abbreviated as CMA) was used to process the aggregate effect size data derived from the primary studies. Without complications that could have arisen, the data were computed, converted (when required), and combined into the same analysis with the assistance of the software. Besides, the statistical testing processes including the publication bias investigation and moderator analysis, and the graphical representation of the data have also been run with this tool.

3.2. Search Strategy

While shaping the search strategy, the approach that Turner et al. used for their study of 2010 [38] was adopted. The systematic literature review of Turner et al. operated a search flow which started from the identification of the search terms and the Boolean strings one by one. The flow proceeded with the determination of the sources, validation of the search, source sharing of the reviewers, and documentation as well as the management of the search results. In our study, as a slight difference, the source determination was made prior to this search flow, and the source sharing step was eliminated.

3.2.1. Identification of the Search Statements

As a beginning, the search terms to be used in the determined sources (i.e. digital libraries) were identified. Since the main objective was to obtain the quantitative construct relationship findings of the chosen theoretical models on technology acceptance, the core set included the terms "empirical", "Technology Acceptance Model", "TAM", and "UTAUT". The expansion of the abbreviation UTAUT, i.e.

“Unified Theory of Acceptance and Use of Technology”, was not included into this set because of its infrequent usage in texts. Gradually, more search terms (e.g. “Correlation Matrix”, “Perceived Ease of Use”, “User Acceptance” etc.) with different string formulations were used, and a total set of 26 term elements was established as can be seen in Table 3.1.

Table 3.1 Search terms and strings formulation (excerpt from Appendix D)

No	Group	Search Term	Search Set	*Library Code*	*Library**
1	a	Measurement	(a1 **OR** a2 **OR** a3) **AND** (b4)	*01* *02* *03* *04* *05* *06* *07*	*IEEE Xplore* *ScienceDirect* *Web of Science* *JSTOR* *ACM Digital Library* *Google Scholar* *CiteSeerX*
2	a	Measure	(a1 **OR** a2 **OR** a3) **AND** (c5 **OR** c6 **OR** n23 **OR** n24 **OR** o25 **OR** p26)		
3	a	Empirical	(a1 **OR** a2 **OR** a3) **AND** (d7 **OR** d8 **OR** d9)		
4	b	Technology Acceptance Model	(a1 **OR** a2 **OR** a3) **AND** (e10)		
5	c	TAM Revision	(a1 **OR** a2 **OR** a3) **AND** (j17 **OR** j18 **OR** k19) **AND** (l20)		
6	c	TAM Variant	(a1 **OR** a2 **OR** a3) **AND** (j17 **OR** j18 **OR** k19) **AND** (m21 **OR** m22)		
…	…	…	…		
26	p	TAM2	-		

*A total of twelve search sets were queried on each of these seven digital libraries.

Table 3.1 presents an excerpt from the complete formulation table (see Appendix D) of search terms and strings for the study. The relevant terms were enumerated and grouped on the condition that the synonymous, similar, and/or contextually close terms are coupled together in the same group; e.g. "measurement", "measure", and "empirical" are coupled together in *Group a* as "*a1*", "*a2*", and "*a3*", respectively.

Next, with the help of the Boolean operators, representational search strings were formed in order to be used as queries in the advanced search (e.g. JSTOR) or expert search (e.g. IEEE Xplore) pages of the digital libraries; e.g. "(a1 OR a2 OR a3) AND (e10)" as the representation of "('Measurement' or 'Measure' or 'Empirical') and ('TAM Constructs')".

Finally, the serial codes which constituted the fifth column of Table 3.1 were given to each digital library (e.g. 01 for IEEE Xplore) for enhanced directory traceability. This structure is explained in Section 3.2.3.

3.2.2. Validation of the Search

To validate the search strategy, the effectiveness of the search was assessed by comparing the search output to the selected primary studies of two preceding meta-analyses as benchmarks: Turner et al.'s study of 2010 [38], and Schepers and Wetzels' study of 2007 [16]. The more recent studies were eliminated considering the relatively fewer number of citations they had, and higher number of citations was considered as a positive admissibility factor in benchmark selection. Turner et al. (2010) and Schepers and Wetzels (2007) were cited 33 times and 162 times, respectively, in SciVerse Scopus[1]. These citation levels supported the selection of the benchmarks. Among their "studies used in meta-analysis" lists, the first 30 publications of each were taken as subsets and compared to the search results of this study. 25 of the first 30 publications which included studies subject to the meta-analysis of Turner et al., and 18 of the first 30 publications which included studies subject to the meta-analysis

[1] SciVerse Scopus, as a service owned by Elsevier B. V., is one of the major bibliographic databases on the Internet which contains the records of a wide range of journals from different disciplines. It is stated that Scopus is the world's largest abstract and citation database of peer-reviewed literature [45].

of Schepers and Wetzels were found existing in our stored and categorized search results. The missing studies observed in the test, rather than being interpreted as mismatches, were interpreted as an effect of the enriched literature regarding the three-year and six-year gap between these benchmark studies and our study. In other words, this meta-analysis study consists of some more recent (later than 2007 and 2010) primary studies.

3.2.3. Documentation and Management of the Search Results

A set of standardized search parameters was formed independently from the digital libraries. These parameters were listed with descriptions in Table 3.2.

Table 3.2 Search parameters applied commonly among digital libraries

Search Parameter	Description
Search in	It defines in what elements of a publication the query is made: e.g., full text, meta data, abstract, title etc.
Returned results for	It specifies which publications the returned results contain: e.g. all content, subscribed/accessible content only etc.
Content type	It specifies which content types are included: e.g. articles, proceedings papers etc.
Topic	It defines whether the topics are narrowed: e.g. "narrow by general topics for engineers" etc.
Subject	It specifies whether the subjects/categories is filtered to some specific group: e.g. "narrow by computer science" etc.
Sort by	It defines what sorting criteria is used: e.g. relevance, author etc.
Publication	It defines whether the results is filtered to some specific publications: e.g. "exclude Energy Policy" etc.

The full matrix for each digital library and for each parameter described in Table 3.2 is provided in Appendix E. Table 3.3 exemplifies one row of this full matrix as an excerpt from Appendix E.

Table 3.3 Search parameters by library (excerpt from Appendix E)

Library / Parameter	**IEEE Xplore**	**ScienceDirect**	**Web of Science**	**JSTOR**	**ACM Digital Library**	**Google Scholar**	**CiteSeerX**
Search in	Search in: Meta Data and Full Text	Search in: Full Text and Abstract	Search in: Topic (TS) and Title (TI)	Search in: Full Text	Search in: Full Text	Search in: ALL	Search in: Full Text

As a preparation to the subsequent study selection phases, a minor literature was created with the search results of the search queries listed in Table 3.1. Each search query was identified with a search set number, and they were applied to each digital library one by one. Appendix F presents the tabulated form of these results. As an excerpt, Table 3.4 shows a two libraries-two queries part from the search results matrix of Appendix F.

Table 3.4 Filtered search results (excerpt from Appendix F)

Search Set No	**Query**	**IEEE Xplore**	**ScienceDirect**
1	("Measurement" OR "Measure" OR "Empirical") AND ("Technology Acceptance Model")	Conf. Pub: 1397 Journals & Magazines: 97 Early Access Articles: 1 Standards: 0 Total: 1495 (200)	Conf. Pub: 0 Journals: 1738 Early Access Articles: 0 Standards: 0 Total: 1738 (197)
2	("Measurement" OR "Measure" OR "Empirical") AND ("TAM Revision" OR "TAM Variant" OR "Unified Theory of Acceptance and Use of Technology" OR "UTAUT" OR "Consumer	Conf. Pub: 356 Journals & Magazines: 13 Early Access Articles: 0 Standards: 0 Total: 369 (71)	Conf. Pub: 0 Journals: 308 Early Access Articles: 0 Standards: 0 Total: 308 (65)

	Table 3.4 (cont.) Acceptance of Technology" OR "TAM2")	… …	…
		TOTAL (after duplication filter): 483	**TOTAL (after duplication filter): 512**
TOTAL (after aggregate duplication filter)		**481**	**488**
TOTAL (after manual elimination)		**328**	**397**

According to the data presented in Table 3.4, the query with search set number 1 returned 1397 conference proceedings, 97 journals and/or magazines, and 1 early access article in IEEE Xplore database. The total was 1495. As a procedure, and by taking the fact the search results were sorted on a relevance basis, the first 200 results were added to the RefWorks database in case of excessive (i.e. larger than 200) query returns. The statement "(200)" next to total value refers to the application of this procedure. Such flow was executed for each digital library and for 12 query sets, and the search output was mitigated iteratively.

First iteration of elimination was made to remove the duplicate records of studies. RefWorks was able to complete this automatically: For instance, after the library based duplication filtering, the number of total results was diminished to 483 for IEEE Xplore as can be seen in Table 3.4. A second iteration of duplication filtering was made for the whole set of digital libraries; this attempt lowered the value of IEEE Xplore to 481. A third manual elimination step made this value finally 328. That is, the minor literature of this thesis study included a total of 328 publications from IEEE Xplore.

The search results (which are tabulated in detail in Appendix F) were recorded, stored, and managed in RefWorks Web Based Bibliographic Management Software. The citations were grouped into hierarchical directories, hence, could be traced conveniently. Figure 3.1 shows a general view of this directory structure.

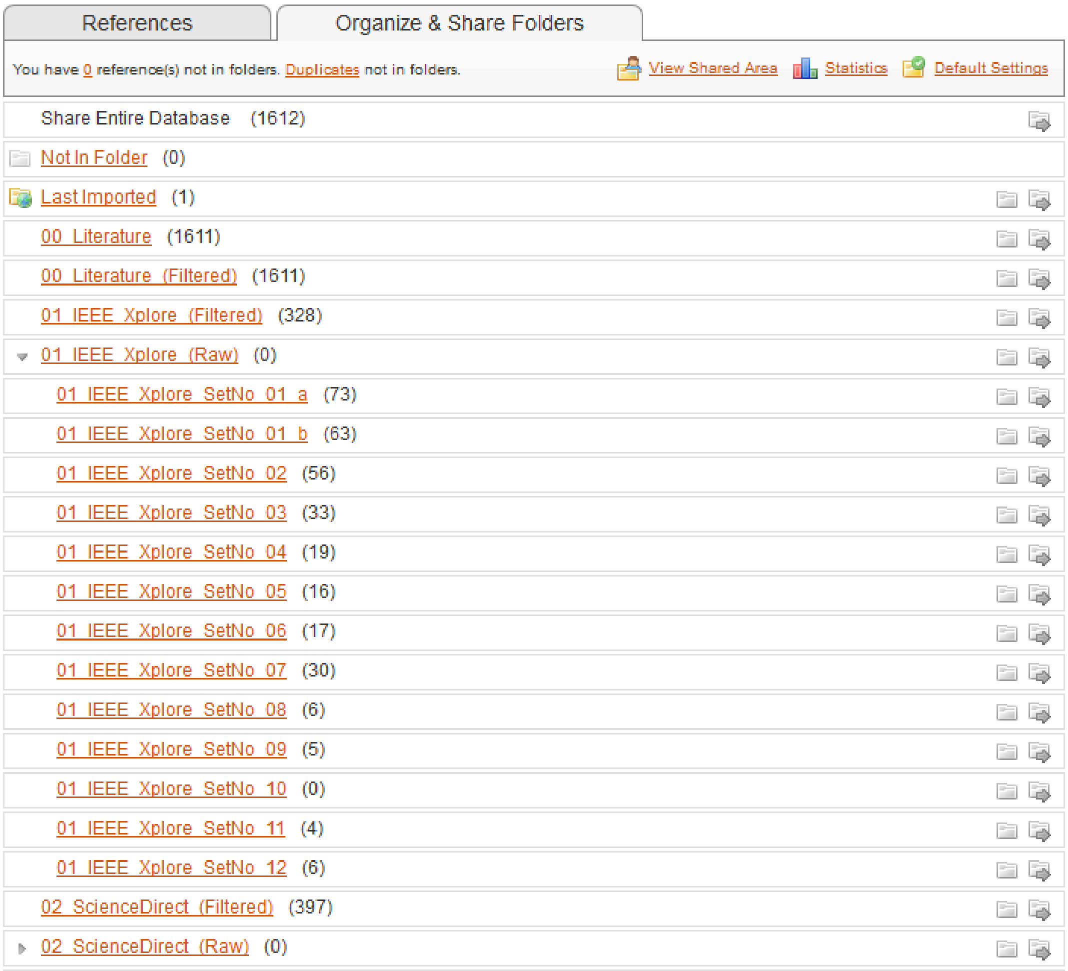


Figure 3.1 A general hierarchical directory structure in RefWorks

As seen from Figure 3.1, the minor literature of the thesis study included a total of 1611 publications under the directory named "00_Literature_(Filtered)". 328 of them were from IEEE Xplore, and again, these total 328 studies were grouped under subdirectories on a search set number basis.

3.3. Inclusion and Exclusion Criteria

Borenstein et al. [3] points out that starting out with a massive volume of literature is not an unusual practice for researchers who conduct systematic literature reviews, and after applying a set of inclusion and exclusion criteria, this volume gets much more contracted. A meta-analysis study, as a type of systematic review, needs to have its inclusion and exclusion criteria, too.

Lipsey and Wilson [1] emphasized that the way the studies are selected should be open and unambiguous for a meta-analysis to be qualified as "good" (necessary but not sufficient). Herein, while defining such criteria, it is important for the researcher to decide on whether to aim collecting as much studies as possible or collecting studies which are as methodologically credible as possible. In [1], these two approaches are mentioned as "more inclusive" and "less inclusive", and this is a tradeoff, in a sense, since the former is accompanied with the risk of being more error-prone regarding "garbage in-garbage out", while the latter is accompanied with the risk of obtaining a relatively smaller set of studies as well as the exclusion of the probably qualified input. Within the context of their debates with Eysenck [13], Glass et al. [46] argued that the issue of methodological quality for primary studies should be an a posteriori investigation rather than an a priori exclusion factor. What is more, Cooper [2], besides suggesting robust schemes and instruments which are aimed to be used for the design assessment, also laid stress on the usually subjective and questionable nature of methodological quality-based a priori elimination attempts, and emphasized the potentially positive effects (e.g. reaching additional information for future studies) of the inclusion of the so-called "bad" studies to the systematic review.

Taking the foregoing points of view into consideration, this study used an approach which is closer to being more inclusive for inclusion decisions and coding scheme formatting by primarily looking for the quantitative and objective output in each reviewed study. Accordingly, the inclusion and exclusion criteria were listed as in Table 3.5.

Table 3.5 Inclusion and exclusion criteria

No	Feature	Decision	Code
1	The study is a primary study.	*INCLUDE*	-
2	The study is available in specified digital libraries.	*INCLUDE*	-
3	The study is published in or after 1989.	*INCLUDE*	-
4	The study reported correlation coefficients (or any other quantitative outcomes that can be used to obtain effect sizes) among TAM, TAM2, TAM3, and/or UTAUT constructs.	*INCLUDE*	-
5	The study reported sample sizes.	*INCLUDE*	-
6	The study applied TAM, TAM2, TAM3, and/or UTAUT.	*INCLUDE*	-
7	The study included any measures of the constructs of the original TAM, TAM2, TAM3, and/or UTAUT.	*INCLUDE*	-
8	The study used the same data set with some other more exhaustive study.	*EXCLUDE*	**[REDN]**
9	The study is based on a narrative review and/or did not include a statistical test.	*EXCLUDE*	**[NARR]**
10	The study is only partially accessible.	*EXCLUDE*	**[UNAV]**
11	The study is irrelevant to the investigation of the technology acceptance.	*EXCLUDE*	**[IRRL]**

As seen in the last column of Table 3.5, the features expressing cause of exclusion were assigned codes. These codes were utilized while filling out the coding schemes for each study, and the inclusion features did not need to be assigned codes because the absence of any of the exclusion marks meant that study met all the inclusion criteria.

3.4. Two Problematic Issues of the Analysis: The Effect Size and the Error Model

This section provides the rationale behind the choice as well as interpretation of the effect size data type which is common to the selected primary studies of the meta-analysis (see Section 3.4.1). In addition, Section 3.4.2 below elucidates the basis for choosing the random-effects meta-analytic model.

3.4.1. Working with the Applicable Effect Sizes

This study is an effect-size based meta-analysis, and it used the standardized regression coefficients, i.e. beta coefficients. This approach was pursued despite the concomitant risks of it: By and large, TAM-related and UTAUT-related empirical studies which were retrieved as the results of the search processes adopted the core constructs of these models into their design, hypothesized their own theoretical models by integrated some additional original constructs, and provided their survey findings which supported or rejected their hypotheses. In other words, among those reviewed, few studies used the original models through an "as-is" approach; rather, newly introduced, revised, and/or extended constructs attempted to enhance the explanatory power of the core TAM and UTAUT. These circumstances posed a threat to the validity of a meta-analytic study which seeks to gather the path coefficients of the relationships between the model constructs. Indeed, the validity risk of using these coefficient values as effect sizes was one of the motivations of Turner et al. [38] for preferring to conduct a "vote-counting" meta-analysis instead of an effect-size based meta-analysis.

On the other hand, both "categorical" oppositions to "vote-counting" method and justifications for the use of "usual" effect-size based meta-analysis exist in the literature. Borenstein et al. [3] draw attention to the questionable validity of the vote-counting method by its very nature: To make it clear, vote-counting bases itself on the synthesis of the p-values from diverse studies, that is, on the comparison of the number of studies which have statistically significant findings and the number of those which do not have. Besides not even calling this method as a type of meta-analysis, [3] states that such approach faultily leads to overlooking the statistically insignificant studies which include some "effect" to be combined with others. A study which finds a considerably strong relationship between two constructs might lack a large sample size, i.e. low precision, hence, lack the statistical significance. Vote-counting eliminates such studies directly whereas an effect-size based meta-analysis embraces the data derived from them by combining their effect sizes and the sample sizes into the analysis pool. This leads to substantial statistical power as well as quite low p-values for the summary effects of the meta-analyses.

Second, the use of beta coefficients for the meta-analysis of models on technology acceptance is not something new. As an example, King and He [36] utilized both correlation coefficients (r values) and path coefficients (beta values) while conducting their meta-analysis on TAM. [36] justified this by stating that a big part of the TAM variants in selected studies were tested with respect to the core TAM. In other words, the connections between the core TAM constructs were not lost.

Third, the approach of deriving the beta coefficients from the core part of the theoretical models is consistent with the notion of the use of a random-effects model which is explained in Section 3.4.2.

3.4.2. Choice of Models: Fixed-Effect or Random-Effects

This study pursued a "random-effects" meta-analytic model. To clarify, the opposite of this model, i.e. fixed-effect model, hypothesize that the entire variation in the meta-analysis takes its source from nothing but the sampling error within each of the selected primary studies. That is, the fixed-effect model claims that in case of an ideal scenario where these studies have some very high sample sizes, hence exactly zero sampling errors, there would be one and only one, common effect size for them. Under fixed-effect meta-analysis, study weighting is made with the objective to suppress these within-study sampling errors of the studies; therefore, studies with low precision (due to low sample size) get quite low weights whereas those with high sample sizes are weighted very high. Fixed-effect model, that is, "one common effect size for all" assumption, is mostly used for the meta-analyses of experimental studies (e.g. clinical randomized trials) which have relatively more similar (or even identical) sample characteristics and external factors.

Contrariwise, random-effects model embraces the presumption that there is no single common effect size for the primary studies which are subject to meta-analysis. That is to say, even in the case of zero sampling errors, the effect sizes of these studies lie somewhere on a specific "distribution" of effects. Therefore, it can be stated that someone who adopts the random-effects model in her meta-analysis study accepts the fact that the "dispersion" among the effects does not only originate from the "within-study" errors but also from the natural dispersion (i.e. *tau-squared*; denoted T^2) between the true effects of the studies. Unlike fixed-effect model, random-effects model is mostly used for the meta-analyses of studies in humanities, social sciences, business etc. Not surprisingly, these fields have study designs which have relatively more dispersed sample structures, and they are usually exposed to a relatively broader set of external factors. Because of the more similar nature of the study designs and proneness to externalities (including the construct diversity), random-effects meta-analysis is conducted within this study.

Borenstein et al. [3] demonstrate the computational steps of a random-effects meta-analysis as follows.

The effect of a selected primary is denoted Y_i. The main objective in such a study is usually the acquisition of weighted mean value, denoted M^*, through the gathered effects. The equation for M^* is given below.

$$M^* = \frac{\sum_1^k W_i^* Y_i}{\sum_1^k W_i^*} \qquad \textit{(Equation 3.1)}$$

As seen from Equation 3.1 above, M* is composed of two components, one of which is W_i^*, the weights assigned to each study. W_i^* is simply the reciprocal of V^*_{Yi}, i.e. the combination of the within-study variance (denoted V^*_{Yi}) and the between-studies variance (denoted T^2). The equations for W_i^* and V^*_{Yi} are given below.

$$Wi^* = \frac{1}{V_Y i^*} \qquad \textit{(Equation 3.2)}$$

$$V_Y i^* = V_Y i + T^2 \qquad \textit{(Equation 3.3)}$$

3.5. Preliminary Data Extraction

After a set iterations of automatic filtering, manual search results review, duplicate study removal, manual study check and sampling, and employment of the inclusion and exclusion criteria, a total of 128 studies were retained, and 84 of which were selected for meta-analysis at the final phase. Among those selected, 12 of the studies were designed by adopting the UTAUT model. Providing statistics on reliability and reporting acceptable levels of reliability for the model constructs were considered. The aggregate sample size of these 84 studies is 27387. The studies subject to meta-analysis are presented in Appendix A.

The organization of the first coding protocol and scheme for the study level constituted the essence of the preliminary data extraction, and is described in Section 3.5.1 below.

The second coding protocol and scheme for the effect size level was isolated from the first phase, and was discussed in Chapter 4, i.e. Data Analysis.

3.5.1. The Study Level Coding Protocol

Lipsey and Wilson's [1] coding manuals and example coding form structures were highly influenced during the development of both study level and effect size level coding protocol schemes. The study level coding protocol scheme is given in Appendix B, and this section describes the components of this protocol with one applied (i.e. coded for study level) primary study.

The coding protocol scheme was prepared in a matrix form structure in order to ease filling in and enhance the traceability. The horizontal axis consisted of three complementary elements which are "Descriptor ID", "Descriptor Code", and "Description" from top to bottom, respectively. Next, the vertical axis constituted the supplemental dimension of the matrix which consisted of the multiple options and, by status, single and open-ended response fields which corresponded to each descriptor at the horizontal axis. Table 3.6 provides an illustrative excerpt for the form "SID0001a_(Szajna_1996)".

Table 3.6 Study level coding protocol (excerpt from Appendix B) for "SID0001a_(Szajma_1996)"

Descriptor ID	**SD01**	**SD02**	**SD03**	**SD04**	**SD05**	**...**
Descriptor Code	**[STUDYID]**	**[AUTHOR]**	**[PUBYEAR]**	**[PUBTITLE]**	**[PUBTYPE]**	**...**
Descriptor	**Study ID**	**Author**	**Publication Year**	**Title of Publication**	**Type of Publication**	**...**
SD01Ω. Study ID	SID0001a					
SD02Ω. Author		Szajna				
SD03Ω. Year			1996			
SD04Ω. Title				Empirical Evaluation of the Revised		

Table 3.6 (cont.)				Technology Acceptance Model		
SD05a. Book					0	
SD05b. Journal					1	
SD05c. Proceedings					0	
SD05d. Dissertation					0	
SD05e. Thesis					0	
SD05f. Technical Report					0	
SD05g. Other					0	
…	…	…	…	…	…	…

Descriptor ID codification was segmented considering two schemes, i.e. study level scheme and effect size level scheme. Study level descriptors were prefixed with the initials, "SD", which refer to the term "study level descriptor", and numbered incrementally; e.g. SD01.

Descriptor code elements were defined as the square-bracketed short expressions of the complete descriptor statements: e.g. "[PUBYEAR]" for "Publication Year".

Descriptors became the core elements of the study level coding protocol, and the scheme consisted of 15 descriptors in total. The first five of the descriptors were presented in Table 3.6, and the whole set of descriptors with corresponding Descriptor ID and Descriptor Code values are shown in Table 3.7.

Table 3.7 List of study level coding protocol descriptors

Descriptor ID	Descriptor Code	Descriptor
SD01	[STUDYID]	Study ID
SD02	[AUTHOR]	Author
SD03	[PUBYEAR]	Publication Year
SD04	[PUBTITLE]	Title of Publication
SD05	[PUBTYPE]	Type of Publication
SD06	***[SGENDER]***	Gender of Sample [g]

	Table 3.7 (cont.)	
SD07	[SMAGE]	Mean age of Sample [a]
SD08	[SOCCUPY]	Occupation of Sample
SD09	[SCULTURE]	Culture Context of Sample
SD10	[SXP]	Prior Experience of Sample [e]
SD11	[SSIZE]	Sample Size
SD12	[ISCONTXT]	Technology Context
SD13	[ISVOLUN]	Technology Voluntariness [v]
SD14	[MODEL]	Acceptance Model Studied
SD15	[CNSTRCTS]	Pairwise Constructs Studied

As seen from the example form "SID0001a_(Szajna_1996)" presented in Table 3.6, the first descriptor, i.e. Study ID (SD01), intersects with option "SD01Ω. Study ID". The capital omega symbol which exists in the options codification of vertical axis refers to that the related descriptor have one open-ended correspondence: e.g. "SID0001a" for Study ID. If the response of the descriptor is multiple-choice, then the alphabetical "a, b, c, …" sequence was used to codify the options: e.g. as possible responses to the Type of Publication (SD05) descriptor, options "SD05a. Book", "SD05b. Journal", "SD05c. Proceedings" etc. were defined. The correct option(s) was marked with value "1", and the other irrelevant options for SD05 were marked with values "0" (see Table 3.6). Also, the cells with responses which are not "0" were highlighted with a darker fill color. For example, in the form "SID0001a_(Szajna_1996)", "SD05b. Journal" option was marked with value "1" while the remaining Type of Publication (SD05) options were filled in with "0" values, and the corresponding cell was highlighted with gray.

The study of Szajna [47] was reviewed at the study level with the assist of the study level coding form named "SID0001a_(Szajna_1996)". The first part of the name is the "Study ID" value (response to descriptor SD01), actually, i.e. SID0001a. The prefix "SID" refers to "study identification", "0001" refers to the incremental method of enumeration for each single independent study, and the postfix "a" refers to that this study (which starts with 'SID0001…') has more than one outcome (or time-point) that should be uncoupled from one another. This exemplified "SID0001…" study had pre-and-post-implementation stages, i.e. two time-points, in fact: One is based on a sample group which is inexperienced, and the other one is based on the sample group which is experienced with the information system at issue [47]. Therefore, although they are reported in the same independent study, these are handled as two sets of non-independent data, and the former was coded as "SID0001a" while the latter was coded as "SID0001b" in two separate forms. The other multiple outcome presences which are not identified by a descriptor of the study level coding form (e.g. two different BI-U outcomes for self-reported use and computed actual use in our example, hence, four BI-U correlations in total) were represented in the Effect Size ID instead of Study ID (see Section 4.1.1).

Considering multiple outcomes or time-points as independent studies is problematic because this would lead to higher weighting of such studies in comparison to those with one outcome or time-point, and because accepting the non-independent data of the same sample set as independent would overestimate the precision of the summary effect [3]. This is why multiple time-points should be integrated into meta-analysis by generating a synthetic effect size as the mean of these correlated time-point effect sizes and a variance of this mean.

CHAPTER 4

DATA ANALYSIS

Data analysis starts with the main heading which comprises the steps of the meta-analyses of relationships within models, that is, Section 4.1 and its subsections.

4.1. Meta-Analysis

The core part, that is, the meta-analysis part of the study continues with step-by-step subsections. Based on their contents, these subsections are lined up as The Effect Size Level Coding Protocol (i.e. Section 4.1.1), The Characteristics of the Studies (i.e. Section 4.1.2), and The Core Meta-Analyses of the Model Relationships (i.e. Section 4.1.3).

4.1.1. The Effect Size Level Coding Protocol

The benefits (actually, necessities) of splitting the descriptors of the study and the empirical findings of that study into two separate categories that Lipsey and Wilson [1] stressed led our study to have two protocols of coding: One is for the study level information which was described and presented with full scheme structure in Section 3.5.1 and in Appendix B, respectively, and one is for the effect size information which is the subject of this section and of Appendix C.

The effect size level coding protocol of our meta-analysis was developed under the guidance of [1], too, with two noteworthy specificities: First, as consistent with what

[1] stated, in our coding structure, each study with a unique study level coding form and a unique Study ID (e.g. SID0001a) could correspond to several effect size level coding forms (e.g. 15a14aSID0001a, 15d14aSID0001a etc.) each of which embodied Study ID value as supplementary identifier besides Effect Size ID. This multiplicity was driven by the diverse pairwise construct relationships of the technology acceptance models which were investigated by the same study. Second, rather than selecting and deriving a single unit of effect size for each of the studies, the raw empirical data which can be converted subsequently for the computation of the preferred effect size statistic were submitted into the forms. This approach was used in order to gather data from each study faster, and to calculate the standardized values of each collectively through the instrument of Comprehensive Meta-Analysis software and/or manual operations (e.g. conversion from standardized regression coefficients to correlation coefficients). Hereby, the effect size level coding protocol was developed as presented in Appendix C, and Table 4.1 provides an excerpt from the full scheme by exemplifying the effect size level coding form "15a14aSID0001a".

Table 4.1 Effect size level coding protocol (excerpt from Appendix C) for "15a14aSID0001a"

Descriptor ID	**SD01**	**ED01**	**ED02**	**ED03**	**ED04**	**...**
Descriptor Code	**[STUDYID]**	**[ESID]**	**[PAIRWISE]**	**[ESTYPE]**	**[PAGENUM]**	**...**
Descriptor	**Study ID**	**Effect Size ID**	**Pairwise Construct**	**Type of Effect Size**	**Page Number of Effect Size**	**...**
SD01Ω. Study ID	SID0001a					
ED01Ω. Effect Size ID		15a14aSID0001a				
ED02Ω. Pairwise Construct			PEU-PU			
ED03a. Correlation and Sample Size				1		
ED03b. Correlation and Standard Error				0		
ED03c. Correlation and Variance				0		
ED03d. Standardized Regression Coefficient (Beta Value) and Sample Size				0		

Table 4.1 (cont.)						
ED03e. Standardized Regression Coefficient (Beta Value) and Standard Error				0		
ED03f. Standardized Regression Coefficient (Beta Value) and Variance				0		
ED03g. Fisher's Z and Sample Size				0		
ED03h. Fisher's Z and Standard Error				0		
ED03i. Fisher's Z and Variance				0		
ED03j. Correlation and t-Value				0		
ED03k. t-Value and Sample Size for Correlation				0		
ED03l. p-Value and Sample Size for Correlation				0		
ED03m. Raw Difference in Means in and Confidence Limits (independent groups)				0		
ED03n. Raw Difference in Means and Standard Error (independent groups)				0		
ED03o. Raw Difference in Means and Variance (independent groups)				0		
ED03p. Cohen's d and Confidence Limit				0		
ED03r. Cohen's d and Standard Error				0		
ED03s. Cohen's d and Variance				0		
ED03t. Hedges' g and Confidence Limit				0		
ED03u. Hedges' g and Standard Error				0		
ED03v. Hedges' g and Variance				0		
ED03w. Raw Mean Difference and Confidence Limit (paired study)				0		
ED03x. Raw Mean Difference and Standard Error (paired study)				0		
ED03y. Raw Mean Difference and Variance (paired study)				0		
ED03z. Mean, SD, and Sample Size in Each Group				0		
ED03aa. Difference in Means, Common SD, and Sample Size				0		
ED03ab. Cohen's d and Sample Size				0		
ED03ac. Means, Sample Size, and t-Value				0		
ED03ad. Difference in Means, Sample Size, and t-Value				0		
ED03ae. Sample Size and t-Value				0		
ED03af. Means, Sample Size, and p-Value				0		
ED03ag. Difference in Means, Sample Size, and p-Value				0		
ED03ah. Sample Size and p-Value				0		
ED03ai. Means, SD Pre and Post, N, in Each Group, Pre/Post Correlation				0		
ED03aj. Means, SD Difference, N, in Each Group, Pre/Post Correlation				0		
ED03ak. Means Pre and Post in Each Group, t within Groups, N				0		
ED03al. Means Pre and Post in Each Group, p within Groups, N				0		
ED03am. Means Pre and Post in Each Group, F for Difference Between Changes, N				0		

Table 4.1 (cont.)						
ED03an. Mean Change, SD Pre and Post, N, in Each Group, Pre/Post Correlation				0		
ED03ao. Mean Change, SD Difference, N, in Each Group, Pre/Post Correlation				0		
ED03ap. Mean Change in Each Group, t within Groups, N				0		
ED03ar. Mean Change in Each Group, p within Groups, N				0		
ED03as. Mean Change in Each Group, F for Difference Between Changes, N				0		
ED03at. F for Difference Between Changes, N				0		
ED03au. Mean Difference, SD of Difference, and Sample Size				0		
ED03av. Means, SD Pre, SD Post, Pre/Post Correlation, and Sample Size				0		
ED03aw. Means, Sample Size, and Paired t-Value				0		
ED03ax. Means, Sample Size, and Paired p-Value				0		
ED03ay. Mean Difference, Sample Size, and t-Value				0		
ED03az. Mean Difference, Sample Size, and p-Value				0		
ED03ba. Sample Size and t-Value from Paired t-Test				0		
ED03bb. Sample Size and p-Value from Paired t-Test				0		
ED04Ω. Page Number					89	
...	...	...	...	...	...	...

As can be seen in Table 4.1, the effect size coding scheme contains both study descriptors (e.g. SD01) and effect size descriptors since the study descriptors were used to refer to the unique study that the effect size level coding form is associated with. Effect size ID of the indigenous descriptors were prefixed with the initials, “ED”, which refer to the term “effect size level descriptor”, and numbered incrementally; e.g. ED01.

As equivalent to the study level coding protocol in terms of codification, descriptor code elements were defined as the square-bracketed short expressions of the complete descriptor statements: e.g. “[PAIRWISE]” for “Pairwise Construct ”.

Both the specified study and the entire effect size descriptors became the core elements of the effect size level coding protocol, and the scheme consisted of 13 descriptors in total including the two exogenous (study level) descriptors. The first five of the descriptors were presented in Table 4.1, and the whole set of descriptors with corresponding Descriptor ID and Descriptor Code values are shown in Table 4.2. The corresponding options which extend from ED03a to ED03bb for the descriptor Type of Effect Size (ED03) were influenced from the proposed data formats of Comprehensive Meta-Analysis software. Effect size types which were based on standardized regression coefficients (i.e. beta values) were put into the set additionally, and these were coded as ED03d, ED03e, and ED03f (see Table 4.1 and Appendix C).

Table 4.2 List of effect size level coding protocol descriptors

Descriptor ID	Descriptor Code	Descriptor
SD01	[STUDYID]	Study ID
ED01	[ESID]	Effect Size ID
ED02	[PAIRWISE]	Pairwise Construct
ED03	[ESTYPE]	Type of Effect Size
ED04	[PAGENUM]	Page Number of Effect Size
SD11	[SSIZE]	Sample Size
ED05	[MEAN]	Mean(s)
ED06	[STDEV]	Standard Deviation(s)
ED07	[TVALUE]	t-Value
ED08	[FVALUE]	F-Value
ED09	[CHISQVAL]	Chi-Square Value
ED10	[ES]	Technology Context
ED11	[CONFESC]	Technology Voluntariness [v]

Not differently from the study level coding form example, in Table 4.1, the capital omega symbol refers to that the related descriptor have one open-ended correspondence: e.g. “15a14aSID0001a” for Effect Size ID. If the response of the descriptor is multiple-choice, then the alphabetical “a, b, c, …” sequence was used. The correct option(s) was marked with value “1”, and the other irrelevant options for ED03 were marked with values “0” (see Table 4.1).

One among several effect size level coding forms which belongs to the study of Szajna [47] was named “15a14aSID0001a”. The first part of the name, i.e. “15a”, refers to the corresponding option “SD15a. PEU-PU” of the Pairwise Constructs Studied (SD15) descriptor which comes from the study level coding form of the specified study. The second part of the name, i.e. “14a”, refers to the corresponding option “SD14a. TAM” of the Acceptance Model Studied (SD14) descriptor which comes from the same study level coding form. The last part of the name, i.e. “SID0001a”, is actually the identity of the associated study. “SID0001” part of it represents a single independent study. The “-a, -b, -c, …” postfix denotes the outcome (e.g. time-points) which is identified by a descriptor of the study level coding form. For instance, two time-points (i.e. pre-implementation and post-implementation stages) in the study are also identified by value changes in SD10 (Prior Experience of Sample) descriptor, hence, two study level forms are identified as “SID0001a” and “SID000b”. These led to “15a14aSID0001a” and “15a14aSID0001b” codifications for the related effect sizes of this study. Next, if a study has further different outcomes which are not identified by a descriptor of the study level coding form (e.g. BI-U_A and BI-U_S outcomes for computed actual use and self-reported use), these outcomes are represented with an additional “-1, -2, -3, …” postfix following “-a, -b, -c, …”. For example, “15e14aSID0001a1” refers to an effect size which is for BI-U (15e) relationship of TAM (14a), and it comes from the first time-point (-a, i.e. pre-implementation) and first outcome (-1, i.e. computed actual use).

Figure 4.1 visually summarizes the logic behind the codification of the effect size level coding form names.

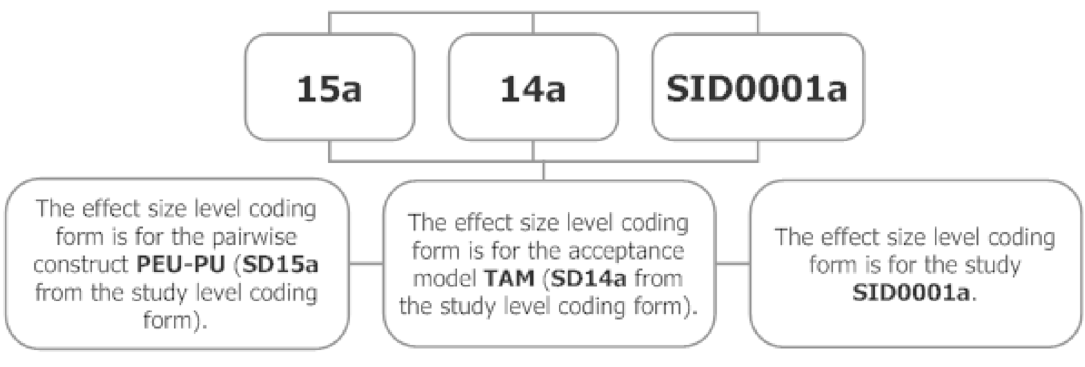


Figure 4.1 Effect size level coding form naming (exemplifying the form ‘15a14aSID0001a’)

The sequence of the decomposed name (which is also the ID of the related effect size) in Figure 4.1 aimed easier bulk sorting based on pairwise construct, acceptance model, and associated study parameters, respectively. Highest priority for sorting is given to the pairwise construct parameter for convenience.

4.1.2. The Characteristics of the Selected Studies

Similar to any primary study, a meta-analysis study has its specific sample characteristics which need elaboration. The sections below present these sample characteristics of 84 selected studies in terms of data provided and contextual features, respectively.

4.1.2.1. Data Characteristics

Table 4.3 provides the sources in which the selected studies were published and the number of studies based on publication type. The table enlists the sources which consisted of more than one study.

Table 4.3 List of sources which consisted of more than one selected primary study

Source	# of Studies
N = 84 **Aggregate N of the Selected Studies = 27387**	
Information & Management	6
System Sciences (HICSS)	5
Computers in Human Behavior	4
E -Business and E -Government (ICEE)	3
Engineering Management, IEEE Transactions	3
Information Society (i-Society)	3
Management and Service Science (MASS)	3
Mobile Business, ICMB	3
Wireless Communications, Networking and Mobile Computing, WiCom	3
Computers and Education	2
Electronic Commerce and Security	2
Expert Systems with Applications	2
Government Information Quarterly	2
International Journal of Medical Informatics	2
Management Science and Engineering, ICMSE	2

Table 4.3 (cont.)	
Technology Management Conference (ITMC), IEEE International	2
Technology Management for Global Economic Growth (PICMET) ***Table 4.3 (cont.)***	2
Tourism Management	2
Conference Proceedings (Total)	***48***
Journal Articles (Total)	***36***

Regarding the selected 84 studies, Table 4.4 below provides statistical data about the theoretical model adopted as well as the testing frequency of the relationships of TAM and the UTAUT model.

Table 4.4 Data based on the adopted model and the tested relationships

Construct Relationship	Model	# of Studies	Percentage*
PEU-PU	TAM**	62	86.1
PEU-ATT	TAM**	22	30.6
PU-ATT	TAM**	24	33.3
PU-BI	TAM**	54	75.0
BI-U	TAM**	10	13.9
BI-U	UTAUT***	5	41.7
PEU-BI	TAM**	42	58.3
SN-PU	TAM**	5	6.9
SN-BI	TAM**	13	18.1
PE-BI	UTAUT***	11	91.7
EE-BI	UTAUT***	11	91.7
SI-BI	UTAUT***	11	91.7
FC-BI	UTAUT***	2	16.7
FC-U	UTAUT***	5	41.7
	TAM (Total)	*72*	*85.7*
	UTAUT (Total)	*12*	*14.3*
	TOTAL	***84***	***100***
*Regarding the constructs, percentage refers to the within-group ratio. *TAM or any of its variants or revisions (TAM-r, TAM2, and TAM3) was studied. **UTAUT or any of its variants or revisions (UTAUT2) was studied.			

As can be seen in Table 4.4 above, the most examined construct relationship within the selected studies is PEU-PU and with regard to UTAUT, PE-BI, EE-BI, and SI-BI relationships are studied equally high. Another interesting point is that few studies attempt to explain the links to “actual use”, most probably because of the practical and experimental difficulties.

4.1.2.2. Contextual Characteristics

Table 4.5 provides contextual information about the characteristics of the examined technologies within the selected studies. The dimensions are the context of the technology (i.e. utilitarian, hedonic, or mixed/unknown), survey participant's experience in the relevant technology (i.e. experienced, inexperienced, or mixed/unknown), and survey participant's voluntariness to use the relevant technology (i.e. mandatory, voluntary, or mixed/unknown). For example, if the sample (that is, the group of survey participants of the selected primary study) of this meta-analysis study's sample (that is, the selected primary study itself) were examined from the perspective of how they adopt online shopping, then the study's technology context is marked as "mixed" since such an electronic store technology incorporates both utilitarian and hedonic information systems characteristics.

Table 4.5 Contextual characteristics of the examined technologies

Subject	Characteristics	# of Studies
Technology Context	Utilitarian	45* / 8**
	Hedonic	12* / 2**
	Mixed/Unknown	15* / 2**
Participant's Experience in Technology	Experienced	35* / 5**
	Inexperienced	5* / 1**
	Mixed/Unknown	32* / 6**
Participant's Voluntariness to Use Technology	Mandatory	10* / 1**
	Voluntary	45* / 8**
	Mixed/Unknown	17* / 3**
*TAM or any of its variants or revisions (TAM-r, TAM2, and TAM3) **UTAUT or any of its variants or revisions (UTAUT2)		

As can be seen in Table 4.5 above, utilitarian, experienced, voluntary use dominated the other types of use within the selected studies.

Table 4.6 provides contextual information about the general characteristics of the survey participants within the selected studies. The dimensions are the gender (i.e. female, male, or mixed/unknown), occupation (i.e. student, non-student, or mixed/unknown), and culture context (i.e. high-context, low-context, or mixed/unknown). For example, if the sample was obtained among the Taiwanese managers, the study was marked as "non-student" and "high-context".

Table 4.6 Contextual characteristics of the survey participants

Subject	Characteristics	# of Studies
Participant's Gender	Female	0* / 0**
	Male	0* / 0**
	Mixed/Unknown	72* / 12**
Participant's Occupation	Student	29* / 3**
	Non-student	16* / 7**
	Mixed/Unknown	27* / 2**
Participant's Culture Context	High-Context	53* / 7**
	Low-Context	11* / 5**
	Mixed/Unknown	8* / 0**
*TAM or any of its variants or revisions (TAM-r, TAM2, and TAM3) **UTAUT or any of its variants or revisions (UTAUT2)		

As can be seen in Table 4.6 above, a big portion of the studies had samples from high-context cultures, and among 84 studies, only one conducted a gender-based technology acceptance study. Since it included both genders, and for convenience, it is still classified under the "mixed" category in table.

4.1.3. The Core Meta-Analyses of the Model Relationships

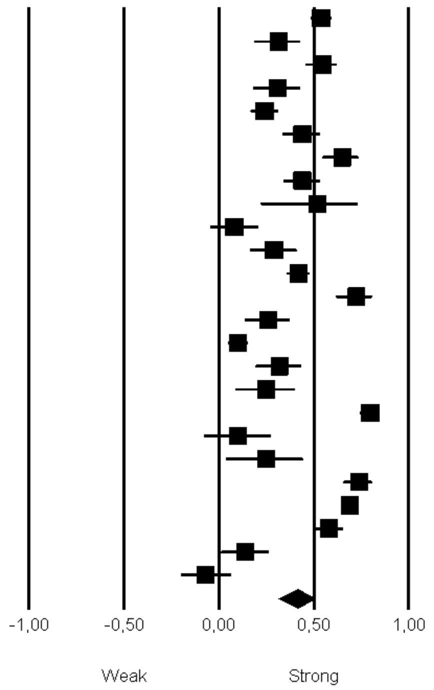
This section presents the meta-analysis results relationship-by-relationship by handling the main constructs of the TAM and UTAUT models. Meta-analyses on PU-ATT and PU-BI, PEU-ATT and PEU-BI, PEU-PU, and BI-U are held respectively, and following the depiction of these, the impact of SN on BI and PU as well as the summary effects of four UTAUT predictors, i.e. PE, EE, SI, and FC, on behavioral intention to use are also presented.

4.1.3.1. The Predictive Ability of Perceived Usefulness on ATT and BI

Figure 4.2 below presents the forest plot of this meta-analysis. As can be seen from Table 4.4 above, 24 studies on TAM contained a PU-ATT relationship. However, since the subgroups within the studies are taken into account on an individual basis with their separate effect sizes, a higher number of effect sizes took place in the meta-analyses. For instance, a study (i.e. SID0081 in plot) investigated the adoption in two groups which differ by voluntariness to use the intranet technology, and contributed with two effect sizes (i.e. 25 effect sizes from 24 studies) to the meta-analysis of PU-ATT which is depicted in Figure 4.2.

Study name	Statistics for each study				
	Correlation	Lower limit	Upper limit	Z-Value	p-Value
SID0013 1481	0,540	0,483	0,592	15,379	0,000
SID0014 1484	0,314	0,188	0,430	4,721	0,000
SID0016 1487	0,545	0,458	0,621	10,319	0,000
SID0019 1492	0,310	0,181	0,429	4,567	0,000
SID0025 1505	0,240	0,166	0,311	6,231	0,000
SID0027 1510	0,440	0,334	0,535	7,437	0,000
SID0028 1511	0,650	0,545	0,735	9,239	0,000
SID0029 1515	0,440	0,338	0,532	7,658	0,000
SID0047 1749	0,520	0,221	0,730	3,209	0,001
SID0049 1761	0,082	-0,048	0,209	1,241	0,215
SID0051 1802	0,290	0,161	0,409	4,306	0,000
SID0054 1859	0,420	0,357	0,479	11,862	0,000
SID0064 2122	0,725	0,616	0,807	9,042	0,000
SID0071 3452	0,260	0,138	0,375	4,088	0,000
SID0073 3456	0,100	0,049	0,151	3,813	0,000
SID0079 3478	0,319	0,193	0,435	4,778	0,000
SID0078 3474	0,250	0,085	0,401	2,946	0,003
SID0080 3479	0,797	0,740	0,842	15,381	0,000
SID0081a 3481 (VOL)	0,100	-0,080	0,274	1,090	0,276
SID0081b 3481 (MAN)	0,250	0,035	0,443	2,270	0,023
SID0085 3494	0,740	0,655	0,807	11,166	0,000
SID0088 3505	0,690	0,646	0,730	20,788	0,000
SID0089 3509	0,580	0,492	0,656	10,516	0,000
SID0090 3513	0,140	0,012	0,264	2,137	0,033
SID0137 4223	-0,070	-0,202	0,064	-1,023	0,306
	0,415	0,313	0,506	7,398	0,000

Correlation and 95% CI



PU-ATT / Random-Effects

Figure 4.2 Random-effects meta-analysis of PU-ATT relationship in TAM

By stating the "0.415" value in its last row, the forest plot in Figure 4.2 above demonstrates the summary effect of 25 effect sizes from 24 studies for the perceived usefulness and attitude towards behavior relationship. Each and every effect size are depicted as "trees" in the forest: The location of the rectangle refers to the magnitude of the effect size, the size of it refers to the weight assigned to it in the meta-analysis, and the horizontal width of it refers to its confidence interval. That is, as the rectangle gets bigger and the confidence interval gets tighter, the estimation of that primary study becomes more precise.

Two observations deserve to be mentioned in the plot provided in Figure 4.2. First, the sizes of the rectangles are very similar most probably because of the similar sample sizes of the studies as well as the weight-balancing approach of random-effects model even among studies with very different sample sizes. Second, one can see the inclusion of even the statistically insignificant studies into summary effect acquisition process; this is an approach that vote-counting method does not pursue.

Table 4.7 provides the summary statistics of the PU-ATT meta-analysis results below.

Table 4.7 Summary statistics of the PU-ATT meta-analysis results

# of Studies	= 25	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.415	0.379
	Lower limit	0.313	0.360
	Upper limit	0.506	0.398
Test of Null (2-Tail)	Z-value	7.398	35.136
	P-value	0.000	0.000
Heterogeneity	Q-value	621.292	
	df (Q)	24	
	P-value	0.000	
	I^2	96.137	
Tau-squared	T^2	0.083	
	Standard error	0.033	
	Variance	0.001	
	T	0.288	

In addition to what the plot depicts, Table 4.7 above ensures some valuable insight into the results of the random-effects meta-analytic model. Consistent with random-effects model's principle of between-studies dispersion which is explained in Section 3.4.2, the summary statistics provided by CMA software points to the existence of variance between true effects with the report of T^2. High Q value (in fact, a Q-df value which is bigger than zero) refers to lack of homogeneity among effects, and I^2 value gives the share of true-effects variance on total variance. These indicators are described in Section 4.1.4.

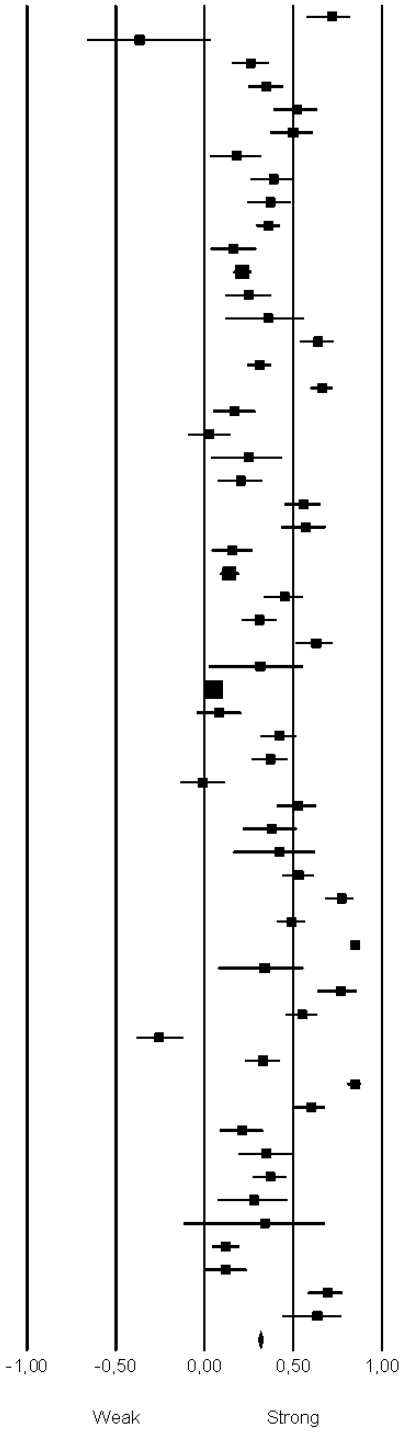
Since the "attitude towards use" construct was eliminated with TAM-r and the main successor, TAM2, several scholars adopted these variants in their studies and investigated the direct relationship between PU and BI.

Figure 4.3 as well as Table 4.8 depicts the results of PU-BI relationship meta-analysis.

Study name	Correlation	Lower limit	Upper limit	Z-Value	p-Value
SID0001 5553	0,720	0,572	0,823	6,912	0,000
SID0002 1443	-0,366	-0,665	0,034	-1,800	0,072
SID0004 1457	0,260	0,152	0,362	4,609	0,000
SID0006 1465	0,349	0,246	0,444	6,310	0,000
SID0007 1467	0,524	0,389	0,637	6,659	0,000
SID0008 1470	0,500	0,367	0,613	6,546	0,000
SID0009 1472	0,180	0,033	0,320	2,387	0,017
SID0010 1475	0,390	0,259	0,507	5,510	0,000
SID0012 1478	0,370	0,237	0,490	5,168	0,000
SID0013 1481	0,360	0,291	0,425	9,594	0,000
SID0014 1484	0,165	0,032	0,293	2,419	0,016
SID0017 1488	0,213	0,160	0,264	7,781	0,000
SID0019 1492	0,250	0,117	0,374	3,639	0,000
SID0023 1499	0,358	0,115	0,561	2,832	0,005
SID0024 1504	0,640	0,535	0,726	9,224	0,000
SID0025 1505	0,310	0,239	0,378	8,160	0,000
SID0026 1506	0,663	0,594	0,722	13,755	0,000
SID0027 1510	0,170	0,047	0,288	2,703	0,007
SID0029 1515	0,027	-0,094	0,147	0,438	0,661
SID0031 1517	0,249	0,039	0,438	2,317	0,020
SID0032 1521	0,205	0,075	0,328	3,063	0,002
SID0033 1524	0,560	0,448	0,655	8,227	0,000
SID0034 1536	0,570	0,431	0,683	6,791	0,000
SID0035 1540	0,157	0,039	0,271	2,596	0,009
SID0036 1546	0,140	0,085	0,194	4,984	0,000
SID0037 1547	0,451	0,333	0,555	6,824	0,000
SID0038 1557	0,310	0,209	0,404	5,814	0,000
SID0039 1559	0,630	0,514	0,723	8,388	0,000
SID0040 1567	0,314	0,023	0,556	2,106	0,035
SID0045 1625	0,051	0,009	0,092	2,401	0,016
SID0049 1761	0,082	-0,048	0,209	1,241	0,215
SID0050 1791	0,423	0,315	0,520	7,079	0,000
SID0053 1858	0,372	0,267	0,469	6,515	0,000
SID0056 1965	-0,011	-0,137	0,116	-0,169	0,866
SID0057a 1966 (CAN)	0,529	0,408	0,632	7,401	0,000
SID0057b 1966 (CHI)	0,379	0,215	0,522	4,333	0,000
SID0058 2030	0,420	0,160	0,625	3,069	0,002
SID0061 2057	0,531	0,437	0,614	9,381	0,000
SID0064 2122	0,772	0,678	0,841	10,098	0,000
SID0066 2128	0,490	0,405	0,567	9,884	0,000
SID0067 2129	0,850	0,822	0,874	26,199	0,000
SID0068 2130	0,339	0,076	0,558	2,496	0,013
SID0069 2133	0,770	0,634	0,860	7,358	0,000
SID0075 3469	0,550	0,453	0,634	9,337	0,000
SID0076 3472	-0,256	-0,386	-0,116	-3,542	0,000
SID0077 3473	0,330	0,227	0,426	6,007	0,000
SID0080 3479	0,847	0,803	0,882	17,569	0,000
SID0082 3483	0,600	0,505	0,681	9,900	0,000
SID0083 3489	0,210	0,083	0,331	3,205	0,001
SID0084 3492	0,350	0,188	0,494	4,086	0,000
SID0086a 3497 (VOL)	0,370	0,269	0,463	6,739	0,000
SID0086b 3497 (MAN)	0,280	0,071	0,465	2,605	0,009
SID0087 3501	0,340	-0,121	0,680	1,460	0,144
SID0088 3505	0,120	0,041	0,198	2,956	0,003
SID0089 3509	0,120	-0,003	0,239	1,914	0,056
SID0295a 3709 (MAL)	0,694	0,582	0,780	8,809	0,000
SID0295b 3709 (FEM)	0,636	0,439	0,774	5,260	0,000
	0,315	0,301	0,329	41,124	0,000

Statistics for each study

Correlation and 95% CI



PU-BI / Random-Effects

Figure 4.3 Random-effects meta-analysis of PU-BI relationship in TAM

Table 4.8 Summary statistics of the PU-BI meta-analysis results

# of Studies	= 57	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.397	0.315
	Lower limit	0.327	0.301
	Upper limit	0.462	0.329
Test of Null (2-Tail)	Z-value	10.319	41.124
	P-value	0.000	0.000
Heterogeneity	Q-value	1372.941	
	df (Q)	56	
	P-value	0.000	
	I^2	95.921	
Tau-squared	T^2	0.087	
	Standard error	0.026	
	Variance	0.001	
	T	0.294	

Despite its relatively lower effect on BI (when compared to PU-ATT relationship), the PU-BI meta-analysis ensures the summary effect of 0.397 with higher precision thanks to its larger pool of effects. On the other hand, again, the dispersion is quite higher than expected.

4.1.3.2. The Predictive Ability of Perceived Ease of Use on ATT and BI

Following the perceived usefulness analysis, perceived of use's explanatory power is examined in Figure 4.4, Table 4.9, Figure 4.5, and Table 4.10, respectively by meta-analyzing its connection to both ATT and BI.

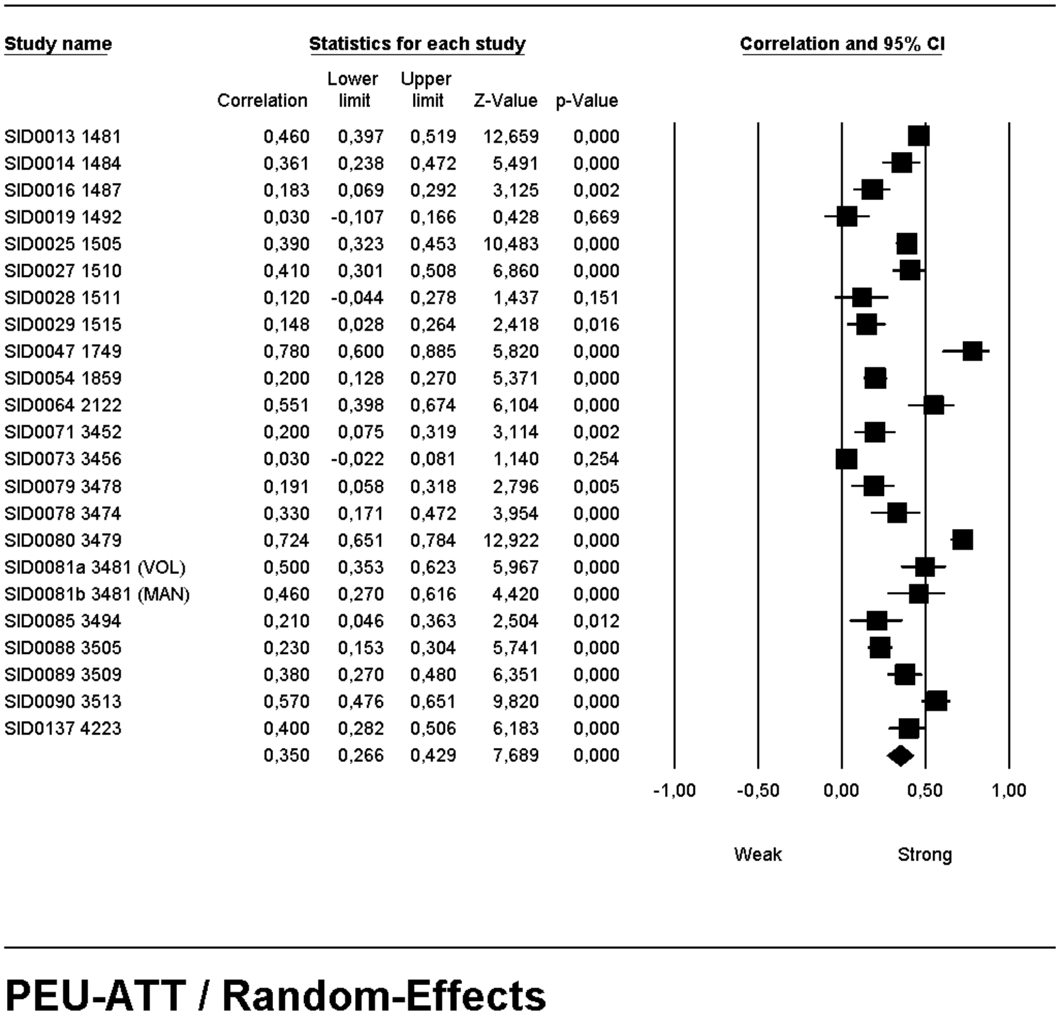


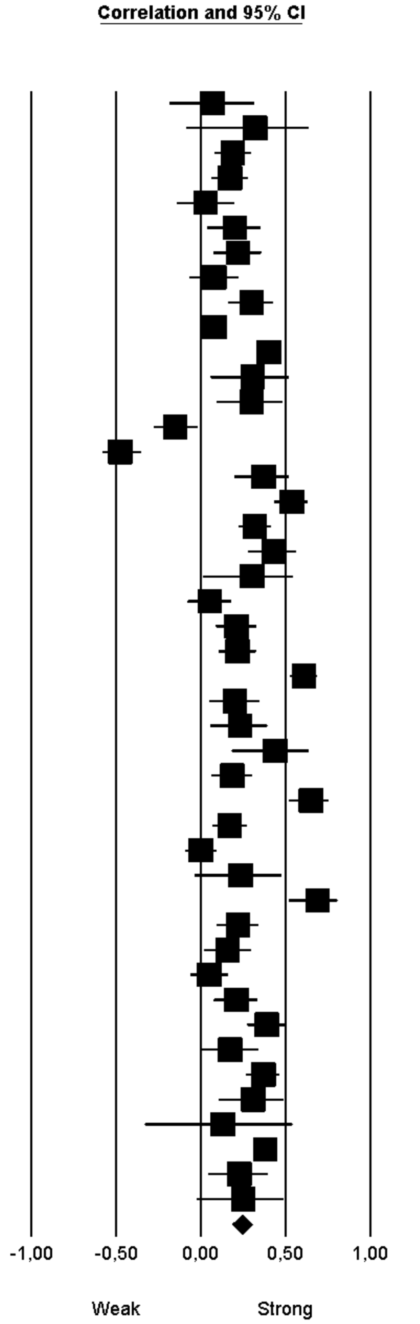
Figure 4.4 Random-effects meta-analysis of PEU-ATT relationship in TAM

Table 4.9 Summary statistics of the PEU-ATT meta-analysis results

# of Studies	= 23	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.350	0.279
	Lower limit	0.266	0.258
	Upper limit	0.429	0.300
Test of Null (2-Tail)	Z-value	7.689	24.536
	P-value	0.000	0.000
Heterogeneity	Q-value	333.996	
	df (Q)	22	
	P-value	0.000	
	I2	93.413	

	Table 4.9 (cont.)		
Tau-squared	**T^2**	0.046	
	Standard error	0.019	
	Variance	0.000	
	T	0.215	

Study name	Correlation	Lower limit	Upper limit	Z-Value	p-Value
SID0001 5553	0,070	-0,185	0,316	0,534	0,593
SID0002 1443	0,321	-0,085	0,636	1,561	0,119
SID0004 1457	0,190	0,079	0,296	3,331	0,001
SID0006 1465	0,172	0,060	0,279	3,009	0,003
SID0007 1467	0,030	-0,140	0,199	0,343	0,731
SID0008 1470	0,200	0,038	0,352	2,416	0,016
SID0009 1472	0,220	0,074	0,357	2,933	0,003
SID0010 1475	0,080	-0,066	0,223	1,073	0,283
SID0012 1478	0,300	0,161	0,428	4,118	0,000
SID0013 1481	0,080	0,003	0,156	2,041	0,041
SID0017 1488	0,403	0,356	0,448	15,368	0,000
SID0023 1499	0,307	0,057	0,520	2,393	0,017
SID0031 1517	0,300	0,094	0,481	2,820	0,005
SID0032 1521	-0,152	-0,279	-0,020	-2,257	0,024
SID0033 1524	-0,475	-0,583	-0,350	-6,715	0,000
SID0034 1536	0,370	0,199	0,519	4,074	0,000
SID0037 1547	0,538	0,431	0,629	8,431	0,000
SID0038 1557	0,320	0,220	0,413	6,016	0,000
SID0039 1559	0,430	0,279	0,560	5,203	0,000
SID0040 1567	0,302	0,009	0,547	2,020	0,043
SID0049 1761	0,052	-0,078	0,180	0,786	0,432
SID0050 1791	0,211	0,089	0,327	3,360	0,001
SID0053 1858	0,217	0,103	0,326	3,677	0,000
SID0056 1965	0,610	0,524	0,684	10,914	0,000
SID0057a 1966 (CAN)	0,202	0,049	0,346	2,575	0,010
SID0057b 1966 (CHI)	0,231	0,055	0,393	2,555	0,011
SID0058 2030	0,438	0,182	0,639	3,220	0,001
SID0061 2057	0,186	0,064	0,302	2,973	0,003
SID0064 2122	0,651	0,521	0,751	7,653	0,000
SID0066 2128	0,170	0,065	0,271	3,165	0,002
SID0067 2129	0,000	-0,094	0,094	0,000	1,000
SID0068 2130	0,236	-0,037	0,476	1,701	0,089
SID0069 2133	0,690	0,520	0,807	6,115	0,000
SID0075 3469	0,220	0,094	0,339	3,377	0,001
SID0076 3472	0,159	0,015	0,296	2,169	0,030
SID0077 3473	0,050	-0,062	0,161	0,877	0,381
SID0082 3483	0,210	0,076	0,337	3,045	0,002
SID0083 3489	0,390	0,274	0,495	6,191	0,000
SID0084 3492	0,174	0,000	0,337	1,965	0,049
SID0086a 3497 (VOL)	0,370	0,269	0,463	6,739	0,000
SID0086b 3497 (MAN)	0,310	0,104	0,491	2,903	0,004
SID0087 3501	0,130	-0,332	0,541	0,539	0,590
SID0088 3505	0,380	0,310	0,446	9,808	0,000
SID0295a 3709 (MAL)	0,228	0,042	0,399	2,389	0,017
SID0295b 3709 (FEM)	0,251	-0,024	0,490	1,795	0,073
	0,245	0,183	0,304	7,554	0,000



PEU-BI / Random-Effects

Figure 4.5 Random-effects meta-analysis of PEU-BI relationship in TAM

Table 4.10 Summary statistics of the PEU-BI meta-analysis results

# of Studies	= 45	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.245	0.244
	Lower limit	0.183	0.225
	Upper limit	0.304	0.263
Test of Null (2-Tail)	Z-value	7.554	24.565
	P-value	0.000	0.000
Heterogeneity	Q-value	424.693	
	df (Q)	44	
	P-value	0.000	
	I^2	89.640	
Tau-squared	T^2	0.041	
	Standard error	0.013	
	Variance	0.000	
	T	0.202	

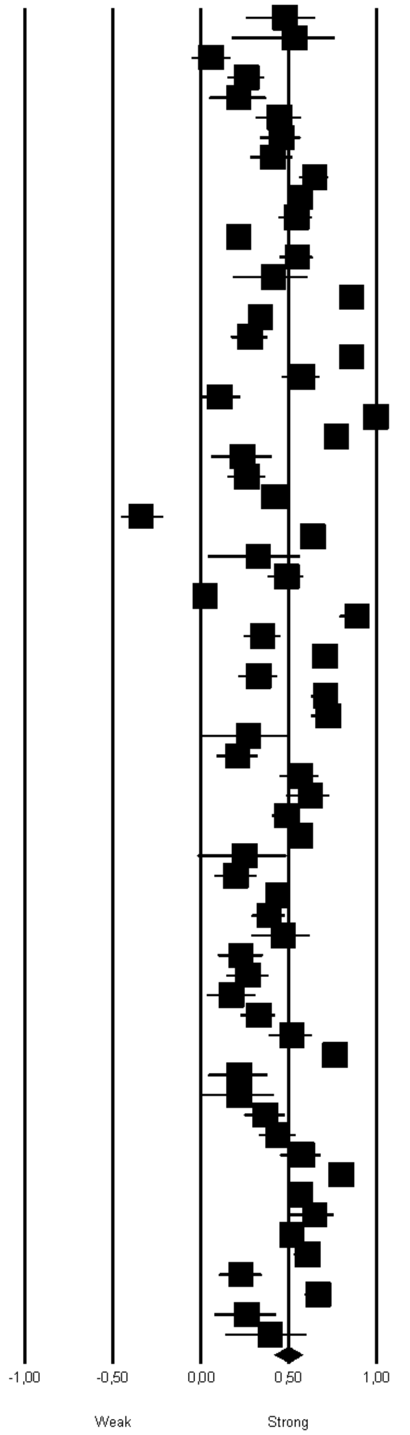
According to the statistics provided in Table 4.10 PEU-BI has remarkably high variance, too. However, this time the relationship gets a relatively lower I^2 value, i.e. 89.64 percent, probably due to the existence of studies which have quite low precision, hence, some bigger within-study sampling error in total for the PEU-BI effects sizes pool.

4.1.3.3. Perceived Ease of Use and Perceived Usefulness Relationship

Without the consideration of BI, the most important possible impact in core TAM model is the effect of PEU not on BI but on PU. In one sense, PEU has both direct and indirect effects on BI thanks to its dual connection. Figure 4.6 provides the summary effect while Table 4.11 gives the descriptive statistics for such summary.

Study name	Statistics for each study				
	Correlation	Lower limit	Upper limit	Z-Value	p-Value
SID0001 5553	0,480	0,260	0,653	3,983	0,000
SID0002 1443	0,533	0,175	0,767	2,788	0,005
SID0004 1457	0,060	-0,053	0,172	1,040	0,298
SID0006 1465	0,261	0,153	0,363	4,628	0,000
SID0007 1467	0,216	0,048	0,372	2,512	0,012
SID0008 1470	0,450	0,310	0,571	5,776	0,000
SID0009 1472	0,460	0,334	0,569	6,522	0,000
SID0010 1475	0,410	0,281	0,524	5,828	0,000
SID0012 1478	0,650	0,557	0,727	10,315	0,000
SID0013 1481	0,570	0,516	0,620	16,483	0,000
SID0014 1484	0,546	0,444	0,634	8,899	0,000
SID0017 1488	0,216	0,163	0,267	7,894	0,000
SID0019 1492	0,550	0,447	0,639	8,811	0,000
SID0023 1499	0,416	0,181	0,606	3,340	0,001
SID0024 1504	0,860	0,812	0,897	15,734	0,000
SID0025 1505	0,340	0,270	0,406	9,014	0,000
SID0026 1506	0,280	0,172	0,381	4,958	0,000
SID0027 1510	0,860	0,824	0,889	20,368	0,000
SID0028 1511	0,580	0,461	0,679	7,894	0,000
SID0029 1515	0,109	-0,011	0,226	1,775	0,076
SID0032 1521	0,998	0,997	0,998	50,871	0,000
SID0033 1524	0,773	0,705	0,827	13,361	0,000
SID0034 1536	0,240	0,058	0,407	2,567	0,010
SID0035 1540	0,263	0,149	0,370	4,417	0,000
SID0036 1546	0,418	0,371	0,463	15,749	0,000
SID0037 1547	-0,340	-0,457	-0,211	-4,967	0,000
SID0038 1557	0,640	0,572	0,699	13,752	0,000
SID0040 1567	0,328	0,038	0,567	2,207	0,027
SID0042 1606	0,490	0,380	0,586	7,750	0,000
SID0045 1625	0,025	-0,017	0,067	1,176	0,240
SID0047 1749	0,890	0,789	0,944	7,917	0,000
SID0053 1858	0,353	0,246	0,451	6,150	0,000
SID0054 1859	0,710	0,671	0,745	23,506	0,000
SID0056 1965	0,330	0,212	0,438	5,278	0,000
SID0057a 1966 (CAN)	0,712	0,626	0,781	11,203	0,000
SID0057b 1966 (CHI)	0,725	0,628	0,800	9,973	0,000
SID0058 2030	0,272	-0,007	0,512	1,913	0,056
SID0061 2057	0,210	0,089	0,325	3,379	0,001
SID0062 2063	0,570	0,450	0,670	7,770	0,000
SID0064 2122	0,624	0,487	0,731	7,205	0,000
SID0066 2128	0,490	0,405	0,567	9,884	0,000
SID0067 2129	0,570	0,503	0,630	13,505	0,000
SID0068 2130	0,252	-0,020	0,489	1,821	0,069
SID0071 3452	0,200	0,075	0,319	3,114	0,002
SID0073 3456	0,440	0,397	0,481	17,945	0,000
SID0074a 3459 (VOL)	0,390	0,290	0,482	7,121	0,000
SID0074b 3459 (MAN)	0,470	0,285	0,621	4,619	0,000
SID0079 3478	0,230	0,098	0,354	3,386	0,001
SID0075 3469	0,270	0,146	0,386	4,181	0,000
SID0076 3472	0,175	0,032	0,311	2,392	0,017
SID0077 3473	0,330	0,227	0,426	6,007	0,000
SID0078 3474	0,520	0,385	0,633	6,647	0,000
SID0080 3479	0,765	0,701	0,817	14,222	0,000
SID0081a 3481 (VOL)	0,220	0,043	0,383	2,430	0,015
SID0081b 3481 (MAN)	0,220	0,003	0,417	1,988	0,047
SID0082 3483	0,370	0,246	0,482	5,548	0,000
SID0083 3489	0,440	0,329	0,539	7,099	0,000
SID0084 3492	0,579	0,451	0,684	7,390	0,000
SID0085 3494	0,800	0,731	0,853	12,906	0,000
SID0086a 3497 (VOL)	0,570	0,489	0,641	11,234	0,000
SID0086b 3497 (MAN)	0,650	0,507	0,758	7,021	0,000
SID0088 3505	0,520	0,459	0,576	14,129	0,000
SID0089 3509	0,610	0,527	0,682	11,254	0,000
SID0090 3513	0,230	0,105	0,348	3,552	0,000
SID0137 4223	0,670	0,589	0,738	11,832	0,000
SID0295a 3709 (MAL)	0,262	0,078	0,429	2,762	0,006
SID0295b 3709 (FEM)	0,395	0,137	0,603	2,924	0,003
	0,502	0,418	0,577	10,153	0,000

Correlation and 95% CI



PEU-PU / Random-Effects

Figure 4.6 Random-effects meta-analysis of PEU-PU relationship in TAM

Table 4.11 Summary statistics of the PEU-PU meta-analysis results

# of Studies	= 67	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.502	0.437
	Lower limit	0.418	0.425
	Upper limit	0.577	0.448
Test of Null (2-Tail)	Z-value	10.153	65.514
	P-value	0.000	0.000
Heterogeneity	Q-value	3653.262	
	df (Q)	66	
	P-value	0.000	
	I^2	98.193	
Tau-squared	T^2	0.190	
	Standard error	0.052	
	Variance	0.003	
	T	0.436	

4.1.3.4. The Influence of BI on Actual Use

As a relatively less investigated construct relationship, the effect of behavioral intention to use on actual use of technology is compiled through the empirical findings of 10 primary studies, and this synthesis is depicted in Figure 4.7 and Table 4.12.

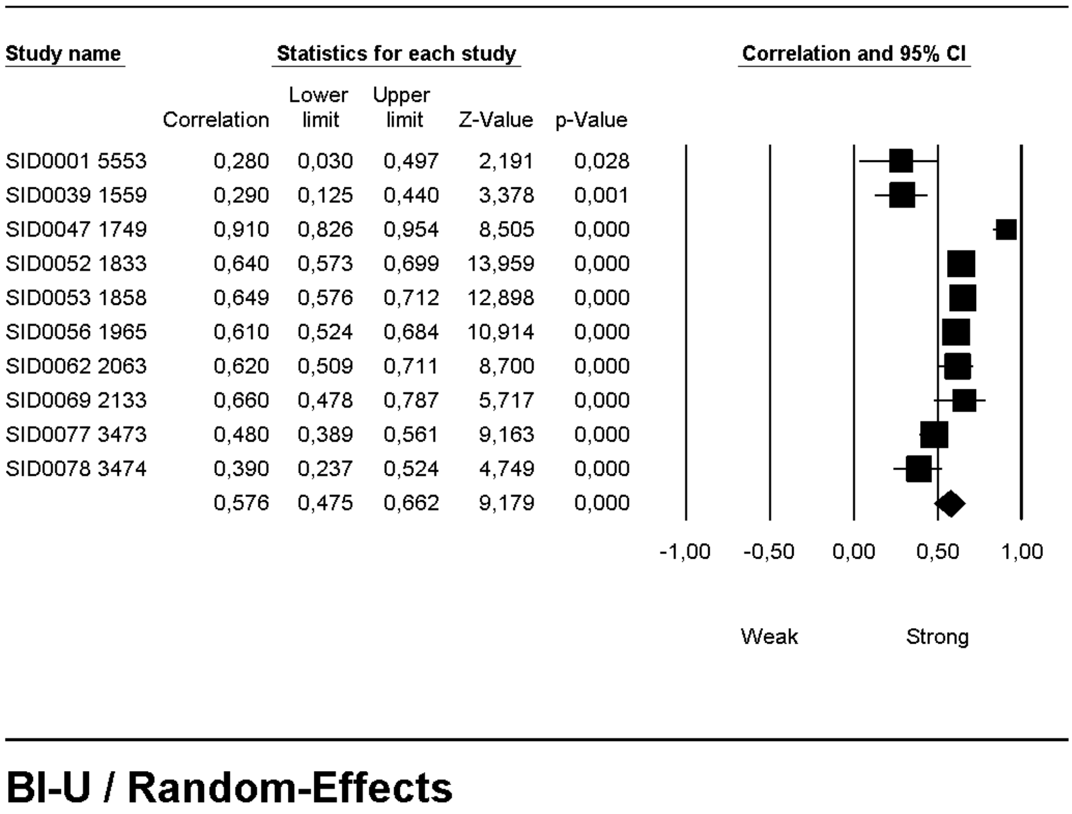


Figure 4.7 Random-effects meta-analysis of BI-U relationship in TAM

Table 4.12 Summary statistics of the BI-U meta-analysis results

# of Studies	= 10	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.576	0.569
	Lower limit	0.475	0.536
	Upper limit	0.662	0.600
Test of Null (2-Tail)	Z-value	9.179	26.704
	P-value	0.000	0.000

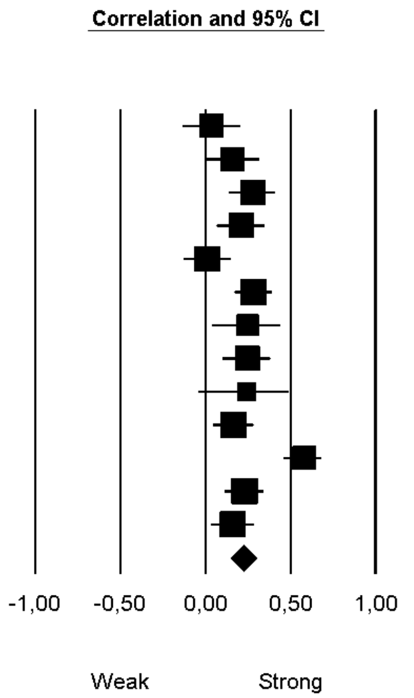
	Table 4.12 (cont.)		
Heterogeneity	**Q-value**	70.676	
	df (Q)	9	
	P-value	0.000	
	I^2	87.266	
Tau-squared	**T^2**	0.042	
	Standard error	0.026	
	Variance	0.001	
	T	0.205	

As can be seen in Table 4.12 above, and with the inclusion of quite few effect sizes (i.e. 10), the BI-U relationship could attain a very high summary effect at 0.576, and a relatively lower true-effects variation ratio (i.e. I^2 = 87.27 percent) was observed, as well.

4.1.3.5. Effects of the Subsequent TAM Construct: Subjective Norm

In spite of the fact that few primary studies provided effect sizes for the influences of SN on BI and PU, and the synthesis of these might lead to relatively weaker deductions, the study still attempts to meta-analyze the combined effects of the subjective norm. The results are provided in Figure 4.8, Table 4.13, Figure 4.9, and Table 4.14, respectively.

Study name	Correlation	Lower limit	Upper limit	Z-Value	p-Value
SID0007 1467	0,035	-0,135	0,203	0,401	0,689
SID0008 1470	0,160	-0,003	0,315	1,923	0,054
SID0009 1472	0,280	0,137	0,411	3,773	0,000
SID0012 1478	0,210	0,066	0,346	2,836	0,005
SID0022 1498	0,010	-0,127	0,147	0,142	0,887
SID0029 1515	0,285	0,171	0,392	4,754	0,000
SID0031 1517	0,248	0,038	0,437	2,307	0,021
SID0033 1524	0,246	0,100	0,382	3,265	0,001
SID0058 2030	0,240	-0,041	0,486	1,678	0,093
SID0061 2057	0,166	0,044	0,283	2,650	0,008
SID0078 3474	0,580	0,456	0,682	7,640	0,000
SID0089 3509	0,230	0,110	0,343	3,718	0,000
SID0090 3513	0,160	0,032	0,283	2,448	0,014
	0,222	0,144	0,297	5,473	0,000



SN-BI / Random-Effects

Figure 4.8 Random-effects meta-analysis of SN-BI relationship in TAM

Table 4.13 Summary statistics of the SN-BI meta-analysis results

# of Studies	= 13	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.222	0.216
	Lower limit	0.144	0.177
	Upper limit	0.297	0.255
Test of Null (2-Tail)	Z-value	5.473	10.429
	P-value	0.000	0.000
Heterogeneity	Q-value	43.987	
	df (Q)	12	
	P-value	0.000	
	I^2	72.719	
Tau-squared	T^2	0.016	
	Standard error	0.009	

	Table 4.13 (cont.)		
	Variance	0.000	
	T	0.125	

According to Figure 4.8 and Table 4.13 above, SN-BI relationship presented remarkably low summary effect; on the other hand, the low effect is accompanied with relatively lower share of between-studies dispersion on the total dispersion (i.e. $I^2 = 72.72$ percent).

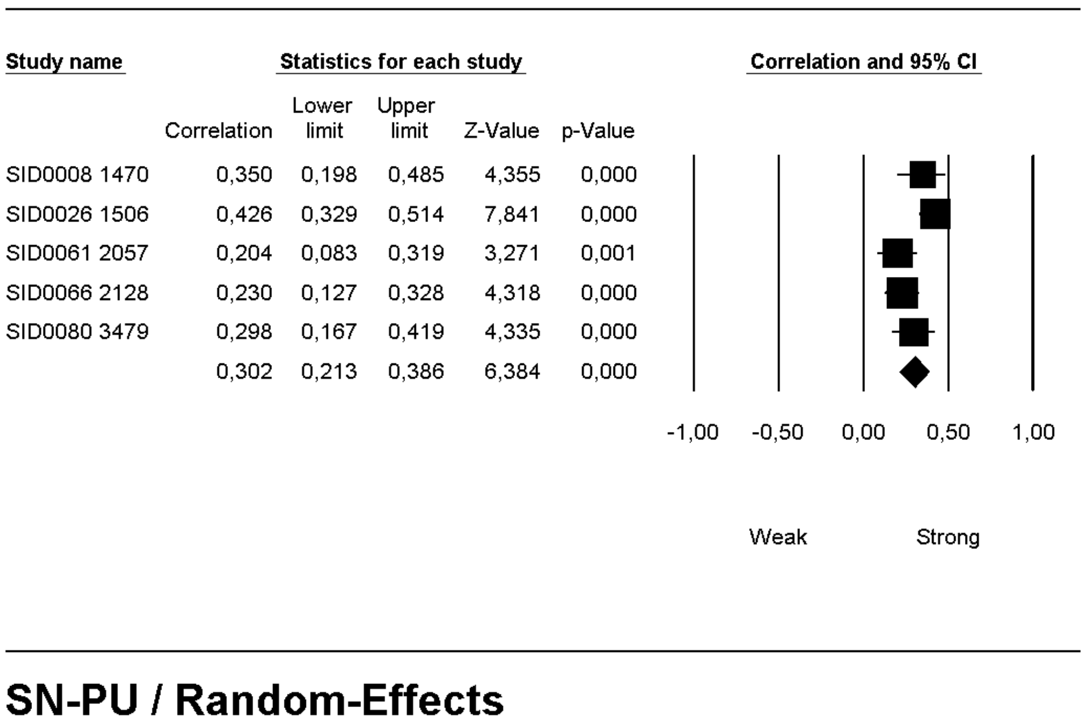


Figure 4.9 Random-effects meta-analysis of SN-PU relationship in TAM

Table 4.14 Summary statistics of the SN-PU meta-analysis results

# of Studies	**= 5**	**Random-Effects**	**Fixed-Effect**
Effect Size and 95% Interval	**Point estimate**	0.302	0.299
	Lower limit	0.213	0.248
	Upper limit	0.386	0.349
Test of Null (2-Tail)	**Z-value**	6.384	10.829
	P-value	0.000	0.000

	Table 4.14 (cont.)		
Heterogeneity	**Q-value**	11.324	
	df (Q)	4	
	P-value	0.023	
	I^2	64.678	
Tau-squared	**T^2**	0.008	
	Standard error	0.008	
	Variance	0.000	
	T	0.087	

As the smallest-sized meta-analysis, and interestingly, the SN-PU relationship achieved the lowest total dispersion (i.e. Q = 11.324 with p-value far from zero) as well as the lowest variance between the true effects (i.e. I^2 = 64.68 percent).

4.1.3.6. UTAUT's Explanatory Constructs for BI and U

By providing Figure 4.10, Table 4.15, Figure 4.11, Table 4.16, Figure 4.12, Table 4.17, Figure 4.13, and Table 4.18 below, and regarding the behavioral intention to use as well as the use behavior for FC, this section demonstrates the predicting power of the UTAUT model's PE, EE, SI, and FC constructs.

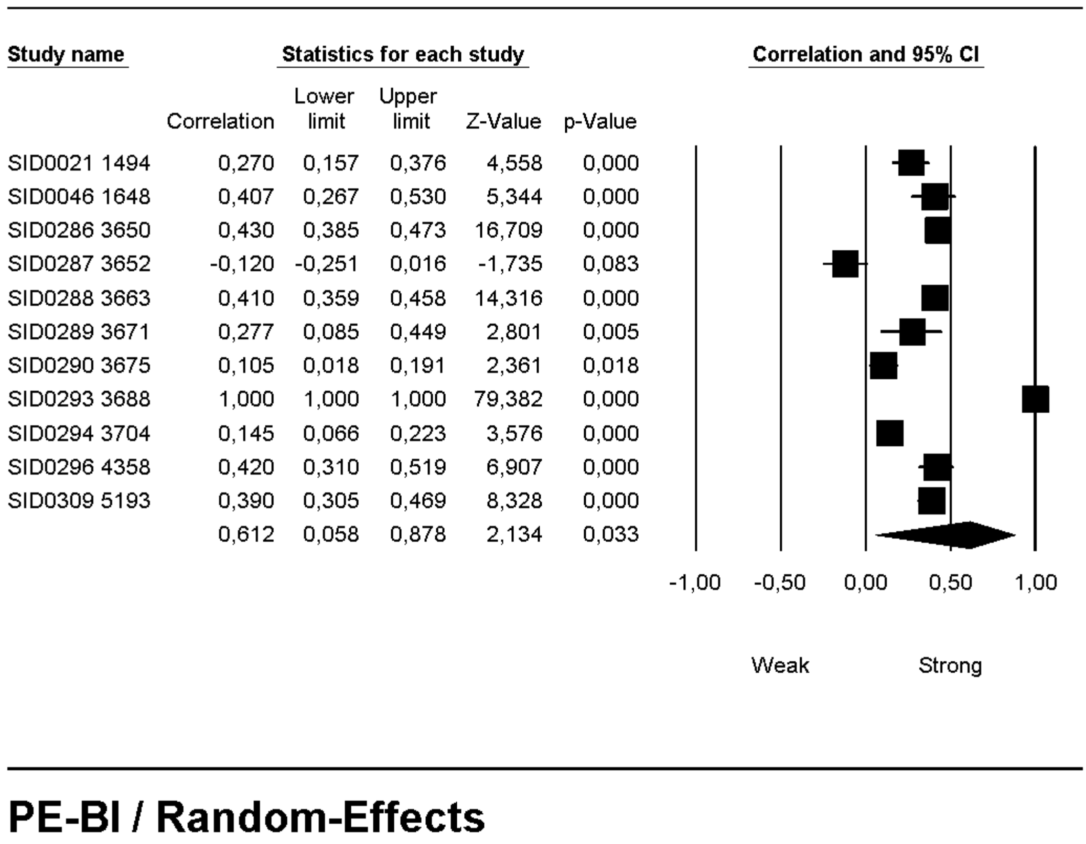


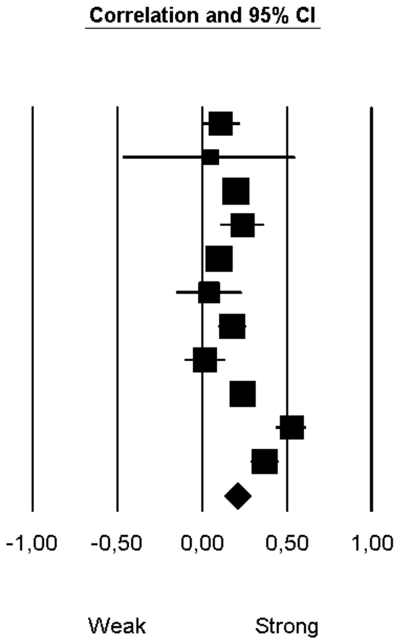
Figure 4.10 Random-effects meta-analysis of PE-BI relationship in the UTAUT model

Table 4.15 Summary statistics of the PE-BI meta-analysis results

# of Studies	= 11	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.612	0.513
	Lower limit	0.058	0.493
	Upper limit	0.878	0.533
Test of Null (2-Tail)	Z-value	2.134	40.613
	P-value	0.000	0.000
Heterogeneity	Q-value	5331.867	
	df (Q)	10	
	P-value	0.033	
	I^2	99.812	
Tau-squared	T^2	1.221	
	Standard error	0.684	
	Variance	0.468	
	T	1.105	

The most noteworthy observation on the PE-BI meta-analysis is that, under random-effects model, the summary effect result gives a dramatically wide confidence interval (i.e. lower-upper limits are at 0.058-0.878). Indeed, the very wide horizon of the diamond which represents the summary effect in Figure 4.10, and the p-value which uncharacteristically approximates to 0.05 are the complementary indicators of low significance. This result arises probably from the outlier coefficients, e.g. SID0293 which converges to 1.

Study name	Statistics for each study				
	Correlation	Lower limit	Upper limit	Z-Value	p-Value
SID0021 1494	0,110	-0,009	0,226	1,818	0,069
SID0046 1648	0,053	-0,472	0,550	0,184	0,854
SID0286 3650	0,200	0,148	0,251	7,366	0,000
SID0287 3652	0,240	0,108	0,364	3,522	0,000
SID0288 3663	0,100	0,041	0,159	3,297	0,001
SID0289 3671	0,041	-0,157	0,236	0,404	0,686
SID0290 3675	0,179	0,093	0,262	4,054	0,000
SID0293 3688	0,017	-0,105	0,138	0,273	0,785
SID0294 3704	0,238	0,161	0,312	5,924	0,000
SID0296 4358	0,530	0,433	0,615	9,104	0,000
SID0309 5193	0,369	0,282	0,450	7,832	0,000
	0,208	0,126	0,287	4,894	0,000



EE-BI / Random-Effects

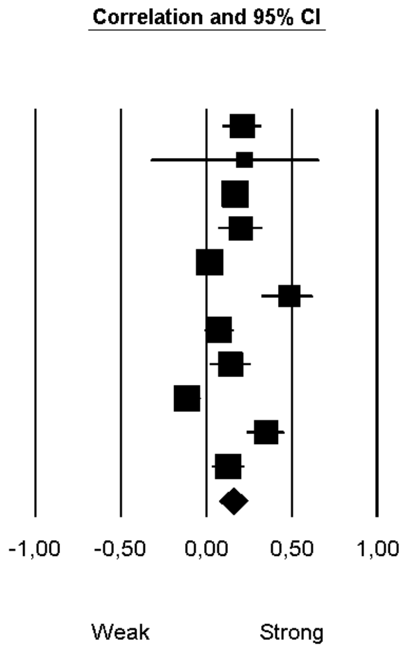
Figure 4.11 Random-effects meta-analysis of EE-BI relationship in the UTAUT model

Table 4.16 Summary statistics of the EE-BI meta-analysis results

# of Studies	= 11	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	**Point estimate**	0.208	0.198
	Lower limit	0.126	0.171
	Upper limit	0.287	0.224

	Table 4.16 (cont.)		
Test of Null (2-Tail)	**Z-value**	4.894	14.156
	P-value	0.000	0.000
Heterogeneity	**Q-value**	76.469	
	df (Q)	10	
	P-value	0.000	
	I^2	86.923	
Tau-squared	**T^2**	0.016	
	Standard error	0.010	
	Variance	0.000	
	T	0.126	

Study name	Correlation	Lower limit	Upper limit	Z-Value	p-Value
	Statistics for each study				
SID0021 1494	0,210	0,094	0,321	3,509	0,000
SID0046 1648	0,224	-0,326	0,660	0,789	0,430
SID0286 3650	0,170	0,117	0,222	6,237	0,000
SID0287 3652	0,200	0,066	0,327	2,917	0,004
SID0288 3663	0,020	-0,040	0,079	0,657	0,511
SID0289 3671	0,486	0,320	0,623	5,228	0,000
SID0290 3675	0,074	-0,013	0,160	1,661	0,097
SID0293 3688	0,141	0,020	0,258	2,276	0,023
SID0294 3704	-0,112	-0,190	-0,032	-2,748	0,006
SID0296 4358	0,350	0,234	0,456	5,638	0,000
SID0309 5193	0,128	0,032	0,222	2,603	0,009
	0,158	0,072	0,242	3,577	0,000



SI-BI / Random-Effects

Figure 4.12 Random-effects meta-analysis of SI-BI relationship in the UTAUT model

Table 4.17 Summary statistics of the SI-BI meta-analysis results

# of Studies	= 11	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.158	0.109
	Lower limit	0.072	0.082
	Upper limit	0.242	0.137
Test of Null (2-Tail)	Z-value	3.577	7.762
	P-value	0.000	0.000
Heterogeneity	Q-value	81.904	
	df (Q)	10	
	P-value	0.000	
	I^2	87.791	
Tau-squared	T^2	0.017	
	Standard error	0.011	
	Variance	0.000	
	T	0.131	

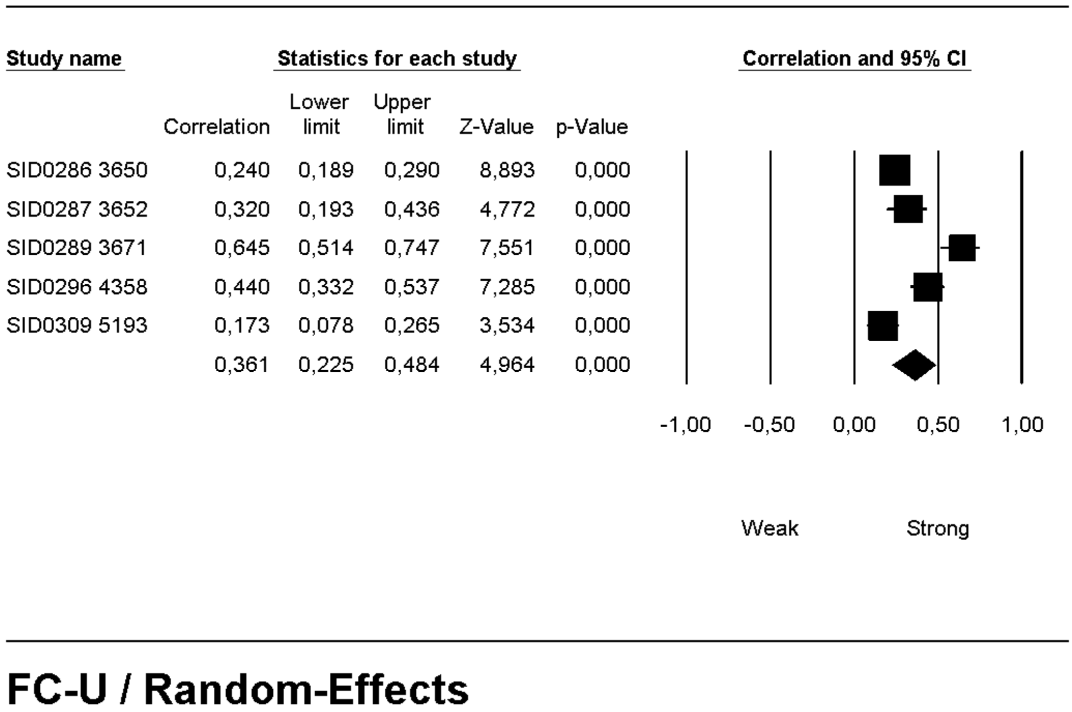


Figure 4.13 Random-effects meta-analysis of FC-U relationship in the UTAUT model

Table 4.18 Summary statistics of the FC-U meta-analysis results

# of Studies	= 5	Random-Effects	Fixed-Effect
Effect Size and 95% Interval	Point estimate	0.361	0.109
	Lower limit	0.225	0.082
	Upper limit	0.484	0.137
Test of Null (2-Tail)	Z-value	4.964	7.762
	P-value	0.000	0.000
Heterogeneity	Q-value	38.443	
	df (Q)	4	
	P-value	0.000	
	I^2	89.584	
Tau-squared	T^2	0.025	
	Standard error	0.023	
	Variance	0.001	
	T	0.158	

As can be seen from Table 4.18 above, the meta-analysis of the construct relationships which constitute the UTAUT model, and particularly FC-U relationship with five effect sized combined, lack reaching the quantities of effect sizes that TAM-related study set provided. Under any circumstances, a persistent approach is pursued during this study by conducting each and every verifiable meta-analysis. The motivation was the emphasis of Borenstein et al. [3] on that one can employ a meta-analysis as soon as she obtains "two" studies since even two studies provide effect estimates with higher precision.

CHAPTER 5

RESULTS AND DISCUSSION

This chapter provides an overall look at the results of the meta-analyses conducted. Besides, the investigations on moderator analysis and publication bias are made under Section 5.1.2 and 5.1.3, respectively.

5.1. A Collective Look at the Meta-Analysis Results

Table 5.2 in Section 5.1.2 constitutes a concise source to get the essence of the 12 meta-analyses within the study, and Table 5.1 presents a trimmed version (without Q-values) of it below.

Not surprisingly, the relationships among the core TAM constructs, i.e. PU, PEU, and BI, achieved the highest point estimate values. However, the effects of PU and PEU on attitude toward use seemed more explanatory in comparison to PU-BI and PEU-BI relationships. This may arise the question of whether TAM-r and successor variants of TAM suffer from the absence of the mediator effect of ATT for a better explanatory power.

Table 5.1 Summary of the point estimate findings

Construct Relationship	Point Estimate	k	I^2
PU-ATT	0.415	25	96.137
PU-BI	0.397	57	95.291
PEU-ATT	0.350	23	93.413

Table 5.1 (cont.)			
PEU-BI	0.245	45	89.640
PEU-PU	0.502	67	98.193
BI-U	0.576	10	87.266
SN-BI	0.222	13	72.719
SN-PU	0.302	5	64.678
PE-BI (UTAUT)	0.612	11	99.812
EE-BI (UTAUT)	0.208	11	86.923
SI-BI (UTAUT)	0.158	11	87.791
FC-U (UTAUT)	0.361	5	89.584

Among the examined construct relationships of the UTAUT model, performance expectancy shows a notably higher point estimate. Nevertheless, because of the low sample sizes, hence, low precision, one should not categorically approve the superiority of any of these UTAUT constructs.

5.1.1. Examination of the Heterogeneity

This section attempts to offer some instructions to look better at the heterogeneity observed in the meta-analyses which are conducted and reported under Section 4.1.3.

5.1.1.1. The Indicators of the Variation

As described in brief under Section 3.4.2, random-effects model presupposes that there already exist some high or low variation between the true effects of the selected primary studies of the domain. This variance is denoted tau-squared or T^2, and is one of two components of the "total variance" in random-effects meta-analysis. The second component is the within-studies variation due to the very nature of the studies. The descriptive tables (from Table 4.7 to Table 4.18) of the meta-analyses conducted in Section 4.1.3 address to a critical information which can clarify the distinction between these two components: I^2 in percentage terms, rather than an unstandardized unit, T^2, describes how much of the total variance belongs to T^2.

Second, one other critical statistic that these tables presented is the Q-value. Q aims to distinguish the excess dispersion from the total dispersion, that is, from itself. Borenstein et al. [3] demonstrates Q as below.

$$Q = \sum_{1}^{k} W_i (Y_i - M)^2 \quad \textit{(Equation 5.1)}$$

In Equation 5.1, k refers to the number of studies, W_i represents the study weight (see Equation 3.2), Y_i represents the effect size of the study, and M refers to the summary effect. The fact is that one can compute the I^2 ratio of the study by using the Q and k values directly as follows:

$$I^2 = (Q^2 - df)/Q \quad \textit{(Equation 5.2)}$$

Degrees of freedom, i.e. df, is simply k minus 1. Thus, by elucidating the connections between each statistic, it is clearer to construe the heterogeneity findings that Section 4.1.3 tables provided.

5.1.1.2. The Supportive Finding for the Meta-Analytic Model

From the specific perspective of heterogeneity, it can be inferred that the effect sizes which are derived from the TAM and UTAUT model studies dispersed insomuch that it could not be explained solely by the within-study sampling errors. For instance, for the meta-analysis on PEU-PU relationship, Table 4.11 gives the Q-value of 3653.26, and the I^2 is given as 98.19 percent. Such a high Q-value (which is much larger than df) points out a heterogeneity between the true effect sizes of the studies. What is more, an I^2 at 98.19 percent refers to that almost whole part of the total variance belongs to T^2, i.e., the true variance between-studies.

Therefore, such significant heterogeneity findings validate the choice made in the preliminary phase of the study, that is, "random-effects" model.

5.1.2. Moderator Analysis

As a first step, Table 5.2 presents a summary of the findings of meta-analyses that are presented in Section 4.1.3.

Table 5.2 Summary of the findings of Section 4.1.3

Construct Relationship	Point Estimate	Q-Value	k	I^2
PU-ATT	0.415	621.292	25	96.137
PU-BI	0.397	1372.941	57	95.291
PEU-ATT	0.350	333.996	23	93.413
PEU-BI	0.245	424.693	45	89.640
PEU-PU	0.502	3653.262	67	98.193
BI-U	0.576	70.676	10	87.266
SN-BI	0.222	43.987	13	72.719
SN-PU	0.302	11.324	5	64.678
PE-BI	0.612	5331.867	11	99.812
EE-BI	0.208	76.469	11	86.923
SI-BI	0.158	81.904	11	87.791
FC-U	0.361	38.443	5	89.584

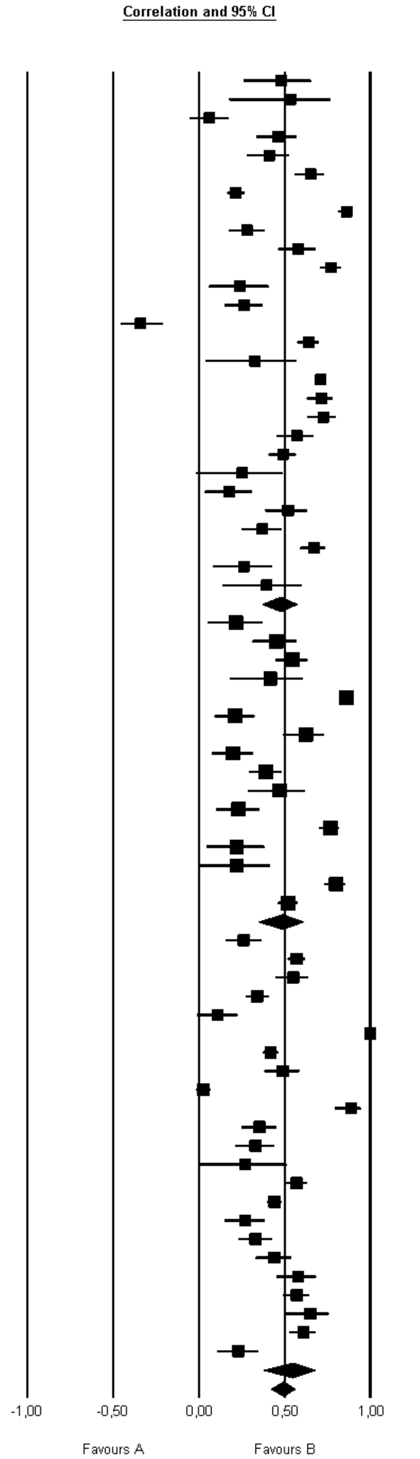
Because the study clearly puts forward the high variation among effects until this point, some further examination can be made in order to discover some possible moderating effects with regard to such remarkable dispersion of the effects.

5.1.2.1. Moderating Effect of the Sample Demographics

In order to conduct a more effective moderating effect discovery, it makes sense to prioritize the meta-analysis based on their number of studies. This is because the larger the study effects pool is, the more diverse types of moderators and bigger moderator sets one can find. Therefore, and because each and every construct relationship shows heterogeneity in the study, the meta-analyses with the highest number of studies, i.e. PEU-PU, PU-BI, and PEU-BI, were selected for moderator analysis.

Figure 5.1 and Table 5.3 below demonstrate the results of the meta-analysis which is conducted by grouping the studies by each of their survey participants' occupation.

Group by Occupation	Study name	Correlation	Lower limit	Upper limit	Z-Value	p-Value
1-Student	SID0001 5553	0,480	0,260	0,653	3,983	0,000
1-Student	SID0002 1443	0,533	0,175	0,767	2,788	0,005
1-Student	SID0004 1457	0,060	-0,053	0,172	1,040	0,298
1-Student	SID0009 1472	0,460	0,334	0,569	6,522	0,000
1-Student	SID0010 1475	0,410	0,281	0,524	5,828	0,000
1-Student	SID0012 1478	0,650	0,557	0,727	10,315	0,000
1-Student	SID0017 1488	0,216	0,163	0,267	7,894	0,000
1-Student	SID0024 1504	0,860	0,812	0,897	15,734	0,000
1-Student	SID0026 1506	0,280	0,172	0,381	4,958	0,000
1-Student	SID0028 1511	0,580	0,461	0,679	7,894	0,000
1-Student	SID0033 1524	0,773	0,705	0,827	13,361	0,000
1-Student	SID0034 1536	0,240	0,058	0,407	2,567	0,010
1-Student	SID0035 1540	0,263	0,149	0,370	4,417	0,000
1-Student	SID0037 1547	-0,340	-0,457	-0,211	-4,967	0,000
1-Student	SID0038 1557	0,640	0,572	0,699	13,752	0,000
1-Student	SID0040 1567	0,328	0,038	0,567	2,207	0,027
1-Student	SID0054 1859	0,710	0,671	0,745	23,506	0,000
1-Student	SID0057a 1966 (CAN)	0,712	0,626	0,781	11,203	0,000
1-Student	SID0057b 1966 (CHI)	0,725	0,628	0,800	9,973	0,000
1-Student	SID0062 2063	0,570	0,450	0,670	7,770	0,000
1-Student	SID0066 2128	0,490	0,405	0,567	9,884	0,000
1-Student	SID0068 2130	0,252	-0,020	0,489	1,821	0,069
1-Student	SID0076 3472	0,175	0,032	0,311	2,392	0,017
1-Student	SID0078 3474	0,520	0,385	0,633	6,647	0,000
1-Student	SID0082 3483	0,370	0,246	0,482	5,548	0,000
1-Student	SID0137 4223	0,670	0,589	0,738	11,832	0,000
1-Student	SID0295a 3709 (MAL)	0,262	0,078	0,429	2,762	0,006
1-Student	SID0295b 3709 (FEM)	0,395	0,137	0,603	2,924	0,003
1-Student		0,474	0,365	0,570	7,616	0,000
2-Non-student	SID0007 1467	0,216	0,048	0,372	2,512	0,012
2-Non-student	SID0008 1470	0,450	0,310	0,571	5,776	0,000
2-Non-student	SID0014 1484	0,546	0,444	0,634	8,899	0,000
2-Non-student	SID0023 1499	0,416	0,181	0,606	3,340	0,001
2-Non-student	SID0027 1510	0,860	0,824	0,889	20,368	0,000
2-Non-student	SID0061 2057	0,210	0,089	0,325	3,379	0,001
2-Non-student	SID0064 2122	0,624	0,487	0,731	7,205	0,000
2-Non-student	SID0071 3452	0,200	0,075	0,319	3,114	0,002
2-Non-student	SID0074a 3459 (VOL)	0,390	0,290	0,482	7,121	0,000
2-Non-student	SID0074b 3459 (MAN)	0,470	0,285	0,621	4,619	0,000
2-Non-student	SID0079 3478	0,230	0,098	0,354	3,386	0,001
2-Non-student	SID0080 3479	0,765	0,701	0,817	14,222	0,000
2-Non-student	SID0081a 3481 (VOL)	0,220	0,043	0,383	2,430	0,015
2-Non-student	SID0081b 3481 (MAN)	0,220	0,003	0,417	1,988	0,047
2-Non-student	SID0085 3494	0,800	0,731	0,853	12,906	0,000
2-Non-student	SID0088 3505	0,520	0,459	0,576	14,129	0,000
2-Non-student		0,487	0,345	0,607	6,044	0,000
3-Mixed/Unknown	SID0006 1465	0,261	0,153	0,363	4,628	0,000
3-Mixed/Unknown	SID0013 1481	0,570	0,516	0,620	16,483	0,000
3-Mixed/Unknown	SID0019 1492	0,550	0,447	0,639	8,811	0,000
3-Mixed/Unknown	SID0025 1505	0,340	0,270	0,406	9,014	0,000
3-Mixed/Unknown	SID0029 1515	0,109	-0,011	0,226	1,775	0,076
3-Mixed/Unknown	SID0032 1521	0,998	0,997	0,998	50,871	0,000
3-Mixed/Unknown	SID0036 1546	0,418	0,371	0,463	15,749	0,000
3-Mixed/Unknown	SID0042 1606	0,490	0,380	0,586	7,750	0,000
3-Mixed/Unknown	SID0045 1625	0,025	-0,017	0,067	1,176	0,240
3-Mixed/Unknown	SID0047 1749	0,890	0,789	0,944	7,917	0,000
3-Mixed/Unknown	SID0053 1858	0,353	0,246	0,451	6,150	0,000
3-Mixed/Unknown	SID0056 1965	0,330	0,212	0,438	5,278	0,000
3-Mixed/Unknown	SID0058 2030	0,272	-0,007	0,512	1,913	0,056
3-Mixed/Unknown	SID0067 2129	0,570	0,503	0,630	13,505	0,000
3-Mixed/Unknown	SID0073 3456	0,440	0,397	0,481	17,945	0,000
3-Mixed/Unknown	SID0075 3469	0,270	0,146	0,386	4,181	0,000
3-Mixed/Unknown	SID0077 3473	0,330	0,227	0,426	6,007	0,000
3-Mixed/Unknown	SID0083 3489	0,440	0,329	0,539	7,099	0,000
3-Mixed/Unknown	SID0084 3492	0,579	0,451	0,684	7,390	0,000
3-Mixed/Unknown	SID0086a 3497 (VOL)	0,570	0,489	0,641	11,234	0,000
3-Mixed/Unknown	SID0086b 3497 (MAN)	0,650	0,507	0,758	7,021	0,000
3-Mixed/Unknown	SID0089 3509	0,610	0,527	0,682	11,254	0,000
3-Mixed/Unknown	SID0090 3513	0,230	0,105	0,348	3,552	0,000
3-Mixed/Unknown		0,544	0,374	0,679	5,508	0,000
Overall		0,492	0,417	0,560	11,151	0,000



PEU-PU / By Occupation

Figure 5.1 Random-effects meta-analysis of PEU-PU relationship – grouped by occupation

Table 5.3 Summary statistics of the PEU-PU relationship – grouped by occupation

		1-Student	1-Non-student	3-Mixed / Unknown	Total Between	Overall
# of Studies		28	16	23	-	67
Effect Size and 95% Interval	**Point estimate**	0.474	0.487	0.544	-	0.492
	Lower limit	0.365	0.345	0.374	-	0.417
	Upper limit	0.570	0.607	0.679	-	0.560
Heterogeneity	**Q-value**	-	-	-	0.538	-
	df (Q)	-	-	-	2	-
	P-value	-	-	-	0.764	-

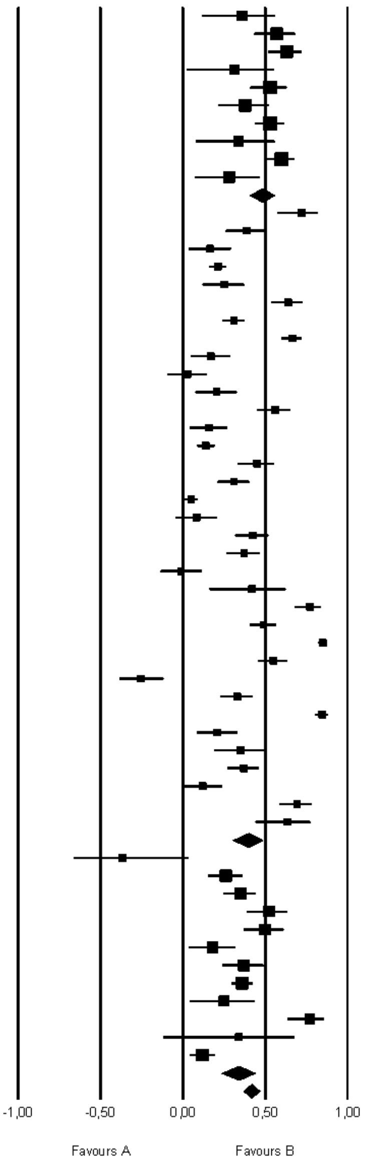
Regarding the forest plot in Figure 5.1, no significant pattern and/or estimate gap can be observed. What is more, the heterogeneity testing in Table 5.3 cannot reject the null hypothesis that heterogeneity does not exist between groups. Q minus df is smaller than zero.

5.1.2.2. Moderating Effect of the Technology Characteristics

As a next step, the meta-analysis on PU-BI relationship is examined based on groups of studies which differ in terms of technology characteristics. Figure 5.2 and Table 5.4 present the results of this examination.

Group by Tech Voluntariness	Study name	Correlation	Lower limit	Upper limit	Z-Value	p-Value
1-Mandatory	SID0023 1499	0,358	0,115	0,561	2,832	0,005
1-Mandatory	SID0034 1536	0,570	0,431	0,683	6,791	0,000
1-Mandatory	SID0039 1559	0,630	0,514	0,723	8,388	0,000
1-Mandatory	SID0040 1567	0,314	0,023	0,556	2,106	0,035
1-Mandatory	SID0057a 1966 (CAN)	0,529	0,408	0,632	7,401	0,000
1-Mandatory	SID0057b 1966 (CHI)	0,379	0,215	0,522	4,333	0,000
1-Mandatory	SID0061 2057	0,531	0,437	0,614	9,381	0,000
1-Mandatory	SID0068 2130	0,339	0,076	0,558	2,496	0,013
1-Mandatory	SID0082 3483	0,600	0,505	0,681	9,900	0,000
1-Mandatory	SID0086b 3497 (MAN)	0,280	0,071	0,465	2,605	0,009
1-Mandatory		0,483	0,405	0,555	10,546	0,000
2-Voluntary	SID0001 5553	0,720	0,572	0,823	6,912	0,000
2-Voluntary	SID0010 1475	0,390	0,259	0,507	5,510	0,000
2-Voluntary	SID0014 1484	0,165	0,032	0,293	2,419	0,016
2-Voluntary	SID0017 1488	0,213	0,160	0,264	7,781	0,000
2-Voluntary	SID0019 1492	0,250	0,117	0,374	3,639	0,000
2-Voluntary	SID0024 1504	0,640	0,535	0,726	9,224	0,000
2-Voluntary	SID0025 1505	0,310	0,239	0,378	8,160	0,000
2-Voluntary	SID0026 1506	0,663	0,594	0,722	13,755	0,000
2-Voluntary	SID0027 1510	0,170	0,047	0,288	2,703	0,007
2-Voluntary	SID0029 1515	0,027	-0,094	0,147	0,438	0,661
2-Voluntary	SID0032 1521	0,205	0,075	0,328	3,063	0,002
2-Voluntary	SID0033 1524	0,560	0,448	0,655	8,227	0,000
2-Voluntary	SID0035 1540	0,157	0,039	0,271	2,596	0,009
2-Voluntary	SID0036 1546	0,140	0,085	0,194	4,984	0,000
2-Voluntary	SID0037 1547	0,451	0,333	0,555	6,824	0,000
2-Voluntary	SID0038 1557	0,310	0,209	0,404	5,814	0,000
2-Voluntary	SID0045 1625	0,051	0,009	0,092	2,401	0,016
2-Voluntary	SID0049 1761	0,082	-0,048	0,209	1,241	0,215
2-Voluntary	SID0050 1791	0,423	0,315	0,520	7,079	0,000
2-Voluntary	SID0053 1858	0,372	0,267	0,469	6,515	0,000
2-Voluntary	SID0056 1965	-0,011	-0,137	0,116	-0,169	0,866
2-Voluntary	SID0058 2030	0,420	0,160	0,625	3,069	0,002
2-Voluntary	SID0064 2122	0,772	0,678	0,841	10,098	0,000
2-Voluntary	SID0066 2128	0,490	0,405	0,567	9,884	0,000
2-Voluntary	SID0067 2129	0,850	0,822	0,874	26,199	0,000
2-Voluntary	SID0075 3469	0,550	0,453	0,634	9,337	0,000
2-Voluntary	SID0076 3472	-0,256	-0,386	-0,116	-3,542	0,000
2-Voluntary	SID0077 3473	0,330	0,227	0,426	6,007	0,000
2-Voluntary	SID0080 3479	0,847	0,803	0,882	17,569	0,000
2-Voluntary	SID0083 3489	0,210	0,083	0,331	3,205	0,001
2-Voluntary	SID0084 3492	0,350	0,188	0,494	4,086	0,000
2-Voluntary	SID0086a 3497 (VOL)	0,370	0,269	0,463	6,739	0,000
2-Voluntary	SID0089 3509	0,120	-0,003	0,239	1,914	0,056
2-Voluntary	SID0295a 3709 (MAL)	0,694	0,582	0,780	8,809	0,000
2-Voluntary	SID0295b 3709 (FEM)	0,636	0,439	0,774	5,260	0,000
2-Voluntary		0,396	0,301	0,484	7,528	0,000
3-Mixed/Unknown	SID0002 1443	-0,366	-0,665	0,034	-1,800	0,072
3-Mixed/Unknown	SID0004 1457	0,260	0,152	0,362	4,609	0,000
3-Mixed/Unknown	SID0006 1465	0,349	0,246	0,444	6,310	0,000
3-Mixed/Unknown	SID0007 1467	0,524	0,389	0,637	6,659	0,000
3-Mixed/Unknown	SID0008 1470	0,500	0,367	0,613	6,546	0,000
3-Mixed/Unknown	SID0009 1472	0,180	0,033	0,320	2,387	0,017
3-Mixed/Unknown	SID0012 1478	0,370	0,237	0,490	5,168	0,000
3-Mixed/Unknown	SID0013 1481	0,360	0,291	0,425	9,594	0,000
3-Mixed/Unknown	SID0031 1517	0,249	0,039	0,438	2,317	0,020
3-Mixed/Unknown	SID0069 2133	0,770	0,634	0,860	7,358	0,000
3-Mixed/Unknown	SID0087 3501	0,340	-0,121	0,680	1,460	0,144
3-Mixed/Unknown	SID0088 3505	0,120	0,041	0,198	2,956	0,003
3-Mixed/Unknown		0,340	0,232	0,439	5,914	0,000
Overall		0,417	0,364	0,467	14,057	0,000

Correlation and 95% CI



PU-BI / By Voluntariness

Figure 5.2 Random-effects meta-analysis of PU-BI relationship – grouped by voluntariness

Table 5.4 Summary statistics of the PU-BI relationship – grouped by voluntariness

		1-Mandatory	2-Voluntary	3-Mixed / Unknown	Total Between	Overall
# of Studies		28	16	23	-	57
Effect Size and 95% Interval	**Point estimate**	0.483	0.396	0.340	-	0.417
	Lower limit	0.405	0.301	0.232	-	0.364
	Upper limit	0.555	0.484	0.439	-	0.467
Heterogeneity	**Q-value**	-	-	-	5.243	-
	df (Q)	-	-	-	2	-
	P-value	-	-	-	0.073	-

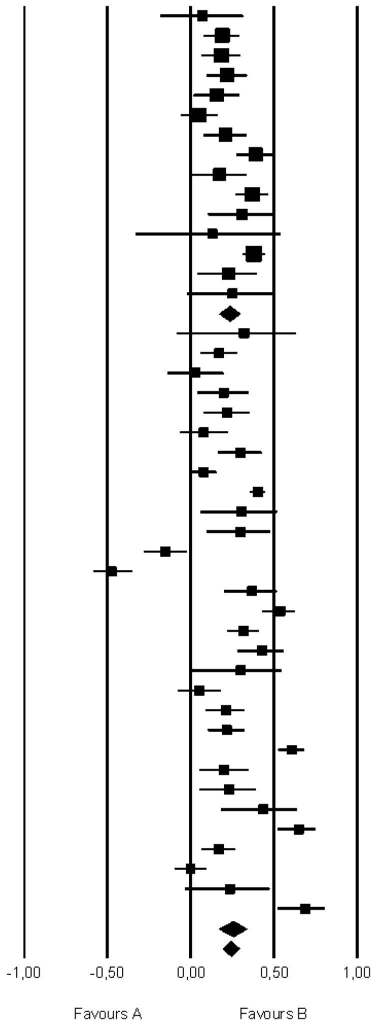
This time, by considering both the descriptive statistics of Table 5.4 and the forest plot structure of Figure 5.2, one can observe some slight heterogeneity between the groups. Q-value is 5.243 (df = 2), and the p-value is close to 0.05. Indeed, the forest plot also shows that the summary effect of the studies which addressed to mandatory use of technology is located at the right side of the scale with a notably high Z-value.

5.1.2.3. An Uncommonly Examined Moderator: Publication Type

As a final step in moderating effects discovery, an uncommonly examined moderator, the publication type (i.e. journal articles and conference proceedings in our study), is handled in order to explain at least some part of the total dispersion of PEU-BI relationship meta-analysis. Figure 5.3 and Table 5.5 provides the results of the grouped meta-analysis.

Group by Type of Pub	Study name	Correlation	Lower limit	Upper limit	Z-Value	p-Value
		Statistics for each study				
2-Journal	SID0001 5553	0,070	-0,185	0,316	0,534	0,593
2-Journal	SID0004 1457	0,190	0,079	0,296	3,331	0,001
2-Journal	SID0061 2057	0,186	0,064	0,302	2,973	0,003
2-Journal	SID0075 3469	0,220	0,094	0,339	3,377	0,001
2-Journal	SID0076 3472	0,159	0,015	0,296	2,169	0,030
2-Journal	SID0077 3473	0,050	-0,062	0,161	0,877	0,381
2-Journal	SID0082 3483	0,210	0,076	0,337	3,045	0,002
2-Journal	SID0083 3489	0,390	0,274	0,495	6,191	0,000
2-Journal	SID0084 3492	0,174	0,000	0,337	1,965	0,049
2-Journal	SID0086a 3497 (VOL)	0,370	0,269	0,463	6,739	0,000
2-Journal	SID0086b 3497 (MAN)	0,310	0,104	0,491	2,903	0,004
2-Journal	SID0087 3501	0,130	-0,332	0,541	0,539	0,590
2-Journal	SID0088 3505	0,380	0,310	0,446	9,808	0,000
2-Journal	SID0295a 3709 (MAL)	0,228	0,042	0,399	2,389	0,017
2-Journal	SID0295b 3709 (FEM)	0,251	-0,024	0,490	1,795	0,073
2-Journal		0,234	0,169	0,298	6,880	0,000
3-Proceedings	SID0002 1443	0,321	-0,085	0,636	1,561	0,119
3-Proceedings	SID0006 1465	0,172	0,060	0,279	3,009	0,003
3-Proceedings	SID0007 1467	0,030	-0,140	0,199	0,343	0,731
3-Proceedings	SID0008 1470	0,200	0,038	0,352	2,416	0,016
3-Proceedings	SID0009 1472	0,220	0,074	0,357	2,933	0,003
3-Proceedings	SID0010 1475	0,080	-0,066	0,223	1,073	0,283
3-Proceedings	SID0012 1478	0,300	0,161	0,428	4,118	0,000
3-Proceedings	SID0013 1481	0,080	0,003	0,156	2,041	0,041
3-Proceedings	SID0017 1488	0,403	0,356	0,448	15,368	0,000
3-Proceedings	SID0023 1499	0,307	0,057	0,520	2,393	0,017
3-Proceedings	SID0031 1517	0,300	0,094	0,481	2,820	0,005
3-Proceedings	SID0032 1521	-0,152	-0,279	-0,020	-2,257	0,024
3-Proceedings	SID0033 1524	-0,475	-0,583	-0,350	-6,715	0,000
3-Proceedings	SID0034 1536	0,370	0,199	0,519	4,074	0,000
3-Proceedings	SID0037 1547	0,538	0,431	0,629	8,431	0,000
3-Proceedings	SID0038 1557	0,320	0,220	0,413	6,016	0,000
3-Proceedings	SID0039 1559	0,430	0,279	0,560	5,203	0,000
3-Proceedings	SID0040 1567	0,302	0,009	0,547	2,020	0,043
3-Proceedings	SID0049 1761	0,052	-0,078	0,180	0,786	0,432
3-Proceedings	SID0050 1791	0,211	0,089	0,327	3,360	0,001
3-Proceedings	SID0053 1858	0,217	0,103	0,326	3,677	0,000
3-Proceedings	SID0056 1965	0,610	0,524	0,684	10,914	0,000
3-Proceedings	SID0057a 1966 (CAN)	0,202	0,049	0,346	2,575	0,010
3-Proceedings	SID0057b 1966 (CHI)	0,231	0,055	0,393	2,555	0,011
3-Proceedings	SID0058 2030	0,438	0,182	0,639	3,220	0,001
3-Proceedings	SID0064 2122	0,651	0,521	0,751	7,653	0,000
3-Proceedings	SID0066 2128	0,170	0,065	0,271	3,165	0,002
3-Proceedings	SID0067 2129	0,000	-0,094	0,094	0,000	1,000
3-Proceedings	SID0068 2130	0,236	-0,037	0,476	1,701	0,089
3-Proceedings	SID0069 2133	0,690	0,520	0,807	6,115	0,000
3-Proceedings		0,254	0,167	0,337	5,592	0,000
Overall		0,242	0,190	0,292	8,858	0,000

Correlation and 95% CI



PEU-BI / By Publication Type

Figure 5.3 Random-effects meta-analysis of PEU-BI relationship – grouped by publication type

Table 5.5 Summary statistics of the PEU-BI relationship – grouped by publication type

		2-Journal	3-Proceedings	Total Between	Overall
# of Studies		15	30	-	45
Effect Size and 95% Interval	**Point estimate**	0.234	0.254	-	0.242
	Lower limit	0.169	0.167	-	0.190
	Upper limit	0.298	0.337	-	0.292
Heterogeneity	**Q-value**	-	-	0.133	-
	df (Q)	-	-	1	-
	P-value	-	-	0.715	-

The results of publication type based moderator analysis lead to very slight change in favor of proceedings according to Table 5.5. One noticeable difference in the forest plot is the existence of some outliers inside the proceedings group.

5.1.3. Investigation of the Publication Bias

As Borenstein et al. [3] point out, it is revealed that studies with higher effect sizes are more likely to be included in publications than those which have weaker effect sizes. In fact, studies which are not published do not need to have weak effect sizes; they might be in preparation stage, the author might intentionally avoid publishing her work (e.g. confidential business reports etc.), the meta-analyst might not have access to some libraries which actually have several different studies, and so forth. That is to say, the absence of some inaccessible studies might pose a bias threat for the meta-analysis study. Taking the fact that studies with low effect sizes are more likely to be kept in the "file-drawer", a set of tests have been developed to determine the existence of a possible publication bias in the meta-analysis study, the origin of the effect, and the impact of a possible bias. The following subsections employ the relevant part of these tests to our study, respectively.

5.1.3.1. Determining the Existence of a Possible Publication Bias

One easy but effective method to determine the existence of a possible publication bias is using a *funnel plot* diagram which is introduced by Light and Pillemer [48]. Higgins and Green [49] defines it as a scatter diagram which combines the effect size data of the studies and their sample size or precision. The plot take its name from its funnel-like form. Its principle of use grounds on the assumption of that effects disperse symmetrically around the mean effect due to "random" sampling error [3]. Otherwise, that is, if the symmetry is only observable on the top side of the plot (i.e. low standard error) and the bottom side high-error studies are skewed to the "higher effect" side on the horizontal line, then the possibility of a publication bias can be considered. Actually, such asymmetry at the bottom is interpreted as the more frequent publication of low-precision studies which have "higher" effect sizes.

CMA software enables to draw funnel plot diagrams for the recognition of a possible bias pattern, and the plots of the three largest meta-analyses of this study are represented in Figure 5.4 below.

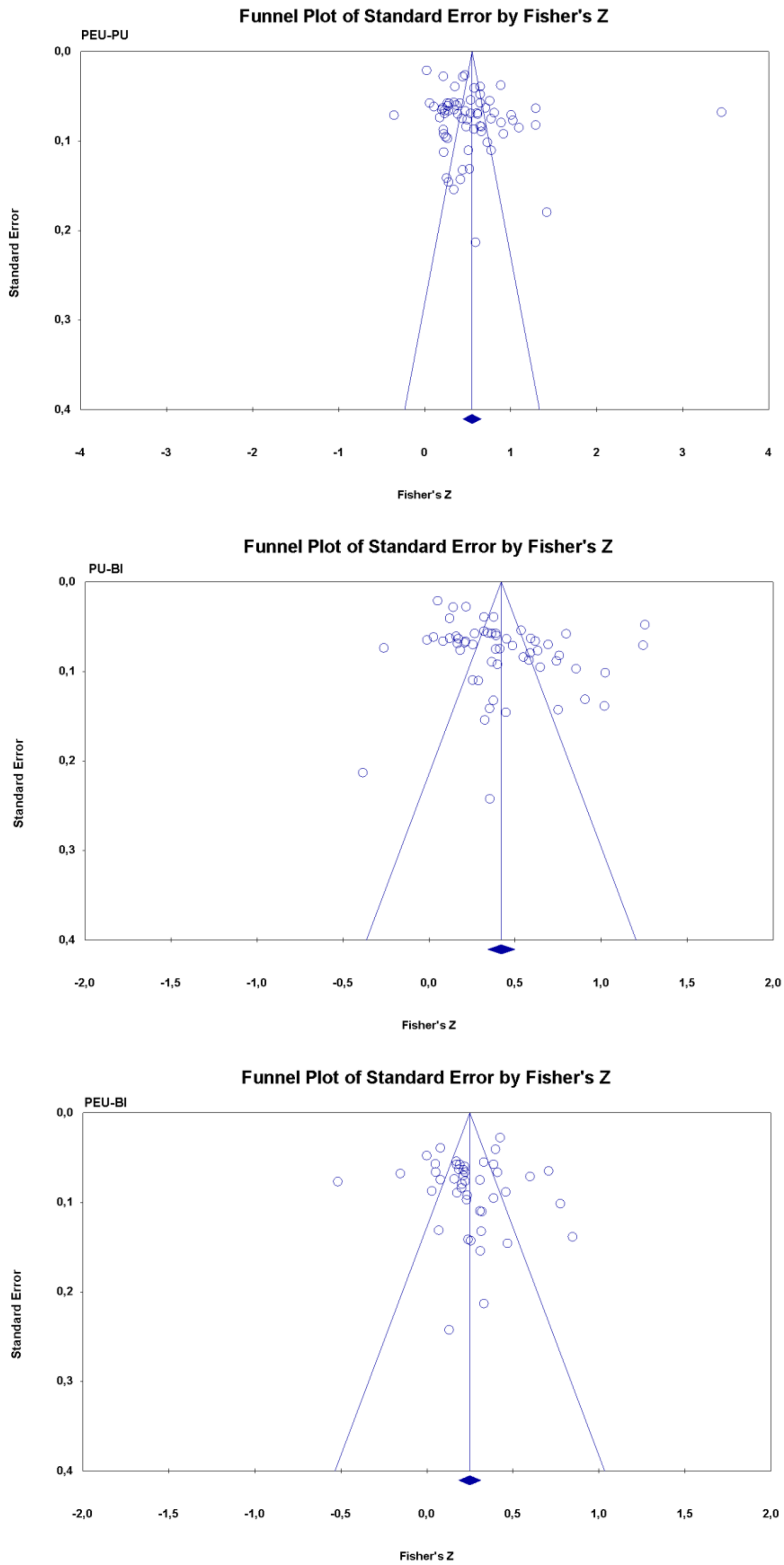


Figure 5.4 Funnel plots of meta-analyses on PEU-PU, PU-BI, and PEU-BI relationships

Remarkably, the observation through Figure 5.4 is that the primary studies are scattered on the very top of the funnels for each of the meta-analyses. In other words, the samples comprise very few studies which have high standard errors, hence, low precisions. In fact, this can also be attributed to the large-sample nature of the social sciences as compared with clinical studies. However, although asymmetric bottom clusters are not seen on these plots, we can still discover some agglomerations at one side of the top parts of the funnels. For instance the scatter of PEU-BI seems more asymmetrical than the other two.

5.1.3.2. Determining the Origin of the Effect: Fail-Safe N Testing

Through the meta-analyses, the study did not only revealed high dispersion among primary studies but also obtained considerably high effect sizes, as well. The point estimate of PEU-PU at 0.502, and PU-BI relationship's point estimate of 0.397 are two examples to these high summary effects. Following a visual look at the possibility of publication, one can also attempt to explore whether the computed summary effect actually originates from the publication bias. For such exploration attempts, Rosenthal [15] introduced the *fail-safe N* test which aims finding the adequate number of dummy studies with zero effects in order to nullify the effect of the meta-analysis study. To illustrate, if a meta-analysis study which has only tens of primary studies as its sample required thousands of dummy studies with zero effect, then it can be concluded that such effect does not simply arise from a publication bias.

As a more flexible approach, Orwin [50] introduced his newer fail-safe N test which distinguishes itself from its predecessor in a way that a custom non-zero effect value could be assigned to the dummy studies.

Table 5.6 below describes the results of the classic fail-safe N test for each of the three meta-analyses; i.e. PEU-PU, PU-BI, and PEU-BI.

Table 5.6 Rosenthal's Fail-safe N testing for meta-analyses on PEU-PU, PU-BI, and PEU-BI

	PEU-PU	PU-BI	PEU-BI
Z-value for Observed Studies	65.56210	43.38462	22.24196
p-value for Observed Studies	0.00	0.00	0.00
Alpha	0.05	0.05	0.05
Tails	2.00	2.00	2.00
Z for Alpha	1.95996	1.95996	1.95996
Number of Observed Studies	67	57	45
Required Number of Missing Studies for p-value > Alpha	74903	27872	5751

Table 5.6 shows that each of the meta-analyses requires the inclusion of thousands of zero-effect missing studies in order to make the p-value greater than alpha. Such finding of classic fail-safe N may be satisfying only to some extent: Borenstein et al. [3] underlines that fail-safe N testing bases itself on the combination of the p-values of the studies, and that those p-values test different null hypotheses, thus, should not be combined. Therefore, the study needs a further step which determines the "impact" of a possible publication bias, and Section 5.1.3.3 provides basis for this.

5.1.3.3. Determining the Impact of Bias: Trim and Fill Testing

Duval and Tweedie's trim and fill testing helps the determination of a publication bias impact [51]. Again, by using the funnel plots which are explained under Section 5.1.3.1, this test first removes the small studies with very high effect sizes until the plot view becomes symmetric, and then adds these studies back into the plot with its imputed mirror study on the opposite side.

Trim and fill testing did not suggest filling a possible left hand side gap of studies in the main three meta-analyses of the study, that is, PEU-PU, PU-BI, and PEU-BI. This is because the studies pursued a random-effects model, and they do not indicate visible asymmetry in their funnel plots.

CHAPTER 6

CONCLUSION

This part, by consisting of Section 6.1, enlists the findings of the study results from a relatively broader perspective. The encapsulated findings are provided in order to suggest paths for further research in Section 6.2, especially studies which focus on the technology acceptance domain, and are in forms of systematic reviews.

6.1. What the Findings Point Out

Table 6.1 below summarizes the findings that are obtained through the meta-analyses conducted within the study. The findings are summarized in line with the identified research questions which are provided first in Section 1.2.

Table 6.1 Summary of the findings on research questions

No	Research Question	Finding
1a	What is the predictive ability of perceived usefulness (PU) of a technology on attitude toward its use (ATT)?	*moderate effect magnitude*****
1b	To what extent does the predictive ability of perceived usefulness (PU) of a technology on attitude toward its use (ATT) vary among studies?	*high variation*****
2a	What is the predictive ability of perceived usefulness (PU) of a technology on behavioral intention to use (BI)?	*moderate effect magnitude*****
2b	To what extent does the predictive ability of perceived usefulness (PU) of a technology on behavioral intention to use (BI) vary among studies?	*high variation*****

2c	***Table 6.1 (cont.)*** Does the predictive ability of perceived usefulness (PU) of a technology on behavioral intention to use (BI) vary by voluntariness of use?	*yes (significant*; p=0.073)*
3a	What is the predictive ability of perceived ease of use (PEU) of a technology on attitude toward its use (ATT)?	*moderate effect magnitude*****
3b	To what extent does the predictive ability of perceived ease of use (PEU) of a technology on attitude toward its use (ATT) vary among studies?	*high variation*****
4a	What is the predictive ability of perceived ease of use (PEU) of a technology on behavioral intention to use (BI)?	*low effect magnitude*****
4b	To what extent does the predictive ability of perceived ease of use (PEU) of a technology on behavioral intention to use (BI) vary among studies?	*high variation*****
4c	Does the published predictive ability finding of perceived ease of use (PEU) of a technology on behavioral intention to use (BI) vary by the type of publication (i.e. journal articles and conference proceedings)?	*no (insignificant; p=0.715)*
5a	What is the predictive ability of perceived ease of use (PEU) of a technology on perceived usefulness (PU)?	*high effect magnitude*****
5b	To what extent does the predictive ability of perceived ease of use (PEU) of a technology on perceived usefulness (PU) vary among studies?	*high variation*****
5c	Does the predictive ability of perceived ease of use (PEU) of a technology on perceived usefulness (PU) vary by the occupation (i.e. student, non-student, and mixed/unknown) of the survey participants?	*no (insignificant; p=0.764)*
6a	What is the predictive ability of behavioral intention to use (BI) of a technology on actual use (U)?	*high effect magnitude*****
6b	To what extent does the predictive ability of behavioral intention to use (BI) of a technology on perceived usefulness (PU) vary among studies?	*high variation*****
7a	What is the predictive ability of subjective norm (SN) on behavioral intention to use (BI) of a technology?	*low effect magnitude*****

7b	***Table 6.1 (cont.)*** To what extent does the predictive ability of subjective norm (SN) on behavioral intention to use (BI) of a technology vary among studies?	*at least moderate variation*****
8a	What is the predictive ability of subjective norm (SN) on perceived usefulness (PU) of a technology?	*moderate effect magnitude*****
8b	To what extent does the predictive ability of subjective norm (SN) on perceived usefulness (PU) of a technology vary among studies?	*at least moderate variation***
9a	(UTAUT) What is the predictive ability of performance expectancy (PE) on behavioral intention to use (BI) of a technology?	*high effect magnitude*****
9b	(UTAUT) To what extent does the predictive ability of performance expectancy (PE) on behavioral intention to use (BI) of a technology vary among studies?	*high variation***
10a	(UTAUT) What is the predictive ability of effort expectancy (EE) on behavioral intention to use (BI) of a technology?	*low effect magnitude*****
10b	(UTAUT) To what extent does the predictive ability of effort expectancy (EE) on behavioral intention to use (BI) of a technology vary among studies?	*high variation*****
11a	(UTAUT) What is the predictive ability of social influence (SI) on behavioral intention to use (BI) of a technology?	*low effect magnitude*****
11b	(UTAUT) To what extent does the predictive ability of social influence (SI) on behavioral intention to use (BI) of a technology vary among studies?	*high variation*****
12a	(UTAUT) What is the predictive ability of facilitating conditions (FC) on actual use (U) of a technology?	*moderate effect magnitude*****
12b	(UTAUT) To what extent does the predictive ability of facilitating conditions (FC) on actual use (U) of a technology vary among studies?	*high variation*****

*p<0.1; **p<0.05; ***p<0.01; ****p<0.001

Besides utilizing the "Q-value minus df is bigger than zero" lookup for the detection of heterogeneity which are demonstrated in Section 4 and Section 5, Table 6.1 above interprets the levels of variation by also considering the tentative I^2 value categorization which are suggested by Higgins et al. [52]. According to [52], I^2 values which are at 25 percent, 50 percent, and 75 percent can be denoted as low, moderate and high, respectively. Similarly, regarding the categorization of the correlation values as effect magnitudes, Cohen [9] suggested a low-to-high sequence for 0.1, 0.3, and 0.5 values. This suggestion is also utilized.

The findings obtained through meta-analyses on twelve construct relationships of TAM and the UTAUT model provided three main insights in terms of study topic and the research method.

First and foremost, the use type of the technology, that is, the voluntary use versus the mandatory use, could explain the variation among perceived usefulness and the behavioral intention to use constructs to some valuable extent. Such finding can be interpreted in a way that the business-related technologies, by their very nature, are designed and developed to ensure measurable benefits (e.g. improved productivity on a specific task etc.) to the users as well as the organizations. Considering the fact that mandatory use of a technology is usually something about business or school, it is not surprising to observe people who behave result-oriented, hence, value the usefulness more in their mandatory use of technology.

Second, the primary studies built remarkably dispersed sets of samples, and among twelve construct relationships, there was no exception. Such general existence of heterogeneity became a supportive element of the preliminary choice of "random-effects" meta-analytic model, and despite the high dispersion between the true effects of the studies, the study which conducted random-effects meta-analysis could combine the effect sizes effectively, attain summary effects for each of the construct relationships of the models, and led to more powerful and precise outcomes in comparison to separate primary studies.

Third, several potential moderators (including gender, age, occupation, culture context, prior experience of use, technology context in terms of utilitarian and hedonic use, and voluntariness to use) have been identified and a subset of them have been examined during the process of study reviews. Furthermore, the preliminary research stage of the study found out that only few primary studies provided the mean age value of their survey participants; rather, some diverse predefined sets of age intervals are used in order to group the participants by age. This unstandardized approach of the primary studies constituted a barrier to the examination of the moderating effect of age. Under any circumstances, the potentially moderating elements identified above as well as those which have not been explored yet might explain the excess variation among the primary study effects sizes.

6.2. Implications for Future Work

As also remarked in Section 1.2, TAM and UTAUT models and their variants need to be meta-analyzed further with respect to two main dimensions: First, future studies may attempt to explore the strengths of construct relationships that were not handled within the meta-analyses of this study; e.g. the predictive ability of perceived enjoyment on perceived ease of use (i.e. a relationship introduced by TAM3), the predictive ability of hedonic motivation on behavioral intention to use (i.e. a relationship introduced by the UTAUT2 model), and the predictive ability of habit on actual use (i.e. again, a relationship introduced by the UTAUT2 model). That is, in the time to come, the newer pairwise relationships of more recent TAM and UTAUT variants may be systematically reviewed in terms of predictive ability and variation among study effect sizes. Second, further systematic reviews may aim to measure the strength and variation of construct relationships that were handled within the meta-analyses of this study, but with relatively small set of collected primary studies; e.g. BI-U relationship of TAM, SN-PU relationship of TAM, FC-U relationship of the UTAUT model etc.

Besides, in a future work, a similar set of construct relationships may also be examined through conducting some different study design approaches meta-anaysis techniques: e.g. psychometric meta-analysis.

As can be seen in Table 6.1, the meta-analyses on almost all construct relationships revealed high heterogeneity, i.e. high variation among the effect sizes of primary studies. In order to discover the possible causes of such significant dispersion, further meta-analysis studies which focus on the moderating effects more comprehensively and one-by-one may be conducted.

Finally, the researchers of the domain of technology acceptance may choose to work with the other theoretical models which also try to elaborate the technology acceptance phenomena. They can do this through conducting meta-analyses on the construct relationships of completely different models in future studies.

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APPENDICES

Appendix A: Studies Subject to Meta-Analysis

No	Study ID	RefWorks Ref ID	Study	Model Studied
1	SID0001	5553	Szajna, B. (1996). Empirical evaluation of the revised technology acceptance model. *Management Science, 42*(1), 85-92.	TAM*
2	SID0002	1443	Gao, S., Moe, S. P., & Krogstie, J. (2010). An empirical test of the mobile services acceptance model. *Mobile Business and 2010 Ninth Global Mobility Roundtable (ICMB-GMR), 2010 Ninth International Conference on*, 168-175.	TAM*
3	SID0004	1457	Saeed, K. A., & Muthitacharoen, A. (2008). To send or not to send: An empirical assessment of error reporting behavior. *Engineering Management, IEEE Transactions on, 55*(3), 455-467.	TAM*
4	SID0006	1465	Chan Kook Park, Hyun Jae Kim, & Yang Soo Kim. (2012). An empirical study of the smart grid technology acceptance model in Korea. *Energy Conference and Exhibition (ENERGYCON), 2012 IEEE International*, 836-841.	TAM*

	Appendix A (cont.)			
5	SID0007	1467	Wenjywan Su, & Hsiu-Ying Lin. (2010). The impact of appropriation consensus and cooperative team norms on the adoption of collaborative information systems: An empirical study in Taiwan. *Technology Management for Global Economic Growth (PICMET), 2010 Proceedings of PICMET '10:* 1-8.	TAM*
6	SID0008	1470	Chorng-Shyong Ong, Jung-Yu Lai, Yu-min Wang, & Shang-Wei Wang. (2005). An understanding of power issues influencing employees' acceptance of KMS: An empirical study of Taiwan semiconductor manufacturing companies. *System Sciences, 2005. HICSS '05. Proceedings of the 38th Annual Hawaii International Conference on,* 269a-269a.	TAM*
7	SID0009	1472	Chen Yu, Dong Yi-ming, & Yang Bao-Jian. (2009). An empirical research on E-recruitment systems base on the technology acceptance model. *Service Systems and Service Management, 2009. ICSSSM '09. 6th International Conference on,* 429-433.	TAM*
8	SID0010	1475	Liu Jie, & Chen Yu. (2010). Empirical research of influence factors to 3G mobile phone's use. *Information Management and Engineering (ICIME), 2010 the 2nd IEEE International Conference on,* 62-66.	TAM*

Appendix A (cont.)

9	SID0012	1478	Chen Yu, Dong Yi-ming, & Yang Bao-Jian. (2008). Empirical study of individual acceptance behaviors in E-recruitment systems. *Wireless Communications, Networking and Mobile Computing, 2008. WiCOM '08. 4th International Conference on,* 1-5.	TAM*
10	SID0013	1481	Chen Pang, & Xiaofen Ji. (2007). The influence of product knowledge on online purchase intention on creative products: An empirical study. *Wireless Communications, Networking and Mobile Computing, 2007. WiCom 2007. International Conference on*, 3501-3504.	TAM*
11	SID0014	1484	Li Ye, Zhang Haohong, & Zhou Fei. (2010). The impact of sales promotion on the C2C online purchasing behavior: An empirical study. *E-Business and E-Government (ICEE), 2010 International Conference on*, 2261-2264.	TAM*
12	SID0016	1487	Sungyul Ryoo, Hyojin Kim, & Soohyun Jeon. (2009). An empirical study on mobile web browsing service adoption in Korea. *Mobile Business, 2009. ICMB 2009. Eighth International Conference on*, 324-328.	TAM*

Appendix A (cont.)

13	SID0017	1488	Jaw, C., Yu, O. S., & Gehrt, K. C. (2011). Integrating user perception and experience into the technology acceptance model: An empirical investigation of online payment service innovation. *Technology Management Conference (ITMC), 2011 IEEE International*, 134-143.	TAM*
14	SID0019	1492	Tsung-Li Wang. (2011). An effect of trust and attitude in the initial adoption of online shopping: An empirical study. *Information Society (i-Society), 2011 International Conference on*, 22-26.	TAM*
15	SID0021	1494	Goh, S. & Yoon, T. (2011). If you build it will they come? An empirical investigation of facilitators and inhibitors of hedonic virtual world acceptance. *System Sciences (HICSS), 2011 44th Hawaii International Conference on*, 1-9.	UTAUT**
16	SID0022	1498	Ya Fen Tseng, Shu-Chen Kao, Tzai-Zang Lee, & ChienHsing Wu. (2011). An extension of trust and privacy in the initial adoption of online shopping: An empirical study. *Information Society (i-Society), 2011 International Conference on*, 159-164.	TAM*

Appendix A (cont.)

17	SID0023	1499	Ziqi Liao, & Landry, R., Jr. (2000). An empirical study on organizational acceptance of new information systems in a commercial bank environment. *System Sciences, 2000. Proceedings of the 33rd Annual Hawaii International Conference on,* 7 pp.	TAM*
18	SID0024	1504	Zhimin Ji, Hong Wu, & Weijing Shang. (2008). The impact of virtual money application to E-customer loyalty in china: An empirical study. *Wireless Communications, Networking and Mobile Computing, 2008. WiCOM '08. 4th International Conference on,* 1-4.	TAM*
19	SID0025	1505	Chen Pang, & Xiaofen Ji. (2008). An empirical study on predicting user purchase intention on the creative product: A case of apparel. *Electronic Commerce and Security, 2008 International Symposium on,* 608-611.	TAM*
20	SID0026	1506	Kan Min, & Cheng Dong. (2007). An empirical research on online infomediary based on extension of the technology acceptance model (TAM2). *Management Science and Engineering, 2007. ICMSE 2007. International Conference on,* 40-45.	TAM*

	Appendix A (cont.)			
21	SID0027	1510	Ya-Yueh Shih, Chen, C. Y., Wu, C. H., Huang, T., & Shiu, S. H. (2010). Adopted intention of mobile commerce from TAM perspective: An empirical study of real estate industry. *Technology Management for Global Economic Growth (PICMET), 2010 Proceedings of PICMET '10:* 1-3.	TAM*
22	SID0028	1511	Dhume, S. M., Pattanshetti, M. Y., Kamble, S. S., & Prasad, T. (2012). Adoption of social media by business education students: Application of technology acceptance model (TAM). *Technology Enhanced Education (ICTEE), 2012 IEEE International Conference on,* 1-10.	TAM*
23	SID0029	1515	Ma Ling, & Ding Lin. (2010). Empirical research of mobile reading consumers' behavior intention. *Multimedia Information Networking and Security (MINES), 2010 International Conference on,* 301-305.	TAM*
24	SID0031	1517	Premchaiswadi, W., Porouhan, P., & Premchaiswadi, N. (2012). An empirical study of the key success factors to adopt e-learning in Thailand. *Information Society (i-Society), 2012 International Conference on,* 333-338.	TAM*

Appendix A (cont.)

25	SID0032	1521	Pei-Lee Teh, & Ahmed, P. K. (2012). Understanding social commerce adoption: An extension of the technology acceptance model. *Management of Innovation and Technology (ICMIT), 2012 IEEE International Conference on*, 359-364.	TAM*
26	SID0033	1524	Chen Yu, Qin Yao, & Liu Jie. (2009). An empirical study on influence factors of the implementation of using genuine software. *Management and Service Science, 2009. MASS '09. International Conference on*, 1-4.	TAM*
27	SID0034	1536	Babar, M. A., Winkler, D., & Biffi, S. (2007). Evaluating the usefulness and ease of use of a groupware tool for the software architecture evaluation process. *Empirical Software Engineering and Measurement, 2007. ESEM 2007. First International Symposium on*, 430-439.	TAM*
28	SID0035	1540	Anandarajan, M., Zaman, M., Qizhi Dai, & Arinze, B. (2010). Generation Y adoption of instant messaging: An examination of the impact of social usefulness and media richness on use richness. *Professional Communication, IEEE Transactions on*, *53*(2), 132-143.	TAM*

	Appendix A (cont.)			
29	SID0036	1546	Cheng-Tsung Lu, & Dauw-Song Zhu. (2010). The study on the determinants of the online consumers' intention to return. *Computer and Information Science (ICIS), 2010 IEEE/ACIS 9th International Conference on,* 289-294.	TAM*
30	SID0037	1547	Young Mo Kang, Chanwoo Cho, & Sungjoo Lee. (2011). Analysis of factors affecting the adoption of smartphones. *Technology Management Conference (ITMC), 2011 IEEE International,* 919-925.	TAM*
31	SID0038	1557	Yan-mei, J., Ya-nan, Z., & Wen-ping, Z. (2011). Decision model research of customers' first online shopping based on reference group influence. *E -Business and E - Government (ICEE), 2011 International Conference on,* 1-8.	TAM*
32	SID0039	1559	Qin Min, & Xu Sheng-hua. (2007). Understanding information technology preadoption and postadoption: An integrated process model. *Management Science and Engineering, 2007. ICMSE 2007. International Conference on,* 239-244.	TAM*
33	SID0040	1567	Hsin-Chih Lin, Kai-Wen Tang, & Hsin-Chih Lai. (2010). User intention and learning effect on an internet-based instruction system: A case study of JoinNet. *Education Technology and Computer (ICETC), 2010 2nd International Conference on, 2* V2-107-V2-111.	TAM*

	Appendix A (cont.)			
34	SID0042	1606	Yung-Ming Li, & Yung-Shao Yen. (2009). Service quality's impact on mobile satisfaction and intention to use 3G service. *System Sciences, 2009. HICSS '09. 42nd Hawaii International Conference on*, 1-10.	TAM*
35	SID0045	1625	Mantymaki, M., & Merikivi, J. (2010). Investigating the drivers of the continuous use of social virtual worlds. *System Sciences (HICSS), 2010 43rd Hawaii International Conference on*, 1-10.	TAM*
36	SID0046	1648	Lai, I. K. W., & Lai, D. C. L. (2010). Negative user adoption behaviors of mobile commerce: An empirical study from Chinese college students. *Supply Chain Management and Information Systems (SCMIS), 2010 8th International Conference on*, 1-6.	UTAUT**
37	SID0047	1749	Chi-Yo Huang, Yi-Fan Lin, & Gwo-Hshiung Tzeng. (2011). A fuzzy DEMATEL based lead user method for deriving factors influencing the acceptance of an innovative technology. *Technology Management in the Energy Smart World (PICMET), 2011 Proceedings of PICMET '11:* 1-9.	TAM*

	Appendix A (cont.)			
38	SID0049	1761	Wang, R., Pan, T., & Cao, Y. (2011). Users' acceptance behavior for m-commerce based on customer perceived value and TAM. *E -Business and E -Government (ICEE), 2011 International Conference on*, 1-4.	TAM*
39	SID0050	1791	ThaeMin Lee, & JongKun Jun. (2005). Contextual perceived usefulness? Toward an understanding of mobile commerce acceptance. *Mobile Business, 2005. ICMB 2005. International Conference on*, 255-261.	TAM*
40	SID0051	1802	Wei-dong Huang, Lei Shi, & Zhe Tong. (2010). Study on the acceptance extended model of virtual items. *Management and Service Science (MASS), 2010 International Conference on*, 1-4.	TAM*
41	SID0052	1833	Morris, M. G., Venkatesh, V., & Ackerman, P. L. (2005). Gender and age differences in employee decisions about new technology: An extension to the theory of planned behavior. *Engineering Management, IEEE Transactions on, 52*(1), 69-84.	TAM*
42	SID0053	1858	Faqih, K. M. S. (2011). Integrating perceived risk and trust with technology acceptance model: An empirical assessment of customers' acceptance of online shopping in Jordan. *Research and Innovation in Information Systems (ICRIIS), 2011 International Conference on*, 1-5.	TAM*

Appendix A (cont.)

43	SID0054	1859	Dauw-Song Zhu, O'Neal, G. S., Zui-Chih Lee, & Yen-Hsun Chen. (2009). The effect of trust and perceived risk on consumers' online purchase intention. *Computational Science and Engineering, 2009. CSE '09. International Conference on, 4* 771-776.	TAM*
44	SID0056	1965	Ma Ling, & Song Xiaofei. (2010). Cognitive factors in adoption of instant messaging: A survey. *Management and Service Science (MASS), 2010 International Conference on,* 1-4.	TAM*
45	SID0057	1966	Jue Zhao, & Weiwei Tan. (2010). E-learning systems adoption across cultures: A comparison study. *E-Product E-Service and E-Entertainment (ICEEE), 2010 International Conference on,* 1-4.	TAM*
46	SID0058	2030	Mohamed, A. H. H. M., Tawfik, H., Norton, L., & Al-Jumeily, D. (2011). e-HTAM: A technology acceptance model for electronic health. *Innovations in Information Technology (IIT), 2011 International Conference on,* 134-138.	TAM*
47	SID0061	2057	Young Hoon Kwak, Park, J., Boo Young Chung, & Ghosh, S. (2012). Understanding end-users' acceptance of enterprise resource planning (ERP) system in project-based sectors. *Engineering Management, IEEE Transactions on, 59*(2), 266-277.	TAM*

	Appendix A (cont.)			
48	SID0062	2063	Yan Liu, Yingwu Chen, & Changfeng Zhou. (2006). Exploring success factors for web-based E-government services: Behavioral perspective from end users. *Information and Communication Technologies, 2006. ICTTA '06. 2nd, 1* 937-942.	TAM*
49	SID0064	2122	Azim, M., Ali, A., & Sattar, J. (2011). Factors influencing adoption of information technology based banking services: A case study of Pakistan. *Frontiers of Information Technology (FIT), 2011,* 45-50.	TAM*
50	SID0066	2128	Maolin Zhang, & Min Yang. (2009). Exploring credit card adoption and usage model of college student: An analysis based on TAM model. *Information Science and Engineering (ICISE), 2009 1st International Conference on,* 2923-2927.	TAM*
51	SID0067	2129	Zhenhua Liu, Qingfei Min, & Shaobo Ji. (2009). An empirical study on mobile banking adoption: The role of trust. *Electronic Commerce and Security, 2009. ISECS '09. Second International Symposium on, 2* 7-13.	TAM*
52	SID0068	2130	I-Hui Hwang, Shang-Jiun Tsai, Chun-Chieh Yu, & Chih-Hsiang Lin. (2011). An empirical study on the factors affecting continuous usage intention of double reinforcement interactive e-portfolio learning system. *Information Technology and Artificial Intelligence Conference (ITAIC), 2011 6th IEEE Joint International, 1* 246-249.	TAM*

	Appendix A (cont.)			
53	SID0069	2133	Feng Xiu-zhen, & Ma Ai-qin. (2009). A study on ICT acceptance model for a virtual team. *Computational Intelligence and Software Engineering, 2009. CiSE 2009. International Conference on,* 1-5.	TAM*
54	SID0071	3452	Kim, T. G., Lee, J. H., & Law, R. (2008). An empirical examination of the acceptance behaviour of hotel front office systems: An extended technology acceptance model. *Tourism Management, 29*(3), 500-513. doi:10.1016/j.tourman.2007.05.016	TAM*
55	SID0073	3456	Schierz, P. G., Schilke, O., & Wirtz, B. W. (2010). Understanding consumer acceptance of mobile payment services: An empirical analysis. *Electronic Commerce Research and Applications, 9*(3), 209-216. doi:10.1016/j.elerap.2009.07.005	TAM*
56	SID0074	3459	Polančič, G., Heričko, M., & Pavlič, L. (2011). Developers' perceptions of object-oriented frameworks – an investigation into the impact of technological and individual characteristics. *Computers in Human Behavior, 27*(2), 730-740. doi:10.1016/j.chb.2010.10.006	TAM*
57	SID0075	3469	Yen, D. C., Wu, C., Cheng, F., & Huang, Y. (2010). Determinants of users' intention to adopt wireless technology: An empirical study by integrating TTF with TAM. *Computers in Human Behavior, 26*(5), 906-915. doi:10.1016/j.chb.2010.02.005	TAM*

	Appendix A (cont.)			
58	SID0076	3472	Oum, S., & Han, D. (2011). An empirical study of the determinants of the intention to participate in user-created contents (UCC) services. *Expert Systems with Applications, 38*(12), 15110-15121. doi:10.1016/j.eswa.2011.05.098	TAM*
59	SID0077	3473	Wu, J., & Wang, S. (2005). What drives mobile commerce?: An empirical evaluation of the revised technology acceptance model. *Information & Management, 42*(5), 719-729. doi:10.1016/j.im.2004.07.001	TAM*
60	SID0078	3474	Cheung, R., & Vogel, D. (2013). Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. *Computers & Education, 63*(0), 160-175. doi:10.1016/j.compedu.2012.12.003	TAM*
61	SID0079	3481	Shih, H. (2004). An empirical study on predicting user acceptance of e-shopping on the web. *Information & Management, 41*(3), 351-368. doi:10.1016/S0378-7206(03)00079-X	TAM*
62	SID0080	3479	Al-Somali, S. A., Gholami, R., & Clegg, B. (2009). An investigation into the acceptance of online banking in Saudi Arabia. *Technovation, 29*(2), 130-141. doi:10.1016/j.technovation.2008.07.004	TAM*

Appendix A (cont.)

63	SID0081	3481	Shih, H. (2004). Extended technology acceptance model of internet utilization behavior. *Information & Management, 41*(6), 719-729. doi:10.1016/j.im.2003.08.009	TAM*
64	SID0082	3483	Hsu, M. K., Wang, S. W., & Chiu, K. K. (2009). Computer attitude, statistics anxiety and self-efficacy on statistical software adoption behavior: An empirical study of online MBA learners. *Computers in Human Behavior, 25*(2), 412-420. doi:10.1016/j.chb.2008.10.003	TAM*
65	SID0083	3489	Kwon, O., & Wen, Y. (2010). An empirical study of the factors affecting social network service use. *Computers in Human Behavior, 26*(2), 254-263. doi:10.1016/j.chb.2009.04.011	TAM*
66	SID0084	3492	Al-Gahtani, S. S. (2011). Modeling the electronic transactions acceptance using an extended technology acceptance model. *Applied Computing and Informatics, 9*(1), 47-77. doi:10.1016/j.aci.2009.04.001	TAM*
67	SID0085	3494	Chang, I., Li, Y., Hung, W., & Hwang, H. (2005). An empirical study on the impact of quality antecedents on tax payers' acceptance of internet tax-filing systems. *Government Information Quarterly, 22*(3), 389-410. doi:10.1016/j.giq.2005.05.002	TAM*

	Appendix A (cont.)			
68	SID0086	3497	Polančič, G., Heričko, M., & Rozman, I. (2010). An empirical examination of application frameworks success based on technology acceptance model. *Journal of Systems and Software, 83*(4), 574-584. doi:10.1016/j.jss.2009.10.036	TAM*
69	SID0087	3501	Pontiggia, A., & Virili, F. (2010). Network effects in technology acceptance: Laboratory experimental evidence. *International Journal of Information Management, 30*(1), 68-77. doi:10.1016/j.ijinfomgt.2009.07.001	TAM*
70	SID0088	3505	Melas, C. D., Zampetakis, L. A., Dimopoulou, A., & Moustakis, V. (2011). Modeling the acceptance of clinical information systems among hospital medical staff: An extended TAM model. *Journal of Biomedical Informatics, 44*(4), 553-564. doi:10.1016/j.jbi.2011.01.009	TAM*
71	SID0089	3509	Chen, C., Fan, Y., & Farn, C. (2007). Predicting electronic toll collection service adoption: An integration of the technology acceptance model and the theory of planned behavior. *Transportation Research Part C: Emerging Technologies, 15*(5), 300-311. doi:10.1016/j.trc.2007.04.004	TAM*
72	SID0090	3513	Hsu, C., & Lu, H. (2004). Why do people play on-line games? An extended TAM with social influences and flow experience. *Information & Management, 41*(7), 853-868. doi:10.1016/j.im.2003.08.014	TAM*

Appendix A (cont.)

73	SID0286	3650	Kijsanayotin, B., Pannarunothai, S., & Speedie, S. M. (2009). Factors influencing health information technology adoption in Thailand's community health centers: Applying the UTAUT model. *International Journal of Medical Informatics, 78*(6), 404-416. doi:10.1016/j.ijmedinf.2008.12.005	UTAUT**
74	SID0287	3652	Pai, J., & Tu, F. (2011). The acceptance and use of customer relationship management (CRM) systems: An empirical study of distribution service industry in Taiwan. *Expert Systems with Applications, 38*(1), 579-584. doi:10.1016/j.eswa.2010.07.005	UTAUT**
75	SID0288	3663	San Martín, H., & Herrero, Á. (2012). Influence of the user's psychological factors on the online purchase intention in rural tourism: Integrating innovativeness to the UTAUT framework. *Tourism Management, 33*(2), 341-350. doi:10.1016/j.tourman.2011.04.003	UTAUT**
76	SID0289	3671	Lee, C., Yen, D. C., Peng, K., & Wu, H. (2010). The influence of change agents' behavioral intention on the usage of the activity based costing/management system and firm performance: The perspective of unified theory of acceptance and use of technology. *Advances in Accounting, 26*(2), 314-324. doi:10.1016/j.adiac.2010.08.006	UTAUT**

	Appendix A (cont.)			
77	SID0290	3675	Chan, F. T. S., Yee-Loong Chong, A., & Zhou, L. (2012). An empirical investigation of factors affecting e-collaboration diffusion in SMEs. *International Journal of Production Economics, 138*(2), 329-344. doi:10.1016/j.ijpe.2012.04.004	UTAUT**
78	SID0291	3681	Chen, J. (2011). The effects of education compatibility and technological expectancy on e-learning acceptance. *Computers & Education, 57*(2), 1501-1511. doi:10.1016/j.compedu.2011.02.009	UTAUT**
79	SID0293	3688	Schaupp, L. C., Carter, L., & McBride, M. E. (2010). E-file adoption: A study of U.S. taxpayers' intentions. *Computers in Human Behavior, 26*(4), 636-644. doi:10.1016/j.chb.2009.12.017	UTAUT**
80	SID0294	3704	Schaper, L. K., & Pervan, G. P. (2007). ICT and OTs: A model of information and communication technology acceptance and utilisation by occupational therapists. *International Journal of Medical Informatics, 76, Supplement 1*(0), S212-S221. doi:10.1016/j.ijmedinf.2006.05.028	UTAUT**
81	SID0295	3709	Im, I., Kim, Y., & Han, H. (2008). The effects of perceived risk and technology type on users' acceptance of technologies. *Information & Management, 45*(1), 1-9. doi:10.1016/j.im.2007.03.005	TAM*

	Appendix A (cont.)			
82	SID0137	4223	Ozkan, S., & Kanat, I. E. (2011). E-government adoption model based on theory of planned behavior: Empirical validation. *Government Information Quarterly, 28*(4), 503-513. doi:10.1016/j.giq.2010.10.007	TAM*
83	SID0296	4358	Wu, L. (2012). An empirical research on poor rural agricultural information technology services to adopt. *Procedia Engineering, 29*(0), 1578-1583. doi:10.1016/j.proeng.2012.01.176	UTAUT**
84	SID0309	5193	Moghavvemi, S., Salleh, N. A. M., Zhao, W. J., & Mattila, M. (2012). The entrepreneur's perception on information technology innovation adoption: An empirical analysis of the role of precipitating events on usage behavior. *Innovation-Management Policy & Practice, 14*(2), 231-246.	UTAUT**

*TAM or any of its variants or revisions (TAM-r, TAM2, and TAM3) was studied.

**UTAUT or any of its variants or revisions (UTAUT2) was studied.

Appendix B: Coding Protocol (Study Level)

Descriptor ID	SD01	SD02	SD03	SD04	SD05	SD06	SD07	SD08	SD09	SD10	SD11	SD12	SD13	SD14	SD15
Descriptor Code	[STUDYID]	[AUTHOR]	[PUBYEAR]	[PUBTITLE]	[PUBTYPE]	[SGENDER]	[SMAGE]	[SOCCUPY]	[SCULTURE]	[SXP]	[SSIZE]	[ISCONTXT]	[ISVOLUN]	[MODEL]	[CNSTRCTS]
Descriptor	Study ID	Author	Publication Year	Title of Publication	Type of Publication	Gender of Sample [g]	Mean Age of Sample [a]	Occupation of Sample	Culture Context of Sample	Prior Experience of Sample [e]	Sample Size	Technology Context	Technology Voluntariness [v]	Acceptance Model Studied	Pairwise Constructs Studied
SD01Ω. Study ID															
SD02Ω. Author															
SD03Ω. Year															
SD04Ω. Title															
SD05a. Book															
SD05b. Journal															
SD05c. Proceedings															
SD05d. Dissertation															
SD05e. Thesis															
SD05f. Technical Report															
SD05g. Other															

Appendix B (cont.)															
SD06a. Female															
SD06b. Male															
SD06c. Mixed/Unknown															
SD07Ω. Mean Age															
SD08a. Student															
SD08b. Non-Student															
SD08c. Mixed/Unknown															
SD09a. High Context															
SD09b. Low Context															
SD09c. Mixed/Unknown															
SD10a. Experienced															
SD10b. Inexperienced															
SD10c. Mixed/Unknown															
SD11Ω. Sample Size															
SD12a. Utilitarian															
SD12b. Hedonic															
SD12c. Mixed/Unknown															
SD13b. Voluntary															
SD13c. Mixed/Unknown															
SD14a. TAM															
SD14b. TAM2															
SD14c. TAM3															
SD14d. UTAUT															
SD14e. UTAUT2															
SD14f. Other															
SD15a. PEU-PU															

Appendix B (cont.)															
SD15b. PEU-ATT															
SD15c. PU-ATT															
SD15d. PU-BI															
SD15e. BI-U															
SD15f. PEU-BI															
SD15g. SN-PU															
SD15h. SN-BI															
SD15i. SN-IMG															
SD15j. IMG-PU															
SD15k. REL-PU															
SD15l. OQ-PU															
SD15m. RES-PU															
SD15n. CSE-PEU															
SD15o. PEC-PEU															
SD15p. CANX-PEU															
SD15q. CPLAY-PEU															
SD15r. ENJ-PEU															
SD15s. OU-PEU															
SD15t. PE-BI															
SD15u. EE-BI															
SD15v. SI-BI															
SD15w. FC-BI															
SD15x. FC-U															
SD15y. HM-BI															
SD15z. PV-BI															
SD15aa. HT-BI															
SD15ab. HT-U															

Appendix C: Coding Protocol (Effect Size Level)

Descriptor ID	**SD01**	**ED01**	**ED02**	**ED03**	**ED04**	**SD11**	**ED05**	**ED06**	**ED07**	**ED08**	**ED09**	**ED10**	**ED11**
Descriptor Code	**[STUDYID]**	**[ESID]**	**[PAIRWISE]**	**[ESTYPE]**	**[PAGENUM]**	**[SSIZE]**	**[MEAN]**	**[STDEV]**	**[TVALUE]**	**[FVALUE]**	**[CHISQVAL]**	**[ES]**	**[RELMSR]**
Descriptor	**Study ID**	**Effect Size ID**	**Pairwise Construct**	**Type of Effect Size**	**Page Number of Effect Size**	**Sample Size**	**Mean(s)**	**Standard Deviation(s)**	**t-Value**	**F-Value**	**Chi-Square Value**	**Effect Size**	**Reliability of Outcome Measure**
SD01Ω. Study ID													
ED01Ω. Effect Size ID													
ED02Ω. Pairwise Construct													
ED03a. Correlation and Sample Size													
ED03b. Correlation and Standard Error													
ED03c. Correlation and Variance													
ED03d. Standardized Regression Coefficient (Beta Value) and Sample Size													

Appendix C (cont.)													
ED03e. Standardized Regression Coefficient (Beta Value) and Standard Error													
ED03f. Standardized Regression Coefficient (Beta Value) and Variance													
ED03g. Fisher's Z and Sample Size													
ED03h. Fisher's Z and Standard Error													
ED03i. Fisher's Z and Variance													
ED03j. Correlation and t-Value													
ED03k. t-Value and Sample Size for Correlation													
ED03l. p-Value and Sample Size for Correlation													
ED03m. Raw Difference in Means in and Confidence Limits (independent groups)													
ED03n. Raw Difference in Means and Standard Error (independent groups)													
ED03o. Raw Difference in Means and Variance (independent groups)													
ED03p. Cohen's d and Confidence Limit													
ED03r. Cohen's d and Standard Error													
ED03s. Cohen's d and Variance													
ED03t. Hedges' g and Confidence Limit													
ED03u. Hedges' g and Standard Error													
ED03v. Hedges' g and Variance													
ED03w. Raw Mean Difference and Confidence Limit (paired study)													

Appendix C (cont.)													
ED03x. Raw Mean Difference and Standard Error (paired study)													
ED03y. Raw Mean Difference and Variance (paired study)													
ED03z. Mean, SD, and Sample Size in Each Group													
ED03aa. Difference in Means, Common SD, and Sample Size													
ED03ab. Cohen's d and Sample Size													
ED03ac. Means, Sample Size, and t-Value													
ED03ad. Difference in Means, Sample Size, and t-Value													
ED03ae. Sample Size and t-Value													
ED03af. Means, Sample Size, and p-Value													
ED03ag. Difference in Means, Sample Size, and p-Value													
ED03ah. Sample Size and p-Value													
ED03ai. Means, SD Pre and Post, N, in Each Group, Pre/Post Correlation													
ED03aj. Means, SD Difference, N, in Each Group, Pre/Post Correlation													
ED03ak. Means Pre and Post in Each Group, t within Groups, N													
ED03al. Means Pre and Post in Each Group, p within Groups, N													
ED03am. Means Pre and Post in Each Group, F for Difference Between Changes, N													

Appendix C (cont.)													
ED03an. Mean Change, SD Pre and Post, N, in Each Group, Pre/Post Correlation													
ED03ao. Mean Change, SD Difference, N, in Each Group, Pre/Post Correlation													
ED03ap. Mean Change in Each Group, t within Groups, N													
ED03ar. Mean Change in Each Group, p within Groups, N													
ED03as. Mean Change in Each Group, F for Difference Between Changes, N													
ED03at. F for Difference Between Changes, N													
ED03au. Mean Difference, SD of Difference, and Sample Size													
ED03av. Means, SD Pre, SD Post, Pre/Post Correlation, and Sample Size													
ED03aw. Means, Sample Size, and Paired t-Value													
ED03ax. Means, Sample Size, and Paired p-Value													
ED03ay. Mean Difference, Sample Size, and t-Value													
ED03az. Mean Difference, Sample Size, and p-Value													
ED03ba. Sample Size and t-Value from Paired t-Test													
ED03bb. Sample Size and p-Value from Paired t-Test													
ED04Ω. Page Number													
SD11Ω. Sample Size													
ED05Ω. Mean(s)													

Appendix C (cont.)													
ED06Ω. Standard Deviation(s)													
ED07Ω. t-Value													
ED08Ω. F-Value													
ED09Ω. Chi-Square Value													
ED010Ω. Effect Size													
ED011a. Sufficient													
ED011b. Insufficient													
ED011c. Unreported													

Appendix D: Search Terms and Strings Formulation

No	Group	Search Term	Search Set	Library Code	Library*
1	a	Measurement	(a1 **OR** a2 **OR** a3) **AND** (b4)	*01*	*IEEE Xplore*
2	a	Measure	(a1 **OR** a2 **OR** a3) **AND** (c5 **OR** c6 **OR** n23 **OR** n24 **OR** o25 **OR** p26)	*02*	*ScienceDirect*
3	a	Empirical	(a1 **OR** a2 **OR** a3) **AND** (d7 **OR** d8 **OR** d9)	*03*	*Web of Science*
4	b	Technology Acceptance Model	(a1 **OR** a2 **OR** a3) **AND** (e10)	*04*	*JSTOR*
5	c	TAM Revision	(a1 **OR** a2 **OR** a3) **AND** (j17 **OR** j18 **OR** k19) **AND** (l20)	*05*	*ACM Digital Library*
6	c	TAM Variant	(a1 **OR** a2 **OR** a3) **AND** (j17 **OR** j18 **OR** k19) **AND** (m21 **OR** m22)	*06*	*Google Scholar*
7	d	Technology Acceptance	(f11 **OR** g12 **OR** g13 **OR** h14 **OR** h15 **OR** i16) **AND** (b4)	*07*	*CiteSeerX*
8	d	Acceptance	(f11 **OR** g12 **OR** g13 **OR** h14 **OR** h15 **OR** i16) **AND** (c5 **OR** c6 **OR** n23 **OR** n24 **OR** o25 **OR** p26)		
9	d	User Acceptance	(f11 **OR** g12 **OR** g13 **OR** h14 **OR** h15 **OR** i16) **AND** (d7 **OR** d8 **OR** d9)		
10	e	TAM Constructs	(f11 **OR** g12 **OR** g13 **OR** h14 **OR** h15 **OR** i16) **AND** (e10)		
11	f	Structural Relationship	(f11 **OR** g12 **OR** g13 **OR** h14 **OR** h15 **OR** i16) **AND** (j17 **OR** j18 **OR** k19) **AND** (l20)		
12	g	Correlation Coefficient	(f11 **OR** g12 **OR** g13 **OR** h14 **OR** h15 **OR** i16) **AND** (j17 **OR** j18 **OR** k19) **AND** (l20)		
13	g	Pearson-Moment			
14	h	Correlation Matrix			
15	h	Correlation Matrices			
16	i	Effect Size			
17	J	Perceived Ease of Use			

	Appendix D (cont.)				
18	J	Ease of Use			
19	k	Perceived Usefulness			
20	l	Behavioral Intention			
21	m	Actual Use			
22	m	Actual Usage			
23	n	Unified Theory of Acceptance and Use of Technology			
24	n	UTAUT			
25	o	Consumer Acceptance of Technology			
26	p	TAM2			
*A total of twelve search sets were queried on each of these seven digital libraries.					

Appendix E: Search Parameters by Library

Library / Parameter	**IEEE Xplore**	**ScienceDirect**	**Web of Science**	**JSTOR**	**ACM Digital Library**	**Google Scholar**	**CiteSeerX**
Search in	Search in: Meta Data and Full Text	Search in: Full Text and Abstract	Search in: Topic (TS) and Title (TI)	Search in: Full Text	Search in: Full Text	Search in: ALL	Search in: Full Text
Returned results for	Returned Results for: My Subscribed Content	Returned Results for: ALL	Returned Results for: ALL	Returned Results for: Only Content I Can Access	Returned Results for: ALL	Returned Results for: ALL	Returned Results for: ALL
Content type	Content Type: ALL (Conference Publications; Journals and Magazines; Standards; Early Access Articles)	Content Type: JOURNALS (Article; Review Article; Short Survey; Short Communication)	Content Type: Article; Abstract or Published Item; Proceedings Paper	Content Type (Item Type): Articles	Content Type: Article; Proceedings Paper	Content Type: ALL	Content Type: ALL
Topic	Topic: FILTERED (NARROW BY: Computing & Processing; Communication, Networking & Broadcasting; General Topics for Engineers; Engineering Profession)	Topic: FILTERED (EXCLUDE: Child; Delta; Mental Health; Supply Chain; Simulated Annealing; World Bank; Climate Change; Markov Chain; Eating Disorder; HIV; Theta; Chronic Pain; PTSD; Line Auction; Perceived Risk; Social Support; Social Anxiety; Body Image; Emotion	Topic (Research Areas): UNFILTERED	Topic (Discipline and/or Publication Title): FILTERED (NARROW BY: Business; Classical Studies; Development Studies; Economics; Education; General Science; History of Science & Technology;	Topic: UNFILTERED	Topic: UNFILTERED	Topic: UNFILTERED

	Appendix E (cont.)	Regulation; OCD; Transformational Leadership; MDS)		Management & Organizational Behavior; Marketing & Advertising; Population Studies; Psychology; Sociology)			
Subject	Subject: UNFILTERED	Subject: FILTERED (NARROW BY: Business, Management & Accounting; Computer Science; Engineering; Psychology; Social Sciences)	Subject (Web of Science Categories): UNFILTERED	Subject: UNFILTERED	Subject: UNFILTERED	Subject: UNFILTERED	Subject: UNFILTERED
Sort by	Sort by: RELEVANCE	Sort by: RELEVANCE	Sort by: RELEVANCE	Sort by: RELEVANCE	Sort by: RELEVANCE	Sort by: RELEVANCE	Sort by: RELEVANCE
Publication	Journal: UNFILTERED	Journal: FILTERED (EXCLUDE: Energy Policy; Personality and Individual Differences; European Journal of Operational Research; Nuclear Engineering and Design; Clinical Psychology Review; International Journal of Production Economics; Social Science and Medicine; World Development; Marine Policy; Accounting, Organizations and Society; Accident Analysis & Prevention;	Journal: UNFILTERED	Journal: UNFILTERED	Journal: UNFILTERED	Journal: UNFILTERED	Journal: UNFILTERED

	Appendix E (cont.)	International Journal of Nursing Studies; Journal of Adolescent Health; Tourism Management; International Journal of Hospitality Management; Journal of Retailing and Consumer Services; Automation in Construction; Social Science & Medicine; Behavior Therapy; PAIN; Psychiatry Research; Journal of Anxiety Disorders; Journal of Research in Personality; Journal of Adolescence; Journal of School Psychology; Journal of Psychosomatic Research; Journal of Applied Developmental Psychology; Body Image; Journal of the American Academy of Child & Adolescent Psychiatry; Early Childhood Research Quarterly; Journal of Clinical Epidemiology; Child Abuse & Neglect; Addictive Behaviors; Journal of Substance Abuse Treatment; Comprehensive Psychiatry; Psychology					

	Appendix E (cont.)	of Sport and Exercise; Journal of Criminal Justice; Children and Youth Services Review)					

Appendix F: Filtered Search Results

Search Set No	Query	IEEE Xplore	ScienceDirect	Web of Science	JSTOR	ACM Digital Library	Google Scholar	CiteSeerX	
1	(a1 **OR** a2 **OR** a3) **AND** (b4)	Conf. Pub: 1397 Journals & Magazines: 97 Early Access Articles: 1 Standards: 0 Total: 1495 (200)	Conf. Pub: 0 Journals: 1738 Early Access Articles: 0 Standards: 0 Total: 1738 (197)	Conf. Pub: 142 Journals: 419 Early Access Articles: 0 Standards: 0 Total: 552 (200)	Conf. Pub: 0 Journals: 102 Early Access Articles: 0 Standards: 0 Total: 102 (200)	Conf. Pub: 83 Journals: 63 Early Access Articles: 0 Standards: 0 Total: 152 (144)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 17100 (196)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 191 (144)	
2	(a1 **OR** a2 **OR** a3) **AND** (c5 **OR** c6 **OR** n23 **OR** n24 **OR** o25 **OR** p26)	Conf. Pub: 356 Journals & Magazines: 13 Early Access Articles: 0 Standards: 0 Total: 369 (71)	Conf. Pub: 0 Journals: 308 Early Access Articles: 0 Standards: 0 Total: 308 (65)	Conf. Pub: 26 Journals: 43 Early Access Articles: 0 Standards: 0 Total: 67 (60)	Conf. Pub: 0 Journals: 70 Early Access Articles: 0 Standards: 0 Total: 70 (0)	Conf. Pub: 0 Journals: 0 Early Access Articles: 0 Standards: 0 Total: 0 (0)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 4100 (94)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 85 (26)	

	Appendix F (cont.)								
3	(a1 **OR** a2 **OR** a3) **AND** (d7 **OR** d8 **OR** d9)	Conf. Pub: 25856 Journals & Magazines: 8904 Early Access Articles: 142 Standards: 0 Total: 35186 (36)	Conf. Pub: 0 Journals: 50037 Early Access Articles: 0 Standards: 0 Total: 50037 (29)	Conf. Pub: 1797 Journals: 5177 Early Access Articles: 0 Standards: 0 Total: 6427 (31)	Conf. Pub: 0 Journals: 20355 Early Access Articles: 0 Standards: 0 Total: 20355 (29)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 123 (7)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 1040000 (51)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 160766 (31)	
4	(a1 **OR** a2 **OR** a3) **AND** (e10)	Conf. Pub: 40 Journals & Magazines: 7 Early Access Articles: 0 Standards: 0 Total: 47 (30)	Conf. Pub: 0 Journals: 115 Early Access Articles: 0 Standards: 0 Total: 115 (37)	Conf. Pub: 4 Journals: 8 Early Access Articles: 0 Standards: 0 Total: 12 (10)	Conf. Pub: 0 Journals: 4 Early Access Articles: 0 Standards: 0 Total: 4 (0)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 16 (9)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 889 (63)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 24 (4)	
5	(a1 **OR** a2 **OR** a3) **AND** (j17 **OR** j18 **OR** k19) **AND** (l20)	Conf. Pub: 551 Journals & Magazines: 31 Early Access Articles: 0 Standards: 0 Total: 582 (23)	Conf. Pub: 0 Journals: 999 Early Access Articles: 0 Standards: 0 Total: 999 (32)	Conf. Pub: 17 Journals: 59 Early Access Articles: 0 Standards: 0 Total: 75 (37)	Conf. Pub: 0 Journals: 43 Early Access Articles: 0 Standards: 0 Total: 43 (29)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 57 (1)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 6680 (41)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 70 (14)	

	Appendix F (cont.)								
6	(a1 **OR** a2 **OR** a3) **AND** (j17 **OR** j18 **OR** k19) **AND** (m21 **OR** m22)	Conf. Pub: 437 Journals & Magazines: 66 Early Access Articles: 0 Standards: 7 Total: 510 (32)	Conf. Pub: 0 Journals: 780 Early Access Articles: 0 Standards: 0 Total: 780 (30)	Conf. Pub: 6 Journals: 23 Early Access Articles: 0 Standards: 0 Total: 29 (20)	Conf. Pub: 0 Journals: 58 Early Access Articles: 0 Standards: 0 Total: 58 (0)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 6 (0)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 9720 (64)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 260 (30)	
7	(f12 **OR** g13 **OR** g14 **OR** h15 **OR** h16 **OR** i17) **AND** (b4)	Conf. Pub: 183 Journals & Magazines: 23 Early Access Articles: 1 Standards: 0 Total: 207 (51)	Conf. Pub: 0 Journals: 591 Early Access Articles: 0 Standards: 0 Total: 591 (42)	Conf. Pub: 0 Journals: 4 Early Access Articles: 0 Standards: 0 Total: 4 (4)	Conf. Pub: 0 Journals: 34 Early Access Articles: 0 Standards: 0 Total: 34 (29)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 35 (7)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 3530 (67)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 17 (0)	
8	(f12 **OR** g13 **OR** g14 **OR** h15 **OR** h16 **OR** i17) **AND** (c5 **OR** c6 **OR** n23 **OR** n24 **OR** o25 **OR** p26)	Conf. Pub: 27 Journals & Magazines: 2 Early Access Articles: 0 Standards: 0 Total: 29 (10)	Conf. Pub: 0 Journals: 106 Early Access Articles: 0 Standards: 0 Total: 106 (37)	Conf. Pub: 0 Journals: 0 Early Access Articles: 0 Standards: 0 Total: 0 (0)	Conf. Pub: 0 Journals: 14 Early Access Articles: 0 Standards: 0 Total: 14 (0)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 7 (2)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 705 (78)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 6 (0)	

	Appendix F (cont.)								
9	(f12 **OR** g13 **OR** g14 **OR** h15 **OR** h16 **OR** i17) **AND** (d7 **OR** d8 **OR** d9)	Conf. Pub: 1001 Journals & Magazines: 310 Early Access Articles: 12 Standards: 3 Total: 1326 (12)	Conf. Pub: 0 Journals: 6237 Early Access Articles: 0 Standards: 0 Total: 6237 (19)	Conf. Pub: 18 Journals: 157 Early Access Articles: 0 Standards: 0 Total: 168 (96)	Conf. Pub: 0 Journals: 34 Early Access Articles: 0 Standards: 0 Total: 34 (29)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 59 (12)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 20000 (85)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 8894 (19)	
	(f12 **OR** g13 **OR** g14 **OR** h15 **OR** h16 **OR** i17) **AND** (e10)	Conf. Pub: 8 Journals & Magazines: 3 Early Access Articles: 0 Standards: 0 Total: 11 (0)	Conf. Pub: 0 Journals: 51 Early Access Articles: 0 Standards: 0 Total: 51 (0)	Conf. Pub: 0 Journals: 1 Early Access Articles: 0 Standards: 0 Total: 1 (0)	Conf. Pub: 0 Journals: 15 Early Access Articles: 0 Standards: 0 Total: 15 (0)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 4 (0)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 252 (65)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 3 (0)	
11	(f12 **OR** g13 **OR** g14 **OR** h15 **OR** h16 **OR** i17) **AND** (j17 **OR** j18 **OR** k19) **AND** (l20)	Conf. Pub: 66 Journals & Magazines: 9 Early Access Articles: 0 Standards: 0 Total: 75 (7)	Conf. Pub: 0 Journals: 429 Early Access Articles: 0 Standards: 0 Total: 429 (11)	Conf. Pub: 0 Journals: 3 Early Access Articles: 0 Standards: 0 Total: 3 (0)	Conf. Pub: 0 Journals: 15 Early Access Articles: 0 Standards: 0 Total: 15 (29)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 37 (16)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 1650 (53)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 8 (0)	

	Appendix F (cont.)								
12	(f12 **OR** g13 **OR** g14 **OR** h15 **OR** h16 **OR** i17) **AND** (j17 **OR** j18 **OR** k19) **AND** (l20)	Conf. Pub: 57 Journals & Magazines: 6 Early Access Articles: 0 Standards: 0 Total: 63 (11)	Conf. Pub: 0 Journals: 254 Early Access Articles: 0 Standards: 0 Total: 254 (13)	Conf. Pub: 0 Journals: 0 Early Access Articles: 0 Standards: 0 Total: 0 (0)	Conf. Pub: 0 Journals: 16 Early Access Articles: 0 Standards: 0 Total: 16 (0)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 11 (5)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 1600 (49)	Conf. Pub: - Journals: - Early Access Articles: 0 Standards: 0 Total: 15 (4)	
		TOTAL (after duplication filter): 483	TOTAL (after duplication filter): 512	TOTAL (after duplication filter): 458	TOTAL (after duplication filter): 264	TOTAL (after duplication filter): 203	TOTAL (after duplication filter): 906	TOTAL (after duplication filter): 272	
TOTAL (after aggregate duplication filter)		481	488	354	263	183	649	252	2670
TOTAL (after manual elimination)		**328**	**397**	**220**	**54**	**93**	**455**	**64**	**1611**