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Synthesizing Prior Information Systems Research: Three Essays on the Methods and Applications of Literature Reviews

par
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Synthesizing Prior Information Systems Research: Three Essays on the Methods and Applications of Literature Reviews

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Résumé

La multiplication, l'accumulation et la diffusion rapide des connaissances en Systèmes d'Information (SI) posent de nouveaux défis aux chercheurs, qui doivent développer des techniques efficaces pour organiser et synthétiser les connaissances. Les revues de littérature autonomes répondent à ce besoin d'organiser et de synthétiser les connaissances acquises et offrent de plus des fondations solides pour les recherches scientifiques futures. Ainsi, plusieurs chercheurs en SI préconisent et sollicitent la réalisation d'un plus grand nombre d'articles de synthèse. La qualité méthodologique des revues de littérature est un aspect critique qui doit être considéré aussi bien lors de la réalisation qu'à la lecture de l'article. En effet, l'application d'une approche méthodologique structurée et le suivi de directives spécifiques sont tout aussi nécessaires à la cohérence et la qualité des articles de synthèse que dans le cas d'une étude empirique. Cependant, dans le domaine des SI, les notions de qualité et de rigueur des revues de littérature n'ont reçu que très peu d'attention jusqu'à présent. Cette thèse a donc pour objectif général d'explorer et de mieux comprendre les méthodologies de recherche associées aux revues de littérature autonomes. Cette proposition de thèse comprend trois articles interdépendants. L'objectif du premier article, intitulé *A Framework for Guiding and Evaluating Literature Reviews*, est de développer, pour différentes catégories de revues de littérature, une grille étendue de critères méthodologiques pour permettre aux chercheurs en SI d'évaluer la rigueur des articles de synthèse. Pour ce faire, nous présentons dans un premier temps quatre catégories de revue de littérature et proposons ensuite un ensemble de recommandations regroupées selon les étapes du processus générique de réalisation d'une revue de littérature. Cette grille sera utilisée dans le deuxième article, intitulé *A systematic assessment of rigor in IS literature reviews*, afin d'évaluer dans quelle mesure les revues existantes en SI ont respecté les directives et recommandations proposées par les méthodologistes. Nos résultats soulignent l'importance de justifier de manière explicite le choix du type de revue et de s'assurer qu'il est aligné avec les objectifs de l'étude, ainsi que de décrire de manière détaillée les procédures méthodologiques utilisées pour réaliser la revue. Le troisième article, intitulé *A tutorial for rigorously investigating information system phenomena with meta-analyses*, a pour objectif d'appliquer et d'illustrer, sous la forme d'un tutoriel, l'approche méthodologique de revue méta-analytique avec la réalisation d'une méta-analyse sur les facteurs expliquant l'adoption organisationnelle des innovations technologiques. Pour ce

faire, nous proposons une procédure structurée pour réaliser une méta-analyse en SI. En particulier, notre approche se concentre sur les difficultés majeures rencontrées par les auteurs de méta-analyses en SI, notamment en ce qui concerne le choix du modèle statistique et la compréhension des hypothèses sous-jacentes, l'analyse du biais de publication, et l'évaluation de la diversité et de l'hétérogénéité des données. En conclusion, nous espérons que cette thèse servira de source d'information et d'inspiration à ceux dans notre domaine, chercheurs, évaluateurs, éditeurs ou étudiants, qui souhaitent réaliser, évaluer ou interpréter les articles de synthèse.

Mots-clés: Revue de littérature, article de synthèse, revue de littérature autonome, méthode de revue de littérature, recommandations méthodologiques, systèmes d'information, méta-analyse, qualité des revues de littérature, évaluation de la rigueur.

Abstract

The proliferation, accumulation, and rapid diffusion of information systems (IS) research calls for reliable ways to organize and synthesize knowledge. Stand-alone literature reviews support those needs and provide a valuable account of past research that other researchers might seek out for inspiration and use to position future scientific investigations. Hence, several senior scholars have made calls for more review articles in our field. When conducting, reading or evaluating a review article, a particular attention should be paid to its methodological quality. Indeed, as in the case of empirical research methods, the quality and coherence of a review emerge from the application of a structured approach with specific guidelines. However, within the IS field, the question of what constitutes a rigorous and well conducted review has received little attention until now. Therefore, the general objective of this thesis is to explore and develop a better understanding of the methods associated with stand-alone literature reviews. This thesis is composed of three interrelated essays. The primary objective of the first essay, entitled *A Framework for Guiding and Evaluating Literature Reviews*, is to propose a comprehensive set of guidelines that will assist researchers make proper assessments of the methodological rigor of IS review articles, and highlight those criteria that apply to particular forms of reviews. To do so, we first distinguish between four broad categories of review articles and then propose a set of guidelines that are grouped according to the generic phases and steps of the review process. As a next step, this set of attributes will be applied in the second essay, entitled *A systematic assessment of rigor in IS literature reviews*. The objective is to evaluate the extent to which IS researchers have implemented the various guidelines or criteria when conducting a review article. Our results emphasize the strengths and weaknesses of review practices in IS. In particular, we strongly encourage prospective authors to pay a particular attention to the justification of the choice of the review type and make sure it is aligned with the primary objective(s) of the study, as well as the description of the methodological procedure used to search, identify, and select the relevant studies, as well as to extract and analyze the data. The third essay, entitled *A tutorial for rigorously investigating information system phenomena with meta-analyses*, focuses on one particular review type, namely, meta-analysis. It aims to apply and illustrate, in the form of a tutorial, the methodological guidelines identified in essay 2 to a meta-analysis of the main predictors of organizational adoption of IT. To do so, we propose a structured method for conducting meta-analytic reviews in IS. In particular, our approach focuses on the main challenges for IS meta-analysts and important sources of potential bias that

occur when methodological assumptions are erroneous or overlooked, when publication bias is not investigated and mishandled, or when study diversity or heterogeneity is ignored or incorrectly managed. To conclude, we hope this thesis will serve as a valuable source for those evaluating or interpreting reviews in our field.

Keywords: Literature review, stand-alone review article, research synthesis, review methodology, methodological guidelines, information systems, meta-analysis, review quality, rigor assessment.

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1 Introduction

La recherche en Systèmes d'Information (SI) s'est imposée récemment comme une discipline importante parmi les autres sciences sociales. En effet, dans les 50 dernières années, le domaine a fait preuve d'une maturité croissante (Baskerville et Myers, 2002), soulignée notamment par la multiplication des publications scientifiques relatives au domaine, par l'émergence de journaux et de conférences établis et respectés (Chen et Hirschheim, 2004) ou par le développement de théories et perspectives spécifiques à la discipline (Baskerville et Myers, 2002; Webster et Watson, 2002). Plus récemment, la maturité de la recherche en SI a également été mise en évidence par son établissement en tant que discipline de référence pour des domaines tels que la psychologie, les sciences de l'éducation, le marketing, ou d'autres domaines de la gestion (King et He, 2005; Paré, Trudel et al., 2013b).

Associées à cette évolution, la multiplication, l'accumulation et la diffusion rapide des connaissances posent de nouveaux défis aux chercheurs en SI. Selon Card (2012), un obstacle au progrès scientifique réside en effet dans les ressources et capacités limitées des chercheurs à retenir, organiser et synthétiser les connaissances produites, ainsi que de s'informer des nouvelles avancées scientifiques. Ainsi, l'accès aux articles et travaux de recherche, étendu et simplifié par les bases de données électroniques, crée une abondance d'information scientifique. À l'opposé de l'objectif initial de partage et de diffusion, le phénomène favorise un cloisonnement des connaissances et une spécialisation croissante des chercheurs vers des champs d'intérêts restreints (Card, 2012; Cooper, 2009). Le développement de la connaissance scientifique est le résultat des contributions individuelles de multiples études et recherches, et repose alors sur les principes de collaboration, d'interaction et d'interdépendance (Cooper, 2009). Les revues de littérature jouent un rôle important pour le progrès scientifique d'une discipline. Elles répondent en effet à ce besoin d'organiser et de synthétiser les connaissances acquises et offrent aussi des fondations solides pour les recherches scientifiques futures.

L'évolution rapide du domaine des SI nécessite que les chercheurs développent des techniques efficaces pour organiser et synthétiser les connaissances (Bandara, Miskon, et Fielt, 2011). Ainsi,

lors de la réalisation de revues et synthèses de la littérature, les chercheurs devraient appliquer un ensemble de méthodes, techniques et directives recommandées par les méthodologistes.

1.1 Les types de revues de la littérature et leur rôle dans la recherche en SI

D'un point de vue général, une revue de littérature consiste en la sélection de travaux de recherche antérieurs portant sur un sujet particulier, puis en l'analyse, l'évaluation et la synthèse des informations contenues dans ces documents en relation avec la question de recherche proposée (Hart, 1999). Il existe cependant de nombreuses confusions sur les types de revue de littérature publiées dans le domaine des SI (Paré et al., 2013b). Dans un premier temps, il est important de distinguer deux grands types de revue de littérature : les revues de littérature en tant que section d'une étude empirique et les revues de littérature autonomes (*stand-alone literature reviews*).

Le premier type de revue est la forme la plus fréquente de recension des écrits. On retrouve le plus souvent ce genre de revue en tant que section d'un article empirique ou en tant que chapitre d'un mémoire de maîtrise ou d'une thèse de doctorat. Ces revues de la littérature ont généralement pour objectif principal de décrire les bases conceptuelles et théoriques nécessaires à la réalisation d'une étude empirique. En tant que section d'une étude plus large, ces revues de littérature doivent situer la contribution de l'étude et justifier les approches théoriques et méthodologiques choisies (Levy et Ellis, 2006). Selon Hart (1999), elles permettent également aux chercheurs de mieux comprendre le sujet, d'évaluer l'état de la connaissance, et de découvrir les problèmes clés et les pistes de recherches futures.

Le second type de revue, appelé revue de littérature autonome ou article de synthèse, est une recherche dont l'unique objectif est de synthétiser la littérature, et qui exclut donc la collecte ou l'analyse de nouvelles données empiriques (Okoli et Schabram, 2010). Les revues de littérature autonomes visent souvent plusieurs objectifs distincts mais non nécessairement exclusifs, tels que synthétiser les connaissances existantes sur un sujet particulier, analyser l'évolution d'un domaine de recherche spécifique, définir de nouveaux concepts ou de nouvelles théories, explorer les applications d'une méthode de recherche, valider les résultats d'études antérieures, ou identifier des avenues de recherches futures (Cooper, 2009; King et He, 2005; Okoli et Schabram, 2010; Webster et Watson, 2002).

Tel que mentionné précédemment, plusieurs auteurs reconnaissent que les articles de synthèse jouent un rôle important dans l'évolution et le progrès scientifique d'un domaine. En effet, contrairement aux revues en tant que section d'article, les revues de littérature autonomes n'ont pas pour objectif de servir de fondements à une étude empirique spécifique mais proposent souvent plusieurs pistes potentielles de recherche future et servent ainsi de point de départ ou d'inspiration aux autres chercheurs du domaine (Mulrow, 1987; Paré et al., 2013b). À cet égard, Paré et al. (2013b) identifient plusieurs revues de la littérature devenues des articles clés ou pivots au sein de la discipline des SI, incluant Benbasat et al. (1987), Delone et Mc Lean (1992), Orlikowski et Baroudi (1991), Alavi et Leidner (2001) ou Wade et Hulland (2004). De nombreux chercheurs utilisent les revues de littérature au moment d'entamer une nouvelle étude, pour se faire une meilleure idée du domaine et améliorer leur compréhension du sujet. En conséquence, les articles de synthèse sont souvent largement cités et représentent une importante contribution pour la communauté scientifique (Okoli et Schabram, 2010; Petticrew et Roberts, 2005). Paré et al. (2013b) mentionnent d'ailleurs que des analyses bibliométriques et de citations ont montré que les revues de la littérature deviennent souvent des articles clés au sein de leur discipline. De plus, Ketcham et Crawford (2007) soulignent que plusieurs éditeurs de journaux scientifiques prêtent aux revues de littérature autonomes le potentiel d'augmenter le facteur d'impact et la valeur de leur journal.

Une autre motivation à la réalisation de revues de littérature autonomes provient de sa capacité à synthétiser de manière rigoureuse les connaissances scientifiques accumulées sur un sujet particulier, et à supporter ainsi la pratique fondée sur les preuves (*evidence-based practice*) qui vise dans le domaine des sciences de l'organisation à améliorer notamment les pratiques de gestion, marketing, finance, ressources humaines, et systèmes d'information (Pfeffer et Sutton, 2006; Rousseau, Manning et Denyer, 2008; Reay, Berta et Kohn, 2009). Le mouvement de la pratique fondée sur les preuves est apparu au début des années 1990 en médecine (Montori et Guyatt, 2008) et a pour but d'éclairer les professionnels sur leurs pratiques et de supporter leurs décisions avec des faits prouvés scientifiquement (Oates, 2011). Tel que mentionné par Oates, Edwards and Wainwright (2012), la pratique en gestion des SI devrait être basée sur des résultats et conclusions scientifiques rigoureuses plutôt que sur l'instinct, des croyances ou une tendance populaire. Les revues de littérature autonomes, lorsque réalisées de manière rigoureuse, constituent une source valide d'information non seulement pour les chercheurs, mais aussi pour les praticiens qui souhaitent appuyer leurs décisions et leurs pratiques sur des preuves

scientifiques solides. L'adoption de nouveaux systèmes d'information, le choix des outils et méthodes de développement, ou l'implantation de modèles de gouvernance, sont des exemples de décisions qui peuvent être supportées par ce mouvement (Oates et al., 2012). À cet égard, les articles de synthèse ont le potentiel de réduire certains écarts entre la recherche et la pratique en gestion des SI, notamment les difficultés rencontrées par les professionnels pour accéder à, comprendre et utiliser la littérature scientifique (Pearson, Pearson, et Shim, 2005).

1.2 Limites des revues de littérature autonomes existantes

Malgré les avantages et le potentiel des articles de synthèse mentionnés précédemment, ainsi que leur grande importance dans le progrès scientifique de la discipline des SI, il existe encore peu de revues de littérature autonomes en SI (Bandara et al., 2011). Ce problème a été soulevé par Levy et Ellis (2006) et Webster et Watson (2002), qui stipulent également que le manque d'articles de synthèse dans le domaine des SI a pour effet de ralentir les progrès et l'évolution de la discipline. Ainsi, dans le but de favoriser la synthèse et l'accumulation des connaissances, plusieurs chercheurs en SI préconisent et sollicitent la réalisation d'un plus grand nombre d'articles de synthèse (e.g., King et He, 2005; Watson, 2001; Webster et Watson, 2002; Rowe, 2014). La création en 2001 d'un département dédié à la publication d'articles de synthèse pour la revue *Management Information Systems Quarterly* (MISQ) souligne la pertinence et l'intérêt porté aux revues de littérature autonomes. Dans le cadre de sa mission, le département, renommé par la suite *MISQ Theory and Review*, propose d'améliorer notre compréhension des recherches antérieures et de faciliter la diffusion des connaissances par la publication de revues de littérature rigoureuses et de qualité. Tel que mentionné par Webster et Watson (2002), le département vise à accélérer l'accumulation des connaissances et à proposer de nouvelles orientations pour les recherches futures. Depuis, la création d'un volet dédié à la publication de revues et d'articles théoriques (*Review and Theory Developement*) pour la revue *Journal of the Association for Information Systems*, l'appel à publication de la revue *Communications of the Association for Information Systems* pour une édition spéciale consacrée aux revues de littérature dans le domaine des SI, ainsi que le lancement d'un journal, *Foundations and Trends in Information Systems*, dédié aux articles de synthèses, sont autant de signaux forts qui démontrent l'importance grandissante des revues de littératures pour notre domaine. De manière encourageante, les appels à la réalisation d'un plus grand nombre d'articles de synthèse semblent commencer à porter leurs fruits. Ainsi, Paré, Trudel, Jaana et Kitsiou (à paraître)

observent une augmentation significative du nombre de revues de littérature publiés en SI au cours des 15 dernières années.

Plusieurs raisons peuvent être avancées pour expliquer le manque d'attrait des chercheurs en SI pour la réalisation des revues de littérature autonomes. D'une part, la relative maturité du domaine peut être vue comme un frein à la multiplication des articles de synthèse (Webster et Watson, 2002). En effet, les motivations qui incitent les chercheurs à réaliser une revue de littérature impliquent souvent l'existence d'une littérature abondante, diversifiée, complexe ou contradictoire. Ainsi, un domaine encore jeune tel que celui des SI fournit moins de champs d'applications potentiels pour des articles de synthèse. Cependant, nous soutenons que cette barrière devient moins forte avec l'évolution récente et la maturité observée du domaine des SI, ce qui devrait favoriser l'augmentation du nombre de possibilités pour ce type de revues. Webster et Watson (2002) suggèrent également que certains types d'articles de synthèse, qui proposent le développement de nouveaux concepts ou théories, peuvent aussi contribuer aux courants de recherche nouveaux et émergents. D'autre part, les revues de littérature autonomes demandent un effort et un investissement important de la part des chercheurs (Okoli et Schabram, 2010; Petticrew et Roberts, 2005; Webster et Watson, 2002). Webster et Watson (2002) soulignent notamment que le processus de publication des revues de littérature est souvent plus long comparé aux autres types d'articles scientifiques. Ainsi, le rythme auquel les articles de synthèse sont réalisés puis rendus disponibles au reste de la communauté scientifique ralentit leur diffusion. Finalement, le manque de familiarité des chercheurs en SI avec les méthodologies utilisées pour réaliser des revues de littérature constitue une autre barrière à l'intégration des connaissances et à l'écriture d'articles de synthèse (Webster et Watson, 2002).

Paré et al. (2013b) soulignent que la qualité des revues de littérature est un aspect critique qui doit être considéré aussi bien lors de la réalisation qu'à la lecture de l'article. En effet, considérant que nombre de revues de littérature ont le potentiel de devenir des articles de référence pour un domaine particulier, le critère de rigueur revêt une importance particulière. Ainsi, les chercheurs doivent s'assurer que les résultats de leur revue sont fiables, pertinents et crédibles. La méconnaissance des méthodes associées aux revues de littérature peuvent également avoir un effet néfaste sur la réputation de la méthode que l'on pourrait juger comme étant moins valide ou moins scientifique. À cet égard, les revues de littérature ne différent pas des autres types de méthodologie. En effet, l'application d'une approche méthodologique

structurée et le suivi de directives spécifiques sont tout aussi nécessaires à la cohérence et la qualité des articles de synthèse que dans le cas d'une étude empirique (Cooper, 2009). Selon Paré et al. (2013b), bien que des chercheurs aient proposé des directives et recommandations pour évaluer la qualité de certains types de revues de littérature, les discussions sur la qualité de celles-ci demeurent principalement abstraites et sujettes à la subjectivité et au jugement des évaluateurs et des éditeurs. En particulier, dans le domaine des SI, les notions de qualité et de rigueur des revues de littérature autonomes n'ont reçues que très peu d'attention jusqu'à présent. Ces questions, associées principalement à la qualité et à la rigueur des revues de littérature, servent de cadre au sujet général de cette thèse.

1.3 Objectifs et structure de la thèse

Tel que mentionné précédemment, la synthèse des connaissances acquises est une condition essentielle au développement et au progrès d'une discipline. Ainsi, nous soutenons que le rôle de plus en plus important qu'auront à jouer les revues de littérature en SI nécessite de s'interroger, d'explorer et d'examiner de manière minutieuse cette approche scientifique. Alors que plusieurs chercheurs se sont interrogés sur les contributions, la nature et la forme des revues de littérature autonomes en SI (p.ex., Oates, 2011; Okoli, 2012; Paré et al., à paraître), très peu d'études ont été publiées sur les méthodes associées aux articles de synthèse.

Cette thèse a donc pour objectif général d'explorer et de mieux comprendre les méthodologies de recherche associées aux revues de littérature autonomes. Plus précisément, nous proposons une nouvelle approche méthodologique à la réalisation des revues de littérature autonomes et explorons les pratiques utilisées par les chercheurs en SI lors de la réalisation d'un article de synthèse. Cette thèse comprend trois articles interdépendants. La principale contribution visée par cette thèse, soit celle qui relie entre eux les trois articles qui la composent, est d'ordre méthodologique.

Ainsi, l'article 1 a pour objectif de développer, pour différentes catégories de revues de littérature autonomes, une grille étendue de critères méthodologiques qui permettent d'évaluer la rigueur des articles de synthèse. Cette grille sera utilisée dans l'article 2 qui vise à évaluer la rigueur méthodologique des revues de littérature publiées en SI. Ainsi, cet article s'inscrit dans la continuité du premier puisqu'il propose d'analyser les pratiques des chercheurs en SI et d'évaluer dans quelle mesure les revues existantes ont respecté les critères de rigueur

préalablement identifiés. Ceci explique les redondances importantes qui existent entre les sections d'introduction et de recension des écrits des articles 1 et 2. Pour sa part, le troisième article explore un type particulier de revue de littérature, soit la méta-analyse. Il a pour objectif d'appliquer et d'illustrer, sous la forme d'un tutoriel, cette approche méthodologique avec la réalisation d'une méta-analyse portant sur les facteurs associés à l'adoption organisationnelle des TI. Les liens entre les trois articles qui composent la proposition de thèse sont explicités dans la figure 1.1.

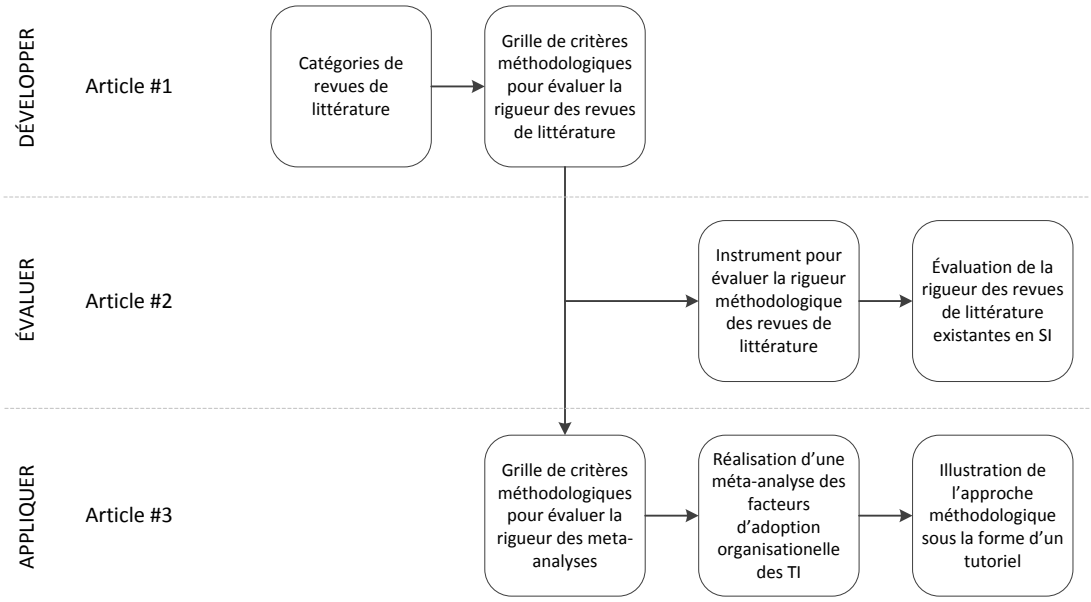

Figure 1.1 - Structure de la thèse

Dans la suite de cette introduction, nous présentons brièvement les objectifs, les cadres conceptuels et méthodologiques et les contributions principales de chacun des trois articles.

1.4 Article #1: A Framework for Guiding and Evaluating Literature Reviews

1.4.1 Objectifs

Tel que mentionné plus tôt, les notions de rigueur et de qualité des revues de littérature autonomes ont reçues peu d'attention dans le domaine des SI. En particulier, les recommandations proposées se concentrent pour la plupart sur un type précis de revue, ou bien ne discutent que d'une étape ou caractéristique de la démarche méthodologique. Plus précisément, les directives et recommandations existantes concernent deux types de revues, soit les revues à objectif de développement théorique (p.ex., Webster et Watson, 2002; Wolfswinkel, Furtmueller, et Wilderom, 2013) et les revues systématiques de la littérature (p. ex., Oates et al., 2012; Okoli et Schabram, 2010). De plus, l'article de vom Brocke, Simons, Niehaves, Riemer, Plattfaut et Cleven (2009) est, à notre connaissance, le seul article discutant les attributs qui contribuent à la rigueur d'une revue de littérature. Cependant, vom Brocke et al. (2009) se concentrent uniquement sur la recherche bibliographique et n'évaluent pas les autres étapes du processus.

Ainsi, le principal objectif de l'article 1 consiste à proposer une grille exhaustive de critères ou d'attributs associés à la rigueur méthodologique des diverses formes de revues de littérature autonomes et de fournir ainsi aux chercheurs en SI un cadre pouvant servir à la fois de guide au développement ou à l'évaluation de celles-ci. Nous soutenons qu'une plus grande attention devrait être portée aux méthodologies associées aux revues de littérature, et plus précisément aux standards de rigueur et de qualité qui s'appliquent à ce type particulier d'articles. Un objectif secondaire associé au développement de la grille de critères est de couvrir et la rendre applicable à toutes les formes de revues de littérature. Ainsi, nous reconnaissons qu'il existe différents types de revues et que certains critères ne s'appliquent qu'à certaines formes particulières de revues.

1.4.2 Bases conceptuelles

Le développement de notre grille de critères s'appuie principalement sur deux bases conceptuelles, soit les catégories de revue de littérature et les étapes du processus de réalisation d'un article de synthèse.

Dans cet article, nous proposons quatre catégories ou familles de revues de littérature qui diffèrent en fonction de leurs objectifs fondamentaux, de leurs motivations et de la manière

dont celles-ci sont réalisées. À cet égard, le présent essai s'inscrit dans la lignée des discussions existantes sur les problèmes méthodologiques des articles de synthèse et qui reconnaissent l'existence de plusieurs types de revues, incluant Cooper (1988), Grant et Booth (2009), Kirkevold (1997), King et He (2005), et Paré et al. (à paraître). À partir de l'analyse des descriptions et définitions proposées dans les articles précédents, nous avons développé quatre catégories de revues, soit : les revues narratives, les revues développementales, les revues cumulatives et les revues agrégatives. La figure 1.2 décrit l'objectif général associé à chacune des quatre catégories de revues. En fonction de leurs objectifs respectifs, les diverses familles de revues diffèrent également en termes d'exigences et de procédures méthodologiques. En effet, comme pour toute méthodologie de recherche, l'approche choisie doit s'appliquer et correspondre aux objectifs visés par la revue.

Tableau 1.1 - Catégories de revues de littérature et objectifs principaux

	Revue narrative	**Revue développementale**	**Revue cumulative**	**Revue agrégative**
Objectif général	Organiser les connaissances actuelles disponibles et identifier les opportunités pour des recherches futures	Développer une approche théorique ou méthodologique innovante sur un domaine d'intérêt particulier	Compiler les preuves, faits et résultats des études existantes et en extraire des conclusions englobantes	Agréger les données des études existantes pour valider des théories ou hypothèses spécifiques
Résultat	Résumé de type narratif de la connaissance portant sur un sujet particulier	Cadre conceptuel, modèle théorique, recommandations méthodologiques, etc.	Portrait d'un courant de recherche spécifique	Validation fondée sur les preuves d'hypothèses ou d'un modèle théorique
Domaine de généralisation	Conclusions généralisables à un échantillon spécifique d'études	Théories, concepts ou approches généralisables à leur domaine d'applicabilité	Conclusions généralisables à une population générale d'études (p.ex., courant de recherche)	Théories ou hypothèses généralisables à une unité d'analyse spécifique

Le processus de réalisation d'une revue de littérature utilisé dans cet article s'appuie sur une adaptation de celui proposé par Okoli et Schabram (2010). En effet, ce processus s'applique à tous les types de revues et non seulement aux revues dites systématiques. Le processus générique proposé pour organiser les critères de rigueur se compose de six étapes, soit (1) la

définition du problème, (2) la recherche de la littérature, (3) le filtrage pour inclusion, (4) l'évaluation de la qualité, (5) l'extraction des données, et (6) l'analyse et la synthèse des données. La figure 1.3 définit chacune des étapes du processus de réalisation d'une revue de littérature.

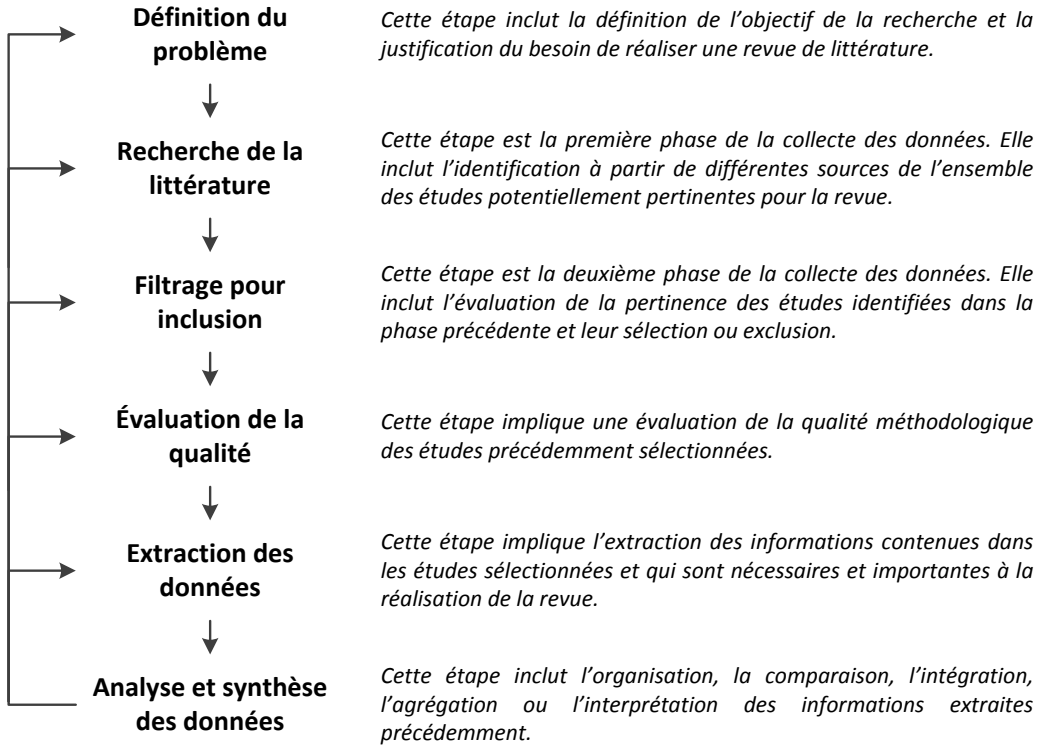

Figure 1.2 - Processus générique de réalisation d'une revue de littérature

1.4.3 Approche méthodologique

L'ensemble des critères proposés dans notre liste ont été identifiés et définis à partir d'une revue des directives et recommandations existantes concernant la réalisation d'un article de synthèse. Plusieurs sources ont été utilisées, incluant une recherche dans la base de données *Web of Knowledge (Thomson Reuters)* et avec le moteur de recherche *Google Scholar*, ainsi qu'une revue des références et citations des articles sélectionnés (i.e., approches ascendante et descendante). L'objectif de cette recherche est d'identifier et de sélectionner un ensemble d'articles clés permettant de couvrir les quatre catégories de revue de littérature et offrant des recommandations pratiques sur comment bien réaliser celles-ci. Au total, 20 références ont été identifiées et minutieusement analysées pour en extraire des recommandations clés.

L'organisation et la synthèse de ces recommandations ont permis d'identifier une grille finale de 19 critères de rigueur qui couvre toutes les étapes du processus de réalisation d'une revue de littérature autonome.

1.4.4 Contributions

La contribution du premier article porte principalement sur l'avancement des connaissances méthodologiques associées aux revues de littérature autonomes. En effet, la grille de critères proposée répond à plusieurs limites, défis et appels à la recherche identifiés dans la littérature. Cette liste devrait ainsi permettre d'améliorer la rigueur et la qualité générale des articles de synthèse et, par conséquent, aider les chercheurs de notre domaine à contribuer aux progrès et à la maturité de la discipline. En résumé, nous pensons, ainsi que Paré et al. (à paraître) et Rowe (2014), que le l'importance grandissante des revues de littérature pour notre domaine nécessite d'y porter une attention particulière. Cet article s'inscrit dans cette ligne d'action et de pensée. Finalement, nous espérons que cet article servira de source d'information et d'inspiration à ceux dans notre domaine, chercheurs, évaluateurs, éditeurs ou étudiants, qui souhaitent réaliser, évaluer ou interpréter les articles de synthèse.

1.5 Article #2: A systematic assessment of rigor in IS literature reviews

1.5.1 Objectifs

Dans les dernières décennies, la notion de rigueur méthodologique a suscité beaucoup d'attention dans le domaine des SI (e.g., Boudreau, Gefen, et Straub, 2001; Dubé et Paré, 2003; Lee et Hubona, 2009; Paré, Cameron et al., 2013a; Pinsonneault et Kraemer, 1993). Cependant, nous connaissons encore peu de chose à propos du niveau de rigueur dans l'utilisation que nous faisons des revues de littérature autonomes. Ainsi, nous proposons d'examiner les pratiques et approches utilisées par les chercheurs en SI lorsqu'ils réalisent ce type de synthèses. En effet, avec l'augmentation observée du nombre de revues de littérature dans les dernières années et le potentiel important de celles-ci pour le progrès et l'évolution du domaine, il devient alors important, voire nécessaire de réfléchir aux pratiques et applications des méthodes de revue de littérature en SI (Paré et al., 2013).

Le principal objectif de cet article est d'évaluer dans quelle mesure les revues de littérature en SI ont adopté et implanté les techniques et pratiques qui, selon les méthodologistes, contribuent à assurer la rigueur et la qualité des revues. Pour ce faire, nous proposons de développer puis de valider un instrument de mesure visant à évaluer le niveau de rigueur méthodologique et de l'appliquer à l'ensemble des articles de synthèse publiés dans le domaine des SI. Cet instrument s'appuie sur la grille de critères proposée dans le premier article.

1.5.2 Approche méthodologique

À partir des conclusions de l'article 1, nous avons développé dans un premier temps un schème de codification qui agit à titre d'instrument de mesure pour évaluer la rigueur méthodologique des revues de littérature. Chacun des 19 critères proposés dans l'article 1 sont représentés dans notre instrument par un ou plusieurs éléments. Nous avons ensuite validé la compréhension et l'utilisation de cet instrument sur un échantillon de cinq revues de littérature incluses dans l'article de Paré et al. (2013b), soit une revue narrative, deux revues développementales, une revue cumulative et une revue de type agrégative.

Par la suite, pour répondre à notre objectif de recherche, nous appliquons l'instrument aux revues de littérature publiées en SI. Pour ce faire, nous avons réalisé une revue de littérature cumulative, c'est-à-dire dont l'objectif est de déterminer dans quelle mesure une population d'études empiriques permet de révéler des configurations ou des tendances relatives à l'objet de recherche (King et He, 2005; Paré et al., à paraître). Nous utilisons comme point de départ à notre recherche d'articles les références incluses dans l'article de Paré et al. (2013b). Cette revue couvre les articles publiés en SI avant Janvier 2012 et disponibles dans la base de données *Web of Knowledge (Thomson Reuters)*. Pour compléter cette recherche d'articles, nous avons réalisé d'une part une mise à jour basée sur les mêmes sources afin d'inclure les articles publiés entre Janvier 2012 et Janvier 2013. D'autre part, tel que recommandé par Shea et al. (2007), nous avons réalisé une recherche complémentaire dans les bases de données *ABI/Inform (Proquest)* et *Business Source Complete (EBSCO)* en utilisant les mêmes critères. Nous avons ensuite sélectionné les articles pertinents en fonction des critères d'inclusion suivants: (1) articles publiés en anglais, (2) articles publiés dans des revues scientifiques arbitrées, (3) articles qui s'intéressent à des problématiques des SI, et (4) articles qui sont des revues de littératures autonomes (p.ex., les articles empiriques, les commentaires et les articles conceptuels ont été exclus).

Notre base de données finale inclut 222 articles de synthèse. Par la suite, nous avons appliqué la grille de codification à chacun des articles sélectionnés pour en extraire les informations pertinentes. Finalement, des statistiques descriptives ont été compilées à partir des données extraites.

1.5.3 Contributions

La contribution du deuxième article porte principalement sur l'avancement des connaissances associées à la rigueur méthodologique des revues de littérature. En effet, nos résultats permettent de souligner les principales forces et faiblesses des différentes revues de littérature ainsi que des pratiques et techniques mises en œuvre. De manière générale, nous pensons que cette étude permettra d'améliorer la rigueur et la qualité globale des articles de synthèse, de favoriser l'utilisation judicieuse des techniques et des bonnes pratiques utilisées par les chercheurs en SI, et d'éliminer certaines erreurs ou défauts rencontrés dans les revues existantes. En particulier, nous encourageons les auteurs de revues de littérature autonomes à :

- Justifier de manière explicite le choix du type de revue et s'assurer qu'il est aligné avec les objectifs de l'étude ;
- Décrire les procédures méthodologiques utilisées pour chercher, identifier, et sélectionner les études pertinentes, ainsi que pour extraire et analyser les données ; en particulier
- Fournir une description détaillée des procédures utilisées pour repérer les études pertinentes et être transparent en ce qui concerne les restrictions appliquées à la recherche de littérature ;
- Fournir la liste des critères d'inclusion et d'exclusion ;
- Fournir en annexe la liste des études incluses, ainsi que la liste des études exclues avec les raisons justifiant leur exclusion ; et
- Documenter dans le détail les procédures d'extraction de données.

Finalement, avec le premier article de cette thèse, nous espérons que cette recherche servira de source d'information et d'inspiration à ceux dans notre domaine qui souhaitent réaliser, évaluer ou interpréter des articles de synthèse.

1.6 Article #3: A tutorial for rigorously investigating information system phenomena with meta-analyses

1.6.1 Objectifs

Selon Webster et Watson (2002), les synthèses de connaissances constituent un mécanisme important associé au développement et au progrès de la discipline des SI. En particulier, King et He (2005) soulignent une tendance et un intérêt grandissant vis-à-vis de l'intégration quantitative des connaissances. À cet égard, la méthode ou l'approche communément appelée méta-analyse est particulièrement utile pour synthétiser de manière quantitative les preuves existantes dans la littérature. La méta-analyse est une forme particulière de revue agrégative, tel que défini dans le premier article. Ainsi, l'objectif des méta-analyses est de valider ou tester des propositions ou hypothèses spécifiques en combinant statistiquement les résultats de plusieurs études empiriques de manière à former une estimation quantitative unique de la valeur d'une relation entre deux variables (Glass, 1976; Paré et al., 2013b). À cet égard, les méta-analyses possèdent de nombreux avantages incluant l'exactitude, la précision et la crédibilité des résultats obtenus (Paré et al., 2013b).

Malgré ces nombreux bénéfices et bien que la méta-analyse soit une des méthodes de revue de littérature les plus utilisées dans certains domaines tels que les sciences médicales, les sciences infirmières, l'éducation ou la psychologie, il existe très peu de méta-analyses dans le domaine des SI (King et He, 2005; Paré et al., 2013b). Comme pour les autres types de revue de littérature, les raisons invoquées pour expliquer le faible nombre de méta-analyse sont le nombre restreint d'application et le manque de connaissances des chercheurs avec les particularités de la méthode (Hwang, 1996; King et He, 2005). Cet article porte plus précisément sur ce second point en rapport avec la méthodologie. En effet, selon King et He (2005), certaines techniques de la méta-analyse utilisée par les chercheurs en SI sont conceptuellement et méthodologiquement erronées. Les résultats du deuxième article ont permis de vérifier cette assertion et de révéler certaines faiblesses et erreurs méthodologiques. L'objectif de rigueur est particulièrement important dans le cas d'une méta-analyse, puisqu'une application erronée ou inappropriée des techniques statistiques peut rendre les résultats invalides ou incohérents (Paré et al., 2013b).

Tel que mentionné plus tôt, le principal objectif de cet article est d'illustrer, sous la forme d'un tutoriel, comment l'approche méthodologique de méta-analyse peut être appliquée de manière

rigoureuse. Pour ce faire, nous réalisons une méta-analyse portant sur les facteurs visant à expliquer l'adoption organisationnelle des innovations technologiques.

1.6.2 Bases conceptuelles

Plusieurs méthodes de méta-analyses ont été proposées dans des disciplines tels que les sciences de l'éducation (e.g., Glass, McGaw, et Smith, 1981; Hedges et Olkin, 1985), les sciences médicales (Liberati et al., 2009; Higgins et Green, 2008; e.g., Borenstein, Hedges, Higgins, et Rothstein, 2011) et la psychologie sociale et clinique (e.g., Cooper, 2009; Hunter et Schmidt, 2004; Lipsey et Wilson, 2001; Rosenthal et DiMatteo, 2001; Rosenthal, 1991). Dans le domaine des SI, il n'existe à notre connaissance que deux références méthodologiques sur la méta-analyse, soient les articles de Hwang (1996) et de King et He (2005). Selon Higgins et Green (2008), la méta-analyse est une forme particulière de revue systématique de la littérature qui utilise des méthodes statistiques plutôt que qualitatives pour synthétiser les résultats d'études antérieures. Ainsi, les recommandations proposées pour les revues dites systématiques (p.ex., Kitchenham et Charters, 2007; Okoli et Schabram, 2010; Oxman et Guyatt, 1988; Oxman, 1994; Shea et al., 2007; Whittemore, 2005) s'appliquent également aux méta-analyses, à l'exception de directives spécifiques concernant l'analyse et la synthèse des résultats.

L'approche méthodologique utilisée pour réaliser notre méta-analyse s'appuie principalement sur l'instrument développé et validé dans les articles 1 et 2 de la présente thèse. L'analyse des références précédentes a permis de raffiner cette approche en y ajoutant des recommandations et directives propres à la méta-analyse.

Les six étapes du processus de réalisation d'une méta-analyse sont semblables à celles présentées dans l'article 1, soit (1) la définition du problème, (2) la recherche de la littérature, (3) le filtrage pour inclusion, (4) l'évaluation de la qualité, (5) l'extraction des données, et (6) l'analyse et la synthèse des données. Tel que mentionné précédemment, les principales nuances concernent l'étape de synthèse et d'analyse des résultats. A cette étape, les chercheurs utilisent des méthodes statistiques pour valider la qualité des données, analyser les biais potentiels et combiner les données extraites. La figure 1.3 décrit la procédure proposée pour la réalisation d'une méta-analyse.

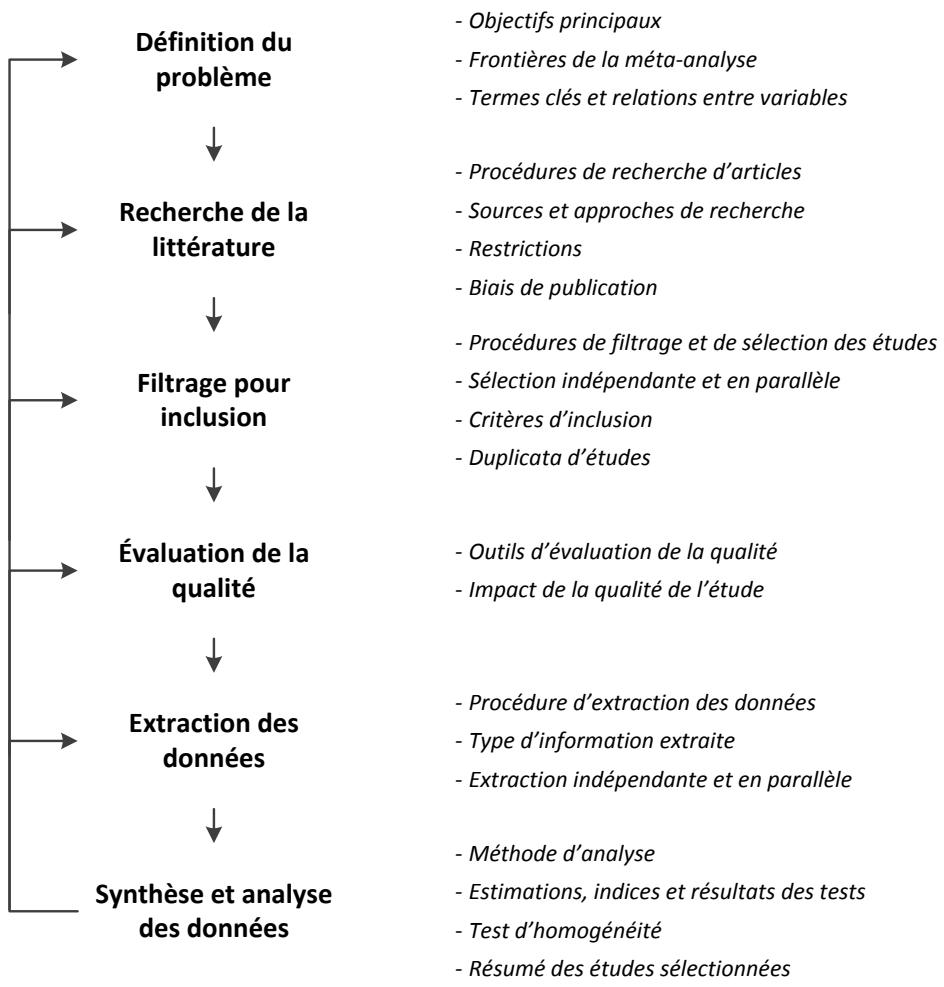

Figure 1.3 - Procédure pour réaliser une méta-analyse en SI

1.6.3 Contributions

La contribution attendue du troisième article porte principalement sur l'avancement des connaissances associées aux techniques et méthodes de recherche pour réaliser une méta-analyse dans le domaine des SI. Suivant les recommandations de King et He (2005), nous proposons une procédure structurée pour réaliser une telle méta-analyse. En particulier, notre approche se concentre sur les difficultés majeures rencontrées par les auteurs de méta-analyses en SI et dans d'autres domaines des sciences de l'organisation, notamment en ce qui concerne le choix du modèle statistique et la compréhension des hypothèses sous-jacentes, l'analyse du biais de publication, et l'évaluation de la diversité et de l'hétérogénéité des données. Nous

recommandons aux auteurs de méta-analyses d'apporter une attention particulière à ces trois éléments, spécialement dans notre domaine.

Nous espérons, à travers le développement de cette approche méthodologique et son illustration, fournir aux chercheurs en SI une meilleure compréhension des méthodes et techniques de la méta-analyse. De plus, nous pensons que cet article permettra d'améliorer la rigueur et la qualité méthodologique des méta-analyses publiées dans notre domaine et de répondre ainsi à l'appel de King et He (2005) sur les erreurs et défauts méthodologiques des méta-analyses antérieures.

Finalement, nous espérons encourager l'utilisation et l'application des techniques de méta-analyse par les chercheurs en SI. Nous sommes en effet convaincu que les méta-analyses ont le potentiel non seulement de synthétiser de manière rigoureuse la littérature existante, mais également de supporter le développement et le progrès théorique prévalant dans notre discipline.

2 Essay #1: A Framework for Guiding and Evaluating Literature Reviews[1]

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2.1 Abstract

Given that the synthesis of cumulated knowledge is an essential condition for any field to grow and develop, we believe that the enhanced role of IS reviews requires that this expository form be given careful scrutiny. Over the past decade, several senior scholars have made calls for more review articles in our field. While the number of IS review articles has substantially increased in recent years, no prior research has attempted to develop a general framework to conduct and evaluate the rigor of stand-alone reviews. This research essay attempts to fill this gap. More precisely, we present a set of guidelines for guiding and evaluating IS literature reviews and specify to which review types they apply. To do so, we first distinguish between four broad categories of review articles and then propose a set of guidelines that are grouped according to the generic phases and steps of the review process. We hope our work will serve as a valuable source for those conducting, evaluating or interpreting reviews in our field.

Keywords: Literature review, stand-alone review article, research synthesis, review methodology, methodological guidelines, review quality.

2.2 Introduction

Although the information systems (IS) field is relatively young compared to other social science disciplines [King and He, 2005], it has grown considerably since the early 1960s. Indeed, the maturity of the domain is evidenced by the increasing volume of published IS research, the emergence of well-established journal outlets [Chen and Hirschheim, 2004], and the development of IS research perspectives and theories [Baskerville and Myers, 2002; Webster and Watson, 2002]. As another sign of maturity, IS has recently become a reference field for studies in psychology, education, marketing and other management domains [King and He, 2005].

However, to further its progress, the domain still needs to consolidate its research tradition. It has become increasingly difficult for researchers to remain knowledgeable of the many aspects of IS research. According to Card [2012], one obstacle to scientific progress is that researchers are limited in their ability to retain, organize and synthesize earlier knowledge while staying abreast of new scientific contributions. Similarly, Cooper [2009] has noticed that an increased quantity of scientific inquiry has resulted in growing specialization within the social sciences. As a result, "time constraints make it impossible for most social scientists to keep up with primary research except within a few topic areas of special interest to them" [Cooper, 2009, p. 2]. Since individual studies incrementally contribute to a larger understanding of a phenomenon of interest, the building of scientific knowledge requires cooperation and interdependent research work [Cooper, 2009]. By uncovering prior knowledge, literature reviews offer foundations for further scientific research and are thus essential to the development of any field. In the IS domain, the increasing amount of research and its rapid diffusion also call for reliable ways of integrating the findings of prior studies [Bandara, Miskon and Fielt, 2011]. In this era of information overload, it is therefore essential that IS researchers engage in the process of research synthesis.

Hart [1999] defines a literature review as "the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfill certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed" (p. 13). A literature review can either serve as the background for an empirical study or as an independent, stand-alone piece that provides a valuable contribution

in its own right [Jesson, Matheson and Lacey, 2011; Okoli and Schabram, 2010]. The former, which can consist of a section in a journal article or a chapter in a graduate thesis, is the most common type of review. The purpose of the review section or chapter is to help a researcher "acquire an understanding of [the] topic, of what has already been done on it, how it has been researched, and what the key issues are" [Hart, 1999, p. 1]. In addition, the background section helps to contextualize the study's contributions and justify an approach, research methods, tools, questions and methods [Levy and Ellis, 2006a].

The second type, called here stand-alone literature review, is a "journal-length article whose sole purpose is to review the literature in a field, without any primary data […] collected or analyzed" [Okoli and Schabram, 2010, p. 2]. Such reviews are conducted for many different purposes, e.g., to make sense of existing knowledge on a particular topic, facilitate theory development, synthesize the extant literature on widely studied and mature areas, or identify research domains where further investigation is needed [Webster and Watson, 2002; King and He, 2005; Okoli and Schabram, 2010]. While providing a critical account of prior research might represent the sole objective of some reviews [Cooper, 1988], authorial critique can play a role (to different degrees) in all review types, as illustrated later. In short, high-quality stand-alone reviews provide a valuable and trustworthy account of past research that other researchers might seek out for inspiration and use to position their own studies. In this line of thought, prior research has shown that review articles frequently become "core" or "milestone" papers within a field [Garfield, 1982; Paré, Trudel, Jaana and Kitsiou, in press; Rowe, 2014]. Further, review articles play an important role in fostering the IS field as a reference discipline. They represent a key source of knowledge for new scholars and doctoral students entering the field as well as for those researchers outside the field.

Moreover, in light of the calls for increased use of evidence-based management, that is, the systematic use of the best empirical evidence to improve management practice [Pfeffer and Sutton, 2006; Rousseau, Manning and Denyer, 2008; Reay, Berta and Kohn, 2009], review articles become essential tools for summarizing or synthesizing the extant literature in all applied fields such as management, marketing, finance, human resources, and information systems. When rigorously conducted, reviews represent powerful information sources for researchers as well as practitioners looking for existing evidence to guide their decision making and managerial practices. The evidence-base paradigm in information systems aims to inform decisions about

issues such as the adoption of new systems, software development methods and tools, and governance models, as decision-makers would rely on and draw upon comprehensive literature reviews [Oates, Edwards and Wainwright, 2012]. Like Atkins and Louw [2000] and Oates [2011] we call for the use of more high-quality review articles that synthesize available knowledge for professional practice.

The relevance of publishing stand-alone literature reviews in the IS field was first underscored by the creation of the Management Information Systems Quarterly (MISQ) Review department in 2001. This department, which later became MISQ Theory and Review, proposes an outlet for review articles that aim to provide robust syntheses of prior research and to facilitate the dissemination of that knowledge [Watson, 2001]. Its mission is to "accelerate the accumulation of IS knowledge" and "provide important input in setting directions for future research" [Webster and Watson, 2002, p. xiii]. The lack of high-quality research syntheses is seen as a potential barrier to theoretical and conceptual progress in the IS field [Levy and Ellis, 2006a; Webster and Watson, 2002]. For this reason, senior IS scholars have called for more review articles so as to foster the field's own development and cumulative tradition [e.g., Watson, 2001; Webster and Watson, 2002; King and He, 2005; Schwarz, Mehta, Johnson and Chin, 2007; Rowe, 2014]. In order to address the abovementioned problems and help information systems academics keep abreast with developments in our field, Foundations and Trends in Information Systems, a new journal fully dedicated to review articles, was recently launched and is expected to start publication in 2014.

According to Webster and Watson [2002], one of the challenges in integrating previous research and advancing knowledge is scholars' lack of familiarity with the methods used for structuring and presenting reviews. The issue of quality is a critical aspect that should be discussed and examined when producing or assessing stand-alone literature reviews [Paré et al., in press]. Indeed, calls for more IS review articles place a strong emphasis on standards of quality. Since literature reviews serve as "benchmarks" for other researchers in a field, they should cover the relevant literature to date and earn the confidence of readers as to the validity, reliability and relevance of their findings. More specifically, we suggest that the quality of a research synthesis involves three dimensions, namely rigor, relevance and methodological coherence between the review's components and its objectives. The term rigor refers to the soundness of the research process [Ogawa and Malen, 1991; Tobin and Begley, 2004]. Without rigor, research has no

scientific value and makes no contribution to knowledge [Morse, Barrett, Mayan, Olson and Spiers, 2002]. Rigor is defined as a desired goal that is met by satisfying criteria such as internal validity, external validity, reliability and objectivity [Morse et al., 2002; Ogawa and Malen, 1991]. The second dimension, relevance, refers to the utility and usefulness of the review. As mentioned earlier, stand-alone literature reviews are conducted for many different purposes, such as to analyze the progress of a specific stream of research, to aggregate findings or reconcile equivocal results of prior studies, to review the application of a theoretical model or a methodological approach, to develop a new theory or research model and to provide a critical account of prior research on a particular topic [Cooper, 1988]. The third dimension, methodological coherence, is defined as the "congruence between the research question and the components of the method" [Morse et al., 2002, p. 18]. Methodological coherence links rigor and relevance and validates the fit between the goals of the review and the methodological guidelines chosen to attain them.

This research essay focuses on methodological rigor, as it is essential to research quality. Indeed, the issue of rigor is particularly important for reviews that are intended as milestones for future research. However, as stressed by Paré et al. [in press], the discussion on methodological rigor in relation to review articles remains highly abstract and is thus prone to subjectivity and judgment on the part of researchers, assessors and editors. Indeed, "in order for the reader – be it a researcher, a policy maker or a practitioner – to benefit from the evidence in the literature on a certain IS topic or subject, it is important to present an informative explanation about how the review was conducted" [Paré, Trudel and Jaana, 2012]. Misconceptions of the methods used for conducting stand-alone literature reviews also raise issues related to rigor. In this regard, literature reviews are no different from other methodologies. The quality and coherence of a review emerge from the application of a structured approach with specific guidelines. As stated by Cooper [2009], "integrating separate research projects into a coherent whole involves inferences as central to the validity of knowledge as the inferences involved in drawing conclusions from primary data analysis" (p. 3). Therefore, in light of the growing interest in stand-alone reviews in the IS field, we posit that greater attention should be paid to the specific criteria used to evaluate their rigor.

Several fields, such as health sciences [e.g., Liberati et al., 2009; Higgins and Green, 2008], nursing [e.g., Cronin, Ryan and Coughlan, 2008; Kirkevold, 1997; Whittemore, 2005], software

engineering [e.g., Kitchenham and Charters, 2007] and social psychology [e.g., Cooper, 1982], have developed a strong tradition of review methods. However, what constitutes a rigorous and well-conducted review has received little attention so far. The few available guidelines either focus on a specific type of review (e.g., theoretical or systematic) or fail to provide comprehensive and specific recommendations. Consequently, the primary objective of this article is to fill this gap by helping researchers, reviewers and editors to properly assess the methodological rigor of IS reviews. While our framework covers all types of stand-alone reviews (as discussed later), it also highlights the guidelines that apply to particular forms of research syntheses. Ultimately, we hope to provide a baseline from which to proceed with the evaluation and the proper conduct of stand-alone literature reviews in the IS field.

In the next section, we describe the major phases and steps which are at the basis of stand-alone reviews, we then present four distinct categories of review articles with their objectives, characteristics, and challenges. Next, we propose a set of guidelines for conducting rigorous IS literature reviews and specify to which forms of reviews they apply. We believe that careful consideration of these guidelines is likely to help the broader IS research community make informed judgments about review articles' contributions to a cumulative tradition.

2.3 Background

2.3.1 General Procedure for Conducting Literature Reviews

As a preliminary step, we sought out existing guidelines for stand-alone reviews. As expected, our search resulted in only a few sources from the IS field. Indeed, "the rigorous, standardized methodology that has developed from the health sciences and other fields is virtually unknown in information systems research" [Okoli and Schabram, 2010, p. 6]. However, several relevant and useful sources emerged from other fields that have a stronger tradition in review methods and evidence-based practice. These include the health sciences and health information domains [e.g., Liberati et al., 2009; Higgins and Green, 2008], software engineering [e.g., Kitchenham and Charters, 2007], social psychology [e.g., Cooper, 1982; Cooper, 2009], as well as management and organization science [e.g., Rousseau et al., 2008; Wolfswinkel, Furtmueller and Wilderom, 2013].

According to Kitchenham and Charters [2007], the process of conducting an effective literature review is comprised of several discrete activities. The authors argue that literature reviews

involve stages that can be grouped into three main phases: (1) planning, (2) carrying out, and (3) reporting. The activities associated with planning include choosing a research question and developing a protocol. The second phase involves many activities, such as searching for and selecting pertinent and available documents on the topic, assessing the quality of the selected studies and extracting, analyzing and synthesizing the data. The last phase encompasses writing the review and developing strategies for disseminating the results to potentially interested parties. In this essay, we limit our analysis to the first two phases.

According to Kitchenham and Charters [2007], there is a consensus among medical and social science methodologists as to the major steps involved in conducting a literature review. The six steps that comprise our framework reflect the main activities involved in developing and conducting a research synthesis: (1) problem formulation, (2) literature search, (3) screening for inclusion, (4) quality assessment, (5) data extraction, and (6) data analysis and synthesis (see Figure 2.1). It must be noted that the proposed sequence of steps need not be followed in a linear manner. Indeed, another important trait of the review process is its iterative nature, since many activities are initiated during the planning phase and later refined during subsequent phases [Kitchenham and Charters, 2007]. The six steps are described in the following paragraphs.

Problem formulation. Authors must justify the need for a stand-alone literature review [Kitchenham and Charters, 2007; Webster and Watson, 2002], identify the purpose of the review [Okoli and Schabram, 2010], and provide definitions of the concepts or constructs at the heart of the synthesis [Cooper, 2009; Webster and Watson, 2002]. The key is to specify which research questions are being addressed [Kitchenham and Charters, 2007]. As stressed by Jesson et al. [2011], the research questions guide the entire study design, as they underscore the type of information that is needed, inform the search for and selection of relevant literature and guide the subsequent analysis.

Literature search. The data in a literature review consists of the information included in each primary study that is deemed relevant [Cooper, 2009]. Before selecting and extracting data, the first step in data collection involves searching through the literature. At this time, researchers identify a range of information sources and single out the studies that require further analysis. The major decision involves the choice of a population of studies [Cooper, 1982]. According to Webster and Watson [2002], the objective of the literature search is to "ensure that [reviewers] accumulate a relatively complete census of relevant literature" (p. xvi). When conducting a

literature review, researchers want their results to pertain to all the extant studies on the problem [Cooper, 1982]. The specified search strategy and procedures, data sources and search restrictions are therefore critical if the researcher is to identify and retrieve all the relevant studies.

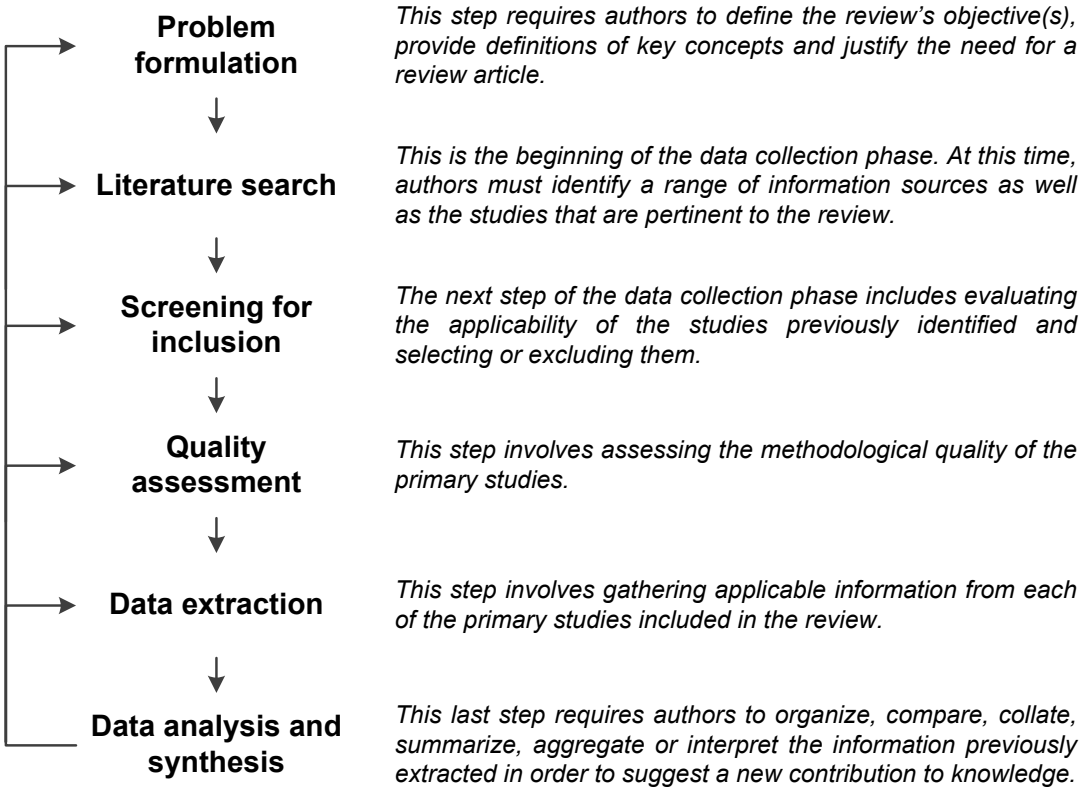

Figure 2.1 – General Procedure for Conducting Literature Reviews

Screening for inclusion. The data collection process in a literature review involves both identifying primary studies and evaluating their applicability [Levy and Ellis, 2006a; vom Brocke et al., 2009]. Indeed, once a group of potential primary studies has been identified, researchers must analyze them in order to determine their relevance [Kitchenham and Charters, 2007]. A set of rules and selection criteria will provide a basis for including or excluding certain studies. This exercise requires a significant investment on the part of researchers, who must ensure enhanced objectivity and avoid mistakes [Liberati et al., 2009].

Quality assessment. In addition to screening studies for inclusion, researchers may need to perform a formal quality assessment in order to refine their inclusion and exclusion decisions, determine whether or not the differences in quality affect the review's results, or guide the analysis of data and interpretation of the findings [Kitchenham and Charters, 2007]. The quality assessment mostly pertains to appraising the research design and methods used in the primary studies. Indeed, researchers must assess these studies against recognized methodological standards [Jesson et al., 2011; Kitchenham and Charters, 2007]. Ascribing quality scores to each study makes it possible to reflect on the extent to which the selected articles address possible biases and maximize validity [Kitchenham and Charters, 2007]. The overall objective of this step is to ensure that the primary studies warrant further analysis and to inform the researcher about potential biases due to methodological shortcomings.

Data extraction. The next step involves gathering applicable information from each primary study included in the review and deciding what is relevant to the problem of interest [Cooper, 1982]. Indeed, the type of data that should be recorded depends mainly on the research question [Okoli and Schabram, 2010]. However, important information may also be gathered about how the primary study was conducted, the research design and methods, or statistical results [Cooper, 2009]. The goal is to record accurate and meaningful information, which will serve as material for the next steps of the data analysis and synthesis.

Data analysis and synthesis. Researchers must collate, summarize, aggregate, organize and compare the evidence extracted from the primary studies. The extracted information must be presented in a meaningful way that suggests a new contribution to knowledge [Jesson et al., 2011]. Researchers are also expected to interpret the cumulative evidence and discuss the findings and conclusions derived from the data [Cooper, 1982]. Webster and Watson [2002] warn researchers that literature reviews should be much more than lists of articles and should provide a coherent lens to make sense of extant knowledge on a given topic.

2.3.2 Types of literature reviews

We concur with Cooper [1988] that there exist various forms of reviews that differ considerably in terms of fundamental objectives, motivations and means by which they are conducted. In fact, considerable confusion and many ambiguities surround the use of the term "review" [Paré et al., in press]. Indeed, numerous terms have been used by researchers to depict their review methods and approaches, such as "narrative review" [e.g., Joseph, Ng, Koh and Ang, 2007], "theoretical

review" [e.g., Varey, Wood-Harper and Wood, 2002], "critical review" [e.g., Fichman, 1992], "descriptive review" [e.g., Yang and Tate, 2009], "comprehensive review" [e.g., Liu, Min and Ji, 2008], "systematic review" [e.g., Williams, Dwivedi, Lal and Schwarz, 2009], and "meta-analysis" [e.g., King and He, 2006]. For this reason, it is imperative to distinguish between several types of stand-alone reviews before we develop a set of guidelines or criteria for assessing rigor.

We adopted an iterative approach in developing our categorization of review types. We started out by searching and reviewing works by leading authors and methodologists. Backward and forward searches allowed us to uncover additional relevant material. Over the years, a few scholars have discussed methodological issues related to research synthesis and proposed dimensions along which to distinguish between types of literature reviews [e.g., Cooper, 1988; Gough, Thomas and Oliver, 2012; Grant and Booth, 2009; King and He, 2005; Paré et al., 2012; Rousseau et al., 2008]. For instance, Cooper [1988] proposes a set of core characteristics along which the various types of review articles may differ. These characteristics include the main area of interest of the review, its primary focus, the reviewers' perspective, the breadth of the literature search, the techniques used to organize the data, and the intended audience. By analyzing, comparing and combining the descriptions and definitions from the abovementioned sources, we extracted four overarching categories of stand-alone reviews that we describe next. More precisely, we grouped and analyzed those dimensions that focused specifically on review aims and approaches. Indeed, as research objectives should suggest the components of the methods, they were the focus of our analysis. Hence, we developed four categories of reviews that differ in terms of their suitability for synthesizing different forms of research findings (i.e., input), their appropriateness for answering specific research questions (i.e., process), and their intended outcomes (i.e., output). Table 2.1 describes the main characteristics of these four categories. It should be noted here that a particular review might pursue several objectives and, hence, share key characteristics that belong to different review types [Cooper, 1988]. For instance, Joseph, Ng, Koh and Ang [2007] conducted a narrative review to summarize the extant knowledge on IT turnover and then proposed a conceptual model of IT turnover intention which they validated through a meta-analytic review procedure. Findings of the narrative review and the meta-analysis were then combined to develop a richer and more comprehensive model of IT turnover. Successfully conducting or evaluating hybrid reviews like this one first requires a thorough understanding of the characteristics and methodological issues related to each review type involved, as well as their rationale. We believe the conceptual framework introduced in this

article will help members of our research community better understand the basic principles of review methods and make more informed choices about their designs.

Table 2.1 – Main Characteristics of Review Categories

		Narrative	Developmental	Cumulative	Aggregative
INPUT	**Primary study focus**	Allow researchers to gather studies that focus on thematically dissimilar concepts and findings		Require studies that focus on similar concepts	Require close conceptual and operational definitions
	Primary study design	Allow researchers to combine both conceptual and empirical studies with varying methods and designs			Require empirical studies that follow the same design
PROCESS	**General objective**	Map the current state of knowledge and identify gaps in prior research	Assemble previous research to develop an innovative approach to the topic of interest	Compile cumulative evidence from earlier research in order to identify patterns and draw overall conclusions	Pool prior data and findings to test specific theories and hypotheses
	Literature coverage	Cover a representative set of the literature by including a sample that is illustrative of the larger population	Cover studies that are central or pivotal to a topic area and include a sample that considers all important aspects	Cover the literature in detail through the identification and inclusion of all pertinent data	
	Logic of synthesis	Follow a logic of configuration by drawing conclusions based on a coherent assembly of findings		Follow a logic of assimilation by confirming findings based on the repetition of evidence	
OUTPUT	**Product**	Narrative summary of knowledge in a topic area	Conceptual framework, theoretical model, methodological guidelines, etc.	Pooled summary of a specific research stream	Evidence-based validation of a theoretical model
	Domain of generaliza bility	Allow researchers to generalize inferences to a particular population of studies	Allow researchers to generalize theories, concepts or new ideas to their domain of applicability	Allow researchers to generalize inferences to a particular population of studies	Allow researchers to generalize hypotheses to a pre-specified unit of analysis

Each review type should respect specific methodological requirements that are consistent with its general objective. Indeed, “clarity about the dimensions along which reviews vary provides a way to develop review methods further and to make critical judgments necessary for the commission, production, evaluation, and use of reviews” [Gough et al., 2012, p. 8]. According to Oxman [1994], designing a research synthesis involves several decisions which must be aligned with the specific purpose of the review and its main focus. Each review type, along with an adapted package of methodological guidelines and techniques, is indeed best suited to certain objectives, questions or issues. It is widely accepted that the production of scientific knowledge depends very much on the tools and techniques applied by researchers [Pinsonneault and Kraemer, 1993]. Since “better legitimization of every choice made during the review process enhances the value of a review” [Wolfswinkel et al., 2013, p. 45], the methods and techniques used must be well suited to the review and thus carefully chosen. In the next paragraphs, we describe and illustrate each review type.

First, **narrative reviews** provide verbal summaries of previously published research on a topic of interest. They focus on concepts and theories, research methods or research outcomes [Paré et al., 2012]. Their main goal is to assemble and synthesize extant literature and to provide readers with a comprehensive report on the current state of knowledge in the area under investigation. The intent of narrative reviews is not to propose novel conceptualizations, criticize a body of literature or validate a theory, but rather to “serve a scientific field by providing a much-needed bridge between the vast and scattered assortment of articles on a topic and the reader who does not have the time or resources to track them down” [Baumeister and Leary, 1997, p. 311]. Such reviews are particularly useful for gathering a large and diverse volume of existing research on a subject [Dixon-Woods, Agarwal, Young, Jones and Sutton, 2004]. Narrative reviews often serve as an appropriate starting point for future inquiries and research developments and help researchers to determine and refine research questions or hypotheses [Cronin et al., 2008].

Very few sources offer guidelines for conducting rigorous narrative reviews [Baumeister and Leary, 1997]. King and He [2005] also note a lack of commonly accepted or standardized procedures: “researchers are relatively free to design their review strategy in terms of selecting relevant papers, categorizing research characteristics, and framing outcomes” [King and He, 2005, p. 667]. In other words, narrative reviews usually do not provide explanations on how primary studies are searched, selected, and synthesized [Paré et al., 2012]. For this reason,

narrative reviews are more prone to subjectivity than other review types. Efforts have been made to increase rigor and to improve knowledge about conducting such reviews [e.g., Cronin et al., 2008; Green, Johnson and Adams, 2006; Levy and Ellis, 2006b]. Indeed, there is a growing number of well-structured narrative reviews in the IS field that present methodological details about the review process [Paré et al., 2012].

Since narrative reviews aim to produce a summary of a research stream and therefore generalize their conclusions to a particular group of studies, they must adopt strategies for gathering a representative literature sample and follow structured procedures for analyzing and synthesizing the evidence [Levy and Ellis, 2006a]. Cooper [1988] defines a representative coverage strategy as the identification and selection of earlier studies that typify a larger group. Authors of these reviews should also discuss the characteristics that make the sample illustrative of a larger population. As per Sandelowski et al.'s [2006; 2012] definition, data analysis in narrative reviews relies on a logic of configuration. The authors distinguish between two broad categories of research syntheses based on different logics: configuration and assimilation. The configuration of findings refers to the arrangement of complementary evidence into a coherent argument [Sandelowski et al., 2006]. Findings from previous studies usually address different aspects of the phenomenon of interest and are therefore linked and organized. Both narrative and developmental (see below) reviews mainly follow the configuration logic. The assimilation of findings aims to reduce or average evidence so as to make empirical statements [Gough et al., 2012; Sandelowski et al., 2012]. The underlying objective is to confirm findings through the repetition of thematically similar evidence.

The article titled "Digitizing government interactions with constituents: an historical review of e-government research in information systems" by Bélanger and Carter [2012] represents an exemplar of a highly-structured narrative review. The primary goal of this article was to explore the most important theories, findings, and approaches used to study diverse electronic government platforms and services. To provide this historical synopsis, the authors examined two samples of e-government articles: the most highly cited e-government articles according to ISI Citations Index, and e-government research published in the Association for Information Systems (AIS) Senior Scholars' basket of journals. The selection criteria are clearly stated in the manuscript and the included papers are listed in distinct Appendices. Coding procedures and inter-rater reliabilities for the classification of primary studies are also detailed in an Appendix.

The analysis of the extant literature reveals significant insights about the metamorphosis of e-government research over time. The authors' discussion of the gaps and opportunities for further work provides researchers with a starting point to investigate e-government phenomena.

Second, **developmental reviews** aim to provide a research community with new conceptualizations, research models, theories, frameworks or methodological approaches. Their general objective is to develop innovative ideas or approaches grounded in previous research from a particular body of knowledge. Developmental reviews are particularly valued for proposing new theoretical foundations, for developing new approaches to address existing research problems on a more mature topic and for giving directions for further improvements [Webster and Watson, 2002]. Developmental reviews usually adopt a theoretical [Webster and Watson, 2002] or a critical stance [Carnwell and Daly, 2001]. As such, developmental reviews could propose new conceptualizations or theoretical approaches or could critically analyze previous knowledge and offer constructive information on problematic areas. Hence, the primary contribution of developmental reviews usually lies in the novelty of the proposed ideas and therefore goes beyond the gathering and synthesis of prior studies.

As is the case with narrative reviews, developmental reviews rarely provide explanations on the methods used [Wolfswinkel et al., 2013]. Guidelines for conducting rigorous developmental reviews have however been proposed in an effort to increase thoroughness and transparency [Webster and Watson, 2002]. Examples of developmental approaches include realist synthesis [Pawson, Greenhalgh, Harvey and Walshe, 2005], grounded theory review [Wolfswinkel et al., 2013], integrative review [Torraco, 2005], meta-synthesis [Hoon, 2013] and meta-ethnography [Noblit and Hare, 1988]. Rigorous developmental reviews offer greater contributions and have a better chance of being published [Webster and Watson, 2002; Wolfswinkel et al., 2013]. According to Torraco [2005], authors of developmental reviews are expected to identify a topic or issue that is appropriate for review, search and retrieve the most significant and relevant literature on that topic, analyze or critique the extant literature and then propose new concepts, theories, frameworks or perspectives through one or more forms of synthesis.

Developmental reviews are usually highly iterative in nature. Reviewers start with a broad research topic that will be refined into a more nuanced question as evidence from studies informs the topic [Hoon, 2013]. The components of the methods can thus be selected and

adapted as the review develops [Gough et al., 2012]. In the IS domain, Webster and Watson [2002] also propose a method for structuring and presenting developmental reviews. The process is centered on two key methodological elements, namely a structured search strategy for identifying relevant studies and a concept-centric approach to analyzing, contextualizing, and synthesizing prior works. Developmental reviews usually adopt a central search strategy in order to include both empirical and conceptual studies that consider all the important aspects of the phenomenon of interest. Cooper [1988] defines central or pivotal coverage as the identification and description of important efforts that provide direction to a field. From these seminal research works, reviewers might extend their search so as to accumulate a relatively complete census of the extant literature [Webster and Watson, 2002]. As with narrative reviews, developmental reviews follow a logic of configuration for analyzing diverse and complementary evidence. They may use various approaches and classifying techniques to coherently organize and make sense of the diverse streams that emerge from the primary studies [Hoon, 2013; Torraco, 2005; Webster and Watson, 2002]. Developmental reviews place a strong emphasis on the conceptual contribution of their outcomes, rather than on a formal assessment of the validity of their findings [Grant and Booth, 2009]. Outcomes are usually evaluated and validated against criteria of logical reasoning and the value of the theoretical contribution.

DeLone and McLean's [1992] seminal article on IS success provides a good example of developmental reviews that adopt a theoretical stance. In this article, the authors express the motivation that if IS research is to make a contribution to the world of practice, it is essential to define a measure of IS success that will be used to evaluate IS policies, practice and procedures. In recognition of this importance, they conduct a literature review of previously published empirical and conceptual studies that have attempted to measure various dimensions and factors pertaining to IS success. Taken together, these studies provide a representative sample of the work conducted in this particular domain from 1981 to 1988. Subsequently, the authors present a conceptual framework with six interrelated categories of IS success, which is used to organize the extant IS research in this area and discover patterns and commonalities. Based on this framework they integrate the multiple dimensions of IS success that were discovered from the literature review and propose a comprehensive conceptual model of IS success to guide future research efforts. This developmental review represents one of the most highly cited article in the IS field today.

For their part, Parker and Castleman [2009] proposed a developmental review that adopts a critical stance. Their primary goal was to evaluate the individual suitability of theories and frameworks in investigating the adoption of e-business adoption in small and medium-sized enterprises (SMEs). To do so, the authors did 'take stock' of the available evidence in the extant literature and used a plethora of studies to illustrate that SMEs are idiosyncratic in nature when it comes to adopt e-business. Then, they provided a critical analysis and evaluation of existing theories and frameworks to examine whether this idiosyncratic nature was captured sufficiently when explaining e-business adoption decisions. Based on this critical appraisal, the authors concluded that all commonly-used theories omit important aspects of small-firm idiosyncrasy and thus highlighted the need for the development of a new integrated framework that will predict more accurately the e-business adoption intentions of SMEs. In addition, they offered preliminary ideas on this framework to direct future research efforts.

Third, **cumulative reviews** seek to compile empirical evidence in order to map bodies of literature and draw overall conclusions regarding particular topics of interest. As with narrative reviews, their main goal is to synthesize extant literature on a particular topic so as to provide readers with a comprehensive description of the current state of knowledge in the area. However, the diversity of the primary studies under scrutiny and their underlying logic of analysis are different. Specific methodological approaches for cumulative reviews have been proposed that differ in terms of the nature of the research area and the range of analysis methods they use. Such approaches include scoping review [Arksey and O'Malley, 2005; Levac, Colquhoun and O'Brien, 2010], mapping review [Anderson, Allen, Peckham and Goodwin, 2008; Petersen, Feldt, Mujtaba and Mattsson, 2008] and descriptive review [King and He, 2005]. When looking at emerging topics, the primary contribution of scoping or mapping reviews lies in their ability to evaluate the size and scope of available literature on a particular subject matter and inform researchers about a new area for future research [Arksey and O'Malley, 2005]. When looking at more mature areas, descriptive reviews aim to determine through frequency analyses the coverage of the research field and the extent to which a body of empirical studies supports or reveals any interpretable patterns or trends with respect to pre-existing propositions, theories, methodologies or findings [King and He, 2005; Petersen et al., 2008].

Cumulative reviews are much less iterative than the two previous types, as reviewers must first identify a clear research question [Arksey and O'Malley, 2005]. In fulfilling their objectives and

ensuring the generalizability of results, researchers usually employ structured search methods to identify as many relevant studies as possible, and collect an exhaustive sample of published works on a topic [Arksey and O'Malley, 2005]. According to Cooper [1988], a reviewer following an exhaustive coverage strategy should strive to include all relevant literature so as to base conclusions on all available materials. Further, researchers should accurately gather significant information from the chosen works. At this stage, the application of a clear, replicable and consistent approach is recommended to avoid any potential outcome biases. Cumulative reviews tend to follow a logic based on assimilation, that is, they compile findings that are thematically similar. As a result, such reviews usually adopt an analytic framework, classifying techniques or thematic analyses in order to make sense of the data and provide a comprehensive summary of earlier evidence. By using evaluation criteria, authors of cumulative reviews extract characteristics of interest, such as publication year, research methods, data collection techniques, and direction or strength of final outcomes (e.g., positive, negative, or non-significant) from each study so as to produce quantitative results in the form of frequency analyses [Arksey and O'Malley, 2005; Bandara et al., 2011; King and He, 2005]. In doing so, authors of cumulative reviews may claim that their findings represent the "state of the art" in a particular area or domain [King and He, 2005].

Dubé and Paré's [2003] article on positivist IS case study research represents an exemplar of a cumulative review. These authors sought to determine the extent to which the field had advanced in its operational use of case study methods. To do so, they performed a systematic search in seven major IS journals over a 10-year period to identify a representative number of empirical articles that employed the case study method. All in all, they identified 183 case articles. Subsequently, they developed and used a coding scheme with pertinent evaluation criteria and attributes to code each article and collectively gauge the extent to which positivist case study research in IS has exploited or not the methodological guidelines that have been made available by leading methodologists. A formal validation of the coding scheme was performed and a satisfactory inter-rater agreement rate was obtained from this process. Frequency analysis was employed in this review to inform the research community about the trends and patterns in the use of positivist case study research. As mentioned earlier, while providing a critical account of prior research represents the sole objective of some developmental reviews, authorial critique can play a role in other forms of research synthesis as in the present cumulative review. Indeed, Dubé and Paré [2003] critically appraised the level of methodological rigor in

prior case research and their overall assessment, which was somewhat equivocal, served as an instrument to reflect on our progress and identify potential areas for improvement.

Last, **aggregative reviews** aim to bring together prior findings and test specific research hypotheses or propositions. By rigorously collating and pooling prior empirical data, aggregative reviews are particularly valued for providing evidence-based validations of pre-specified theoretical models and propositions. As a result, such reviews support evidence-based practice, a movement that developed in the field of medicine in the early 1990s [Montori and Guyatt, 2008]. Indeed, aggregative reviews have been advocated as essential to synthesizing the accumulated knowledge on a particular subject and supporting evidence-based management [Briner, Denyer and Rousseau, 2009; Rousseau et al., 2008]. These types of reviews can take three general forms, namely, systematic reviews, meta-analyses, and umbrella reviews, also known as overviews of reviews [Higgins and Green, 2008], which use various qualitative or quantitative synthesis approaches and techniques [Paré et al., 2012]. The distinction between systematic and meta-analytic reviews lies in the techniques used to analyze data, which are respectively qualitative or quantitative in nature. Further, whereas systematic and meta-analytic reviews collate data from previous empirical studies, overviews of reviews build on evidence available from previous systematic reviews or meta-analyses on the topic [Paré et al., 2012]. Over the years, aggregative reviews have become increasingly popular across a broad spectrum of research domains including medicine, nursing, public health, medical informatics, education, and management.

Aggregative reviews follow "explicit, systematic methods that are selected with a view to minimizing bias, thus providing more reliable findings from which conclusions can be drawn and decisions made" [Higgins and Green, 2008, p. 6]. A variety of guidelines have been proposed for conducting aggregative reviews in various scientific domains including health sciences [e.g., Liberati et al., 2009; Higgins and Green, 2008; Shea et al., 2007], software engineering [e.g., Kitchenham and Charters, 2007], social psychology [e.g., Cooper, 1982] and information systems [e.g., Okoli and Schabram, 2010; Oates et al., 2012]. A rigorous and consistent procedure for the execution of aggregative reviews involves the *a priori* definition of a clear set of research objectives and questions which will guide the development of a structured review protocol [Higgins and Green, 2008; Kitchenham and Charters, 2007]. As with cumulative reviews, aggregative reviews require an exhaustive search and selection strategy in order to identify and

gather all the relevant literature that is available [Higgins and Green, 2008; Liberati et al., 2009; Oxman, 1994]. By gathering and combining close replications of prior evidence, aggregative reviews follow a logic of assimilation. They are also expected to consider potential errors, biases or flaws in the available evidence [Higgins and Green, 2008; Kitchenham and Charters, 2007]. Indeed, formal appraisal of the quality of primary studies is necessary for substantiating results. Overall, systematic reviews, meta-analyses and umbrella reviews are recognized as instrumental in summarizing accurately and reliably vast amounts of research evidence. In short, compared to the previous types of research syntheses, aggregative reviews follow higher standards of rigor and quality, as they attempt to provide an explicit, comprehensive and reproducible account of an existing body of knowledge [Okoli and Schabram, 2010].

Turner, Kitchenham, Brereton, Charters and Budgen [2010] offer a good example of a meta-analytic review that aims to examine whether the Technology Acceptance Model (TAM) is an accurate predictor of actual system use. In following a systematic review process, the authors present the narrow research questions the study aims to address, the search strategy and criteria (inclusion and exclusion) used to identify relevant empirical studies, the methods used to assess the quality of the selected studies, and the data extraction strategy. Originally, these authors planned to perform an effect-size based meta-analysis. However, due to the heterogeneity of reporting of the primary studies in terms of the TAM used or the statistical method used, they conducted a vote-counting meta-analysis instead of a full effect-size meta-analysis. From a methodological perspective, this study contains a wide array of elements (e.g., quality assessment of primary studies) that are required to ensure the clarity and transparent reporting of a quantitative systematic review. Furthermore, it highlights the importance of considering and investigating, before pooling data into a meta-analysis, the diversity of methods and measures across the included studies (i.e. heterogeneity).

2.4 Guidelines to evaluate stand-alone literature reviews

In order to develop a comprehensive set of methodological guidelines, we searched for recommendations on *how* to conduct rigorous stand-alone literature reviews. Our review is developmental in nature. Therefore, we followed a highly iterative search strategy in order to identify relevant studies that cover all phases of the review process and consider all types of reviews in our taxonomy. As a first step, we reviewed the reference lists of the abovementioned sources [e.g., Cooper, 1988; Gough et al., 2012; Grant and Booth, 2009; King and He, 2005; Paré

et al., 2012; Rousseau et al., 2008]. We selected those references that offer practical or pragmatic guidelines on how to perform literature reviews. As expected, a rapid screening of the identified articles shows that they mainly propose guidelines for aggregative reviews. For this reason, we decided to perform a purposeful search on the other review methods. The *ISI Web of Knowledge* (Thomson Reuters) database was consulted, as well as the *Google Scholar* search engine. We conducted the search using the terms "review", "research synthesis" or "research syntheses" in conjunction with any of the following keywords: "descriptive", "integrative", "quantitative", "critical", and "narrative". A few additional references were added to our initial list. As a final step, we validated our list of references using the backward and forward search techniques. Table 2.2 presents the list of key references that were used to help us build our set of criteria.

Table 2.2 – List of Included References for the Development of the Guidelines

	Narrative	Developmental	Cumulative	Aggregative
Arksey and O'Malley (2005)			X	
Bandara et al. (2011)			X	
Carnwell and Dally (2001)		X		
Cooper (2009)				X
Cronin et al. (2008)	X			
Higgins and Green (2008)				X
Kitchenham and Charters (2007)				X
Levac et al. (2010)			X	
Levy and Ellis (2006a)	X			
Liberati et al. (2009)				X
Okoli and Schabram (2010)				X
Oxman and Guyatt (1988)				X
Oxman (1994)				X
Pawson et al. (2005)		X		
Petersen et al. (2008)			X	
Shea et al. (2007)				X
Torraco (2005)		X		
Webster and Watson (2002)		X		
Whittemore (2005)				X
Wolfswinkel et al. (2013)		X		

Table 2.3 – Framework for Evaluating Stand-Alone Literature Reviews

	Narrative reviews	Developmental reviews	Cumulative reviews	Aggregative reviews
Step 1: PROBLEM FORMULATION				
Specify the primary goal(s) of the review	✓	✓	✓	✓
Clearly define the key concept(s) and establish the boundaries of the review	✓	✓	✓	✓
Step 2: LITERATURE SEARCH				
Specify the search procedure in sufficient detail			✓	✓
Use a combination of data sources and search approaches	✓	✓	✓	✓
Avoid restrictions that are not based on the research question(s)	✓	✓	✓	✓
Adopt strategies to minimize publication bias				✓
Step 3: SCREENING FOR INCLUSION				
Specify the screening and selection procedures in sufficient detail			✓	✓
Conduct parallel independent assessment of studies for inclusion			✓	✓
Use inclusion criteria that reflect the research question(s)	✓	✓	✓	✓
Identify and be explicit about duplicate studies			✓	✓
Include studies from reputable sources	✓	✓		✗[2]
Step 4: QUALITY ASSESSMENT				
Use recognized quality assessment tools				✓
Consider the quality assessment in the selection of studies or the interpretation of the findings				✓
Step 5: DATA EXTRACTION				
Specify the type of information to be extracted			✓	✓
Use a structured procedure for data extraction	✓	✓	✓	✓
Conduct parallel independent data extraction		✓	✓	✓
Step 6: DATA ANALYSIS AND SYNTHESIS				
Report the appropriate standards for the synthesis of the results				✓
Describe the logical reasoning and justifications behind the findings		✓		
Provide a detailed summary of the included studies	✓	✓	✓	✓

[2] Such a guideline is detrimental in the case of aggregative reviews and, hence, should be avoided.

As far as was possible, we included trustworthy articles and articles that are considered pivotal in their own field. Except for those articles published in the last three years, the references included in our list are highly cited, with an average of 810 citations. As can be seen in the table, we were able to identify key references for each of the four review categories included in our framework, although a majority were associated with aggregative reviews.

As a second step, each of the references in Table 2.2 was carefully scrutinized. At first, we extracted for each step of the review process all available recommendations and pragmatic advice from the selected references. Next, from a careful examination of each recommendation, we grouped the extracted guidelines under broader categories. For instance, the various recommendations regarding the search process (e.g., search databases and registers, scan important journals manually, contact experts for references, follow the backward and forward approaches, search the references from reports or key studies) were grouped under the common attribute "*Use a combination of approaches and data sources*". Similarly, the general guideline *"Conduct parallel independent data extraction"* comprises various specific recommendations (e.g., involve multiple researchers in the extraction process, assess inter-rater consistency, ensure that all researchers understand the extraction protocol and use consensus and arbitration to resolve disagreements). In consequence, we developed a list of 19 guidelines that are divided into the different phases and steps depicted in our general framework (see Table 2.3).

As a third and final step, we reflected on the usefulness and necessity of each activity, or guideline, in the review process by questioning how it seeks to satisfy a specific purpose in terms of the methodological rigor of the study. Cooper [1988] not only maintains that the process of reviewing the extant literature is in itself a scientific methodology but that it should deserve the same attention to design and rigor as primary study methodologies. In fact, "each methodological decision at each stage of a synthesis may enhance or undermine the trustworthiness of its conclusion or, in common social science terms, can create a threat to the validity of its conclusion" [Cooper, 2009, p. 11]. As mentioned previously, the term rigor encompasses various principles and approaches that aim to minimize bias and error in the review process [Ogawa and Malen, 1991]. For our own purposes, we focused on four criteria that have been proposed to reach the goal of rigor, namely, internal validity, objectivity, external validity,

and reproducibility [Davies and Dodd, 2002; Morse et al., 2002; Tobin and Begley, 2004]. The first criterion, *internal validity*, is defined as the extent to which the review represents accurately the phenomena it is intended to describe or explain [Hammersley, 1987]. Internal validity should reflect the soundness in the choice of the approach, including the decisions related to the sources searched, the keywords used, the period of time covered, the criteria used for selecting articles or the type of data extracted. Second, we define *objectivity* as the extent to which the findings of the review are determined by the objects of the inquiry and not by the researchers' biases and values. To claim objectivity, the review process should establish "that data and interpretations of the findings are not figments of the inquirer's imagination, but are clearly derived from the data" [Tobin and Begley, 2004, p. 392]. Methods for overcoming such bias involve mainly a consistent observance of the review protocol and a parallel verification of sensitive elements of the process. The third criterion, *external validity*, is defined as the extent to which the findings have applicability in other contexts [Beck, Keddy and Cohen, 1994]. External validity refers to the generalizability of the review conclusions and involves two targets [Cooper, 1982]. For narrative, cumulative and aggregative reviews, findings should pertain to a larger population of studies comprising previous research on the topic of interest. Developmental and aggregative reviews also aim to generalize their findings across the unit of analysis that is of interest to the topic area, for instance the domain of applicability of a particular theory. Whereas reviewers are constrained by the domains studied in primary research, they exert control over external validity through their choice of which sources to consider and how to search and select the articles [Cooper, 1982]. Lastly, *reproducibility* measures the extent to which the review is repeatable, traceable and clearly documented. Reproducibility of a research synthesis is attained through a thorough documentation of the review method and process, including the search, selection, extraction and analysis performed in the review. Reproducibility is essential to determine whether the findings of the review would be the same if the process were replicated [Beck et al., 1994; Coryn, 2007].

2.4.1 Step 1: Problem formulation

Problem definition includes guidelines associated with the identification of the purpose and the definition of the central topic of the review. This step is one of the most sensitive in the review process and goes beyond the mere objective of rigor. Indeed, this step also pertains to the other dimensions of review quality as indicated previously, namely relevance and methodological

coherence. Besides its methodological quality, the utility of a review is evaluated against the relevance of the problem it aims to address. Even if it is rigorously conducted, a review addressing a problem that is not germane and relevant would have low value for its audience. In short, reviewers must motivate the problem as being both timely and appropriate and accordingly justify why the review is conducted. Further, this step will guide the researchers in the choice of an appropriate design and provide the structure for the next phases of the review process [Jesson et al., 2011; Levac et al., 2010]. The alignment between methodological components of the review process and the research questions directly contributes to the goal of methodological coherence. An appropriate formulation of the problem is therefore required for all categories of review. Nevertheless, for cumulative and aggregative reviews, the formulation of the problem serves the additional purpose of reproducibility, as clear definitions of the problem and key concepts should help the reader understand the review process and outcomes and ensure that the review is repeatable.

2.4.1.1 Specify the primary goal(s) of the review

Defining the research objectives (or research questions) represents one of the most important steps to be taken in any study, be it an empirical study, a conceptual piece or a review article. Hence, researchers must satisfactorily motivate the need for conducting a stand-alone review [Okoli and Schabram, 2010]. As mentioned earlier, stand-alone review articles can be undertaken to analyze the progress of a specific stream of research, to aggregate findings or reconcile equivocal results of prior studies, to review the application of one theoretical model or one methodological approach, to develop a new theory or research model or to provide a critical account of prior research [Cooper, 1988]. For instance, Jeyaraj, Rottman and Lacity [2006] justify their aggregative review by stressing the richness and diversity of the IT-based innovation research stream and underlining the existence of conflicting and contradictory findings on the antecedents of adoption. In general, authors of a review must be explicit about the pursued objectives since they are closely related to the form or category of review.

2.4.1.2 Clearly define the key concept(s) and establish the boundaries of the review

All authors of reviews must necessarily exclude a multitude of work that lies near the boundary of their problem domain, even if they are works that other reviewers might choose to include. To solve this issue, researchers must define the key concept(s) at the heart of their review [Arksey and O'Malley, 2005; Cooper, 2009; Webster and Watson, 2002]. Another characteristic

is the research materials to which the review directs its main attention. Indeed, this guideline serves to distinguish relevant from irrelevant studies [Cooper, 2009]. Narrative and developmental reviews usually start with a wide focus that is narrowed down throughout the process, whereas cumulative and aggregative reviews are often concerned with using predefined concepts and precise boundaries [Gough et al., 2012; Hoon, 2013]. Drawing on Cooper [1988] and Whittemore [2005], literature reviews can potentially direct their focus in one or more of the following areas: research findings or outcomes; concepts, theories or research models; and research methods. Like primary goals, these areas of focus are not mutually exclusive, and some reviews might have more than one focus with varying degrees of attention.

2.4.2 Step 2: Literature Search

This step includes guidelines associated with the identification of potentially relevant studies. The search for relevant literature is critical for all categories of review, though the choice about the population of studies will differ according to the review's objectives. Indeed, the literature search mainly refers to the goal of external validity. For narrative reviews, reviewers aim to identify a sample of studies that is representative of the research stream of interest. For developmental reviews, the objective of the literature search is to accumulate a sample of studies that covers all important aspects of the topic of inquiry [Webster and Watson, 2002]. In such reviews, researchers usually conclude the search and selection process when it reaches conceptual saturation. For their part, when conducting cumulative or aggregative literature reviews, reviewers want their results to pertain to all the studies deemed relevant for the problem [Cooper, 1982; Petersen et al., 2008]. Hence, the strategy attempts to include all potential articles associated with the topic of interest. A thorough documentation of the search process is also necessary for cumulative and aggregative reviews to contribute to the objective of reproducibility.

2.4.2.1 Specify the search procedures in sufficient detail

Literature reviews draw exclusively on the information included in primary studies to provide clear answers to research questions. Therefore, the search and identification of relevant studies is one of the most critical tasks. To ensure a high level of rigor during this process, it is recommended to determine and follow a rigorous search strategy [Kitchenham and Charters, 2007]. The authors must clearly answer questions such as "where to search, which terms to use,

which sources are to be searched, time span, and language" [Levac et al., 2010, p. 3]. Further, for cumulative and aggregative reviews that aim for reproducibility, the authors must be explicit in describing their approach and justifying their decisions [Kitchenham and Charters, 2007; Okoli and Schabram, 2010]. This is important to assure the reader that all the pertinent and important literature has been considered [Oxman, 1994; Okoli and Schabram, 2010]. This information is also critical for replication purposes as well as for further updates [Liberati et al., 2009]. Important information on the search procedure that should be reported includes the data sources [Kitchenham and Charters, 2007; Liberati et al., 2009], the search terms used [Kitchenham and Charters, 2007; Okoli and Schabram, 2010], and the number of hits for each source [Higgins and Green, 2008; Liberati et al., 2009]. Wu and Lederer's [2009] meta-analysis on the technology acceptance model provides a good example of how to specify clearly the search and identification procedures. The authors specify the types of studies included in their review, the sources that were used to locate the studies and the detailed procedure followed to retrieve the studies. Such precisions allowed them "to maximize the number of studies, reduce the source bias, and thus increase the power of the meta-analysis" (p. 424).

2.4.2.2 Use a combination of data sources and search approaches

A high-quality review should also cover all aspects of the relevant literature related to the initial research questions [Webster and Watson, 2002]. Retrieval from any single source is likely to be incomplete [Kitchenham and Charters, 2007; Liberati et al., 2009]. It is therefore important to combine multiple sources and approaches to ensure the comprehensiveness of the search. The commonly used sources in stand-alone reviews are electronic databases, including *ABI/Inform*, *ISI Web of Knowledge*, *PubMed*, *JSTOR*, and *IEEE Xplore*, to name but a few [Okoli and Schabram, 2010]. Shea et al. [2007] suggest that at least two complementary electronic databases must be used to scan the extant literature on a given topic. Further, it is recommended that electronic databases be used in combination with alternative search approaches, such as scanning "manually" journals and conference proceedings and contacting experts on the topic of interest [Kitchenham and Charters, 2007; Okoli and Schabram, 2010]. Webster and Watson [2002] also propose that backward searches (identifying and examining references cited in an article of interest) and forward searches (identifying and considering articles that cite a particular article) be conducted. Turner et al. [2010] provide a good example of how multiple sources can be combined. In addition to the articles obtained through the electronic searches, they included all

the relevant references from a previous review on the same topic and performed a backward search.

2.4.2.3 Avoid restrictions that are not based on the research question(s)

When a review is concerned with the generalizability of its findings, then it should ideally capture all the studies of interest. Indeed, researchers "must select and justify a search strategy that is appropriate for [the] research question" [Kitchenham and Charters, 2007, p. 17]. Ideally, restrictions pertaining to the publication language, status and date should be avoided unless the limitations correspond to the boundaries of the review itself [Higgins and Green, 2008]. When restrictions are applied, authors should report them [Liberati et al., 2009] and provide clear justifications [Kitchenham and Charters, 2007].

2.4.2.4 Adopt strategies to minimize publication bias

Publication bias refers to the problem that significant (and supporting) results are more likely to be published than non-significant (and non-supporting) results. Publication bias is particularly harmful for the internal validity of aggregative reviews, for such reviews aim to test hypotheses and theories. Therefore, researchers should address this issue by adopting strategies such as scanning grey and unpublished literature or contacting experts on the topic of interest to locate unpublished material [Kitchenham and Charters, 2007; Liberati et al., 2009]. For instance, in their meta-analysis, Wu and Lederer [2009] included doctoral dissertations and conference proceedings to minimize the risk of publication bias, and they sent an inquiry for working papers and conference proceedings to the IS community through the AISWorld mailing list.

2.4.3 Step 3: Screening for Inclusion

A broad and comprehensive search is likely to yield many articles that are not relevant to the research question [Oxman and Guyatt, 1988]. Therefore, the reviewer must select the appropriate articles among those retrieved during the initial search. To claim internal validity of their results, all review types aim to include only those articles that are appropriate and relevant for the conduct of the synthesis. For each study, reviewers should ask themselves if it addresses the problem under inquiry and helps answer the research question [Pawson et al., 2005]. As a proxy to appraise the quality of the included studies and thus increase their internal validity, narrative and developmental reviews might also restrict the selection of studies based on the expected quality and reputation of the sources. Further, for cumulative and aggregative reviews, researchers should make important efforts during the study selection to enhance objectivity and

avoid research bias [Liberati et al., 2009]. Oxman and Guyatt [1988] posit that a systematic, explicit and rigorous screening/selection procedure is recommended to protect against biased selection of studies. These authors show how two reviews that investigated the same question included two highly different sets of primary studies and, as a result, produced diametrically opposed conclusions. Lastly, as for the previous steps, a thorough documentation of the selection process is necessary to contribute to the objective of reproducibility.

2.4.3.1 Specify the screening and selection procedures in sufficient detail

Researchers should be explicit about how the studies were selected or chosen to ensure greater transparency and allow replicability [Oxman, 1994; Okoli and Schabram, 2010; Higgins and Green, 2008]. According to Kitchenham and Charters [2007], study selection is a multistage process. The reviewers should first perform an initial screening of the titles and abstracts against the inclusion criteria to decide whether they are worth reading or not [Okoli and Schabram, 2010]. Next, they should thoroughly examine the full papers to ensure compliance with the inclusion criteria [Higgins and Green, 2008]. In addition to the screening procedure, the reviewer should report appropriate information on this stage, such as the inclusion criteria [Oxman and Guyatt, 1988; Liberati et al., 2009; Okoli and Schabram, 2010], the number of excluded studies at each stage with reasons for exclusion [Kitchenham and Charters, 2007; Liberati et al., 2009] and the final number of included studies [Liberati et al., 2009]. Liberati et al. [2009] also advise using a diagram flow to summarize the study selection process. Hauge, Ayala and Conradi's [2010] review on the adoption of open source software provide a good example of how this guideline can be applied.

2.4.3.2 Conduct parallel independent assessment of studies for inclusion

The procedure for study selection should minimize biases and the potential for errors of judgment [Oxman, 1994]. The objective is to ensure and validate the objectivity and consistency of the inclusion process. According to Oxman and Guyatt [1988], "expert assessment of primary research studies generally results in a level of disagreement that is both extraordinary and distressing" (p. 700). Parallel independent assessment of the studies is therefore recommended to minimize the risk of errors and judgments from the researchers [Kitchenham and Charters, 2007; Okoli and Schabram, 2010]. Disagreements should be discussed and resolved using techniques such as consensus or arbitration [Higgins and Green, 2008; Kitchenham and Charters,

2007]. The level of agreement between researchers could also be measured using the Cohen Kappa statistic [Higgins and Green, 2008; Kitchenham and Charters, 2007].

2.4.3.3 Use inclusion criteria that reflect the research question(s)

According to Okoli and Schabram [2010], research studies must explicitly state on what criteria judgement will be based. As mentioned by Oxman [1994], "the criteria used to select studies for inclusion should be consistent with the [research] focus" (p. 649). Therefore, the criteria required for study inclusion are usually based on the content of the study and refer to the research question and/or topic of interest [Cooper, 2009; Kitchenham and Charters, 2007; Liberati et al., 2009; Okoli and Schabram, 2010; Petersen et al., 2008], the theories and constructs included in primary studies [Levy and Ellis, 2006a] or the research design and methodology followed by the primary studies [Okoli and Schabram, 2010]. Other criteria might be based on practical considerations such as the publication status, language, years considered and a lack of or missing information [Liberati et al., 2009; Okoli and Schabram, 2010]. The use of such pragmatic selection criteria reflects trade-offs between satisfactorily answering the research question and practically managing the review [Okoli and Schabram, 2010] and should be used with caution [Liberati et al., 2009]. In the conduct of aggregative reviews, which aim to validate theories by repeating primary evidence, reviewers should first contact the primary authors of those studies that lack important information to obtain the missing information before making a decision regarding inclusion or exclusion [Oxman and Guyatt, 1988; Kitchenham and Charters, 2007]. A good example of how to clearly justify the choice of inclusion criteria is provided in Robey et al.'s [2008] review on inter-organizational information systems. The authors indicate that "because [their] primary interest is assessing theoretical trends and future directions, [they] restrict [their] review to empirical articles because they best demonstrate the influence of theoretical choices on the production of research findings" (p. 499).

2.4.3.4 Identify and be explicit about duplicate studies

"Duplicate publication can take various forms, ranging from identical manuscripts to reports describing different numbers of participants and different outcomes" [Higgins and Green, 2008, p. 152]. Duplicate studies might also involve multiple reporting of similar or different results from the same sample. The inclusion of multiple publications associated with the same data set can be very harmful, especially for cumulative and aggregative reviews which base their conclusions on the repetition of evidence. Therefore, researchers should find ways to identify duplicates and

then make proper decisions regarding their inclusion or not [Kitchenham and Charters, 2007]. For instance, Ma and Liu [2004] reported they "carefully checked the sample [of the included studies] to make sure they were not based on the same data" (p. 63). Similarly, Wu and Lederer [2009] "ensured the uniqueness of each study by carefully comparing its description and statistical data with those others" (p. 424). Authors usually remove duplicates from their sample, although some choose to average results from publications pertaining to the same study.

2.4.3.5 Include studies from reputable sources

This guideline is specific to narrative and developmental reviews because they adopt coverage strategies that place a strong emphasis on important contributions to the topic of interest. Contrarily, this guideline should be avoided in the case of aggregative reviews, as it could introduce a form of publication bias. Authors of cumulative reviews could apply such restrictions depending on their research questions. Since narrative and developmental reviews usually do not perform a formal quality assessment of the primary studies they include (see step 4), they must find other ways to ensure the quality of the evidence on which they base their conclusions [Levy and Ellis, 2006a]. For instance, it is often recommended that researchers limit their search to top-tier journals and conferences [Levy and Ellis, 2006a]. In the same vein, Webster and Watson [2002] suggest starting the search process with leading journals, where the major contributions are most likely to be found.

2.4.4 Step 4: Quality Assessment

Whereas the previous step is mainly concerned with the relevance of primary studies, this step includes guidelines associated with the evaluation of the rigor of the included articles. In this article, the quality assessment process refers to a formal evaluation of the methodological quality, as it has been defined by leading methodologists [e.g., Higgins and Green, 2008; Kitchenham and Charters, 2007; Shea et al., 2007]. Over the years, the process of quality appraisal has emerged as a formal and recommended guideline particularly for certain types of aggregative reviews, such as systematic reviews and meta-analyses [Whittemore, 2005]. Indeed, in order to claim internal validity of their findings, aggregative reviews require high quality primary evidence that they pool to validate theories and hypotheses. In these reviews, quality assessment usually refers to two main issues. First, *internal validity* is the extent to which the design, methods, execution and analysis of the individual studies minimize or avoid potential sources of bias [Higgins and Altman, 2008]. Second, *external validity* refers to "the extent to

which the results of a study provide a correct basis for generalizability to other circumstances" [Jüni, Altman and Egger, 2001, p. 42]. If individual studies included in a review contain methodological deficiencies or invalid results due to systematic errors and flawed designs, then these studies might distort the findings of the review and introduce bias in its conclusions [Liberati et al., 2009; Oxman and Guyatt, 1988]. For aggregative reviews, quality assessment usually leads to the exclusion of primary studies or guides researchers when interpreting their results. Other types of stand-alone reviews are often implicit regarding the evaluation of the methodological quality of their primary studies. Yet, for such reviews, quality assessment may in fact provide a valuable aspect of the narrative or descriptive component of a review or a lens for interpreting their findings.

2.4.4.1 Use recognized quality assessment tools

According to Oxman and Guyatt [1988], "important aspects of the design and conduct of each primary study should be critiqued and the standard used in these critiques made explicit" (p. 700). When conducting aggregative reviews, researchers should assess the quality of the primary studies using recognized assessment tools and checklists such as those proposed by Pinsonneault and Kraemer [1993] for survey research, Dubé and Paré [2003] for positivist case research, and Paré, Cameron, Poba-Nzaou and Templier [2013] for ranking-type Delphi studies. Turner et al. [2010] and Hauge et al. [2010] provide good examples of how to perform such quality assessment. Both reviews relied on checklists that cover various aspects related to the definition of the variables and their respective measures, the description of the research method and the reporting of the results.

2.4.4.2 Consider the quality assessment in the selection of studies or the interpretation of the findings

Okoli and Schabram [2010] suggest that the quality assessment process might serve two non-mutually exclusive purposes. First, the results might assist researchers during the selection of primary studies. For instance, a review could apply a minimum quality threshold for the inclusion of papers for further analysis. Second, researchers might consider the potential impact of methodological quality on the findings of their review. In fact, it is recommended to investigate whether quality differences provide explanations for variations in results [Kitchenham and Charters, 2007]. Quality scores might also serve to moderate the results of individual studies when aggregating those results and further guide the interpretation of the findings and the recommendations for future research [Kitchenham and Charters, 2007].

2.4.5 Step 5: Data Extraction

This step includes guidelines for the gathering and extraction of applicable information from each study. According to Bandara et al. (2011), this step consists of determining what to capture and how to capture things effectively. All categories of reviews are concerned with this step because the outcome of data extraction is the primary material for analysis, and therefore they aim to record accurate and meaningful information [Kitchenham and Charters, 2007]. Cooper [2009] suggests that errors or bias in the data extraction process could lead to a misrepresentation of the studies in the following analysis and therefore decrease the internal validity of the conclusions. Authors of developmental, cumulative and aggregative reviews also aim in this step to avoid bias and errors and to ensure consistency in the execution of the data extraction. Data extraction for developmental reviews usually includes some thematic coding and conceptual classification and therefore involves interpretation and judgment from the researchers. Confidence in the results is achieved through an objective coding and extraction procedure. Further, for cumulative and aggregative reviews, a clear description of what and how the data was extracted serves the additional purpose of reproducibility.

2.4.5.1 Specify the type of data to be extracted

Authors of cumulative and aggregative reviews should plan and specify the type of data to be extracted from the primary studies [Kitchenham and Charters, 2007; Higgins and Green, 2008] and then propose a strategy to collect data [Higgins and Green, 2008]. Most of the recorded data usually provide evidence about the *a priori* research questions [Okoli and Schabram, 2010]. Nevertheless, important information about how the primary study was conducted, the research design and methods or statistical results might also be gathered [Cooper, 2009]. Dubé and Paré's [2003] review article on rigor in IS case research clearly specifies the type of information gathered from the primary studies. The authors also provide a table that lists the coded variables that were included in their analysis.

2.4.5.2 Use a structured procedure for data extraction

In addition to the type of information extracted, authors of cumulative and aggregative reviews should document clearly how data was extracted for reproducibility purposes [Higgins and Green, 2008]. For all categories of reviews, the use of a standardized "data extraction form" [Bandara et al., 2011; Higgins and Green, 2008; Kitchenham and Charters, 2007; Okoli and Schabram, 2010], a set of "bespoke forms" [Pawson et al., 2005], a "data charting form" [Arksey

and O'Malley, 2005; Levac et al., 2010] or a "classification scheme" [Petersen et al., 2008] is a widely recommended approach for structuring this process. The data extraction form should allow researchers to collect all the information needed to address the research questions [Kitchenham and Charters, 2007]. Several alternative methods have also been proposed, such as the use of an indexing or summary system [Cronin et al., 2008] or a concept-centric approach that involves the use of a concept matrix to extract key information from the selected studies [Webster and Watson, 2002]. Jeyaraj et al.'s [2006] review on IT innovation adoption and diffusion provides a good example of how to structure the data extraction process. The authors first identified a list of dependent and independent variables from the primary studies. Then, they created a coding template "in order to uniformly code the findings between independent variables and dependent variables" (p. 5). They further developed a coding scheme that helped them assign values to the relationship between variables. The authors also provide practical examples of how they used the coding scheme in their review.

2.4.5.3 Conduct parallel independent data extraction

The procedures used for data extraction should minimize biases and judgment errors. Therefore, it is important to ensure that the researchers extract the data in a reliable and consistent manner. Kitchenham and Charters [2007] recommend that two researchers independently perform the data extraction exercise in order to minimize errors and reduce potential bias introduced by reviewers. The authors suggest that at least a random sample of the primary studies be cross-checked by two or more members of the research team. Further, as for the screening and selection procedure, data extracted from the researchers should be compared and disagreements discussed and resolved [Kitchenham and Charters, 2007]. Also, the Cohen Kappa statistics could be used to measure the level of agreement between researchers [Higgins and Green, 2008; Kitchenham and Charters, 2007]. Higgins and Green [2008] further recommend the use of clear instructions and decision rules about coding the data in order to facilitate the consistency of the data extraction process.

2.4.6 Step 6: Data Analysis and Synthesis

The last step refers to the use of appropriate techniques to make sense of the information gathered as well as the appropriate reporting of the review results. "During data analysis, the separate data points collected by the researcher are summarized and integrated into a unified picture" [Cooper, 2009, p. 16]. Analysis and synthesis can be done following different methods

and approaches. For instance, narrative and developmental reviews usually present verbal descriptions of the data contained in primary studies, whereas cumulative and aggregative reviews might complement the narrative summary with quantified data, such as a frequency analysis or more complex statistical methods [King and He, 2005]. Consequently, even though all forms of reviews attempt to synthesize prior evidence and present findings that are both valid and reliable, objectives in terms of rigor and methodological guidelines will significantly vary among the different categories of reviews. As for the previous steps, cumulative and aggregative reviews also require a thorough documentation of the analysis and synthesis process for reproducibility purposes.

2.4.6.1 Report the appropriate standards for the synthesis of the results

As mentioned by Cooper [2009], "rules for summarizing and integrating data from the individual studies might be inappropriate and lead to incorrect cumulative results" (p. 249). Errors in data analysis and synthesis are particularly detrimental for aggregative reviews, where the objective is to validate theories and test hypotheses. A strategy to protect the analysis and synthesis process from potential internal validity threats is to be as explicit as possible about the approaches, procedures and assumptions for analyzing data [Cooper, 1982; Kitchenham and Charters, 2007]. This also makes the review process easier to replicate [Cooper, 2009]. Likewise, the review results should be reported in sufficient detail to allow the reader to critically assess the foundations of the authors' conclusions [Oxman and Guyatt, 1988]. Liberati et al. [2009] propose a list of appropriate standards that should be reported when presenting the main results of the review. For instance, in the case of a meta-analysis, the authors should present the sample size and the estimated effects with their confidence intervals, as well as the pooled effect estimates across studies with a confidence interval for each relationship [Liberati et al., 2009]. Such information is commonly shown in a table or a forest plot [Kitchenham and Charters, 2007; Liberati et al., 2009]. Authors of meta-analyses should also provide an assessment of the consistency of the data using statistics such as the I^2 index [Liberati et al., 2009]. In the case of narrative systematic reviews, it is recommended that authors explicitly present the qualitative inferences, make their conclusions as transparent as possible and provide explanations for the conflicting results [Cooper, 2009; Liberati et al., 2009; Oxman and Guyatt, 1988]. A sensitivity analysis should also be undertaken, for instance by repeating the analysis and comparing the results for subgroups of studies [Kitchenham and Charters, 2007; Liberati et al., 2009]. Sensitivity

analyses are much less straightforward for qualitative syntheses, but researchers could consider the possibility of conducting sub-group analyses [Kitchenham and Charters, 2007].

2.4.6.2 Describe the logical reasoning and justifications behind the findings

As developmental reviews focus mainly on the creation of new research concepts, models, theories or frameworks, the authors should clearly demonstrate how key outcomes emerged from the analysis and synthesis of the extant literature. Moreover, the outcomes of a developmental review are usually validated against criteria of analytical logic, creativity and added-value. As mentioned by Webster and Watson [2002], the reasoning and justifications behind the findings stand for a crucial part of the data analysis and synthesis process. Presenting the underlying logic and conceptual reasoning also helps the reader to follow the connections between the research purpose, the analysis and synthesis of the evidence and the outcome of the review [Torraco, 2005]. Various forms and methods of logical reasoning may be used in order to make sense of the evidence from previous studies. For instance, Webster and Watson [2002] suggest that reviewers should provide justifications for their findings and propositions by using a combination of theoretical explanations, past empirical findings and practical examples. Other approaches are suggested by Torraco [2005]; they include the use of a guiding theory or competing models in order to provide a coherent structuring of the evidence. For their part, Wolfswinkel et al. [2013] recommend the use of *Grounded Theory* to analyze the content of the selected studies because it provides "disciplined ways of analyzing and integrating findings and insights" (p. 47).

2.4.6.3 Provide a detailed summary of the included studies

All forms of reviews should contain figures or tables that provide a descriptive summary pertaining to the characteristics and findings of the included studies [Higgins and Green, 2008; Levac et al., 2010; Pawson et al., 2005]. Narrative, developmental and cumulative reviews usually demonstrate both the reliability and accuracy of their findings through a clear and structured reporting strategy [Arksey and O'Malley, 2005; Levy and Ellis, 2006a; Pawson et al., 2005]. Therefore, reviewers should trace the usage and non-usage of primary materials [Pawson et al., 2005] and thus describe the chain of evidence and how the findings were reconstructed from the data extracted [Levy and Ellis, 2006a]. In addition, for cumulative reviews, researchers should explicitly describe all characteristics of the included studies, such as the overall number of studies, years of publication, research methods, context of the studies or characteristics relevant

to the population [Arksey and O'Malley, 2005; Levac et al., 2010]. In the case of aggregative reviews, Liberati et al. [2009] recommend reporting study-level information on the main characteristics of the primary studies included in the review. Indeed, "publication of summary data from individual studies allows the analyses to be reproduced, and other analyses […] to be investigated" [Liberati et al., 2009, p. 17]. In addition, providing a descriptive summary may help in demonstrating appropriate relevance, representativeness and generalizability pertinent to the population of studies [Cooper, 2009]. As an example, DeLone and McLean's [1992] review clearly indicates which primary studies supported each dimension of their IS success framework.

2.5 Discussion and concluding remarks

This essay addresses the growing issue of the methodological rigor of review articles. After distinguishing among four broad categories of reviews, we propose a list of 19 methodological guidelines that cover all steps of the review process and are grouped under the six following general headings: (1) formulation of the problem, (2) literature search, (3) screening for inclusion, (4) quality assessment, (5) data extraction, and (6) data analysis and synthesis. Our framework is also comprehensive inasmuch as it covers all categories of reviews that are published in the field of IS and also highlights those guidelines that apply to particular forms of reviews. Indeed, it is our contention that the set of guidelines proposed here covers all the main aspects of the review process and could be used appropriately for all forms of reviews. It is worth noting that only two sources were found in relation to guidelines for conducting narrative reviews. This confirms the lack of commonly accepted methods and procedures associated with this particular type of reviews [Baumeister and Leary, 1997; King and He, 2005]. At the same time, Paré et al. [in press] recently observed that narrative reviews are the second most important type of reviews published in leading IS journals. More efforts are therefore needed to improve our collective knowledge about how to conduct and evaluate narrative reviews.

To the best of our knowledge, no prior research has attempted to develop such a comprehensive set of guidelines to evaluate stand-alone reviews. As a first attempt to demystify the rigor associated with review articles, our framework is broadly integrative; and we realize that particular review types (e.g., systematic review; scoping review; meta-analysis) would deserve more attention. For instance, the aggregative category includes systematic reviews, vote-counting reviews, meta-analyses and overviews of reviews. Hence, there is a need for further discussion of the various forms and nature of literature reviews in our field. Paré et al.'s [in press]

recent work on the types of review articles is a valuable contribution at this point and one of the first attempts to provide a descriptive account of IS researchers' current review behaviors and practices. Next, while a comprehensive and general framework is relevant, it is also important to caution researchers that there are no sets of specific rules and recommendations that apply to all types of reviews. Therefore, it is imperative to rely on guidelines that take into account the singularity of each review type. We acknowledge that we have proposed a series of general guidelines and realize that not all review articles have to implement all the facets of these guidelines. Future work could develop in more detail the appropriate rules and recommendations that need to be followed for each type of review.

Further, we believe the value of our framework rests on two principal elements since it applies to both the process and the output of a review article (see Table 1). As mentioned previously, a method is a tool available to researchers to produce new knowledge. The Oxford Dictionary's[3] definition of a tool involves two meanings: a tool is both "a device […] used to carry out a particular function" and "a thing used to help perform a job". While methodologists faithfully consider the impact of the method on the quality of the output, practical considerations and ease of use are frequently neglected. However, a strong and valuable methodology should improve the rigor of research work, as will be discussed below, and help ease the work of researchers in conducting their own studies. Therefore, for each guideline, we proposed specific strategies and described available rules of thumb that aim to help researchers in the conduct of their reviews. By decomposing the whole process of reviewing into less complex and more manageable tasks, our listing of guidelines also provides a framework that it is hoped will be useful to researchers as well as journal reviewers and editors. We believe our work could serve important educational purposes as well by being introduced to doctoral students in research methods seminars. Ultimately, by providing the IS community with a structured approach to reviewing and a better understanding of review methods, we hope to reduce the effort required in the future to produce rigorous and effective stand-alone literature reviews. In that respect, future work could decompose each guideline into more details, help operationalize the guiding principles into practical strategies and discuss the range of methodological practices available at each step. For instance, vom Brocke et al. [2009] investigate the methodological rigor specifically associated with the search process. Other contributions could focus on the remaining steps of

[3] http://www.oxforddictionaries.com/

the review process. Notably, the last step (data analysis and synthesis) is one of the less documented. Indeed, data analysis techniques and processes are hard to evaluate as they usually involve mental activities and reasoning mechanisms that are difficult to state formally. Only very recently authors such as Wolfswinkel et al. [2013] and Hoon [2013] have proposed structured methods and approaches to rigorously analyze data from prior literature. Further developments are definitely needed in this particular area.

Regarding the output of the review, we believe a careful consideration of the guidelines listed in Table 3 is likely to enhance the overall rigor of review articles. To validate the contribution of our framework to the methodological rigor of the output, we reviewed the various guidelines available at each step and compared their appropriateness in answering specific issues of internal validity, external validity, objectivity and reproducibility. Therefore, we hope our work will provide a baseline from which to proceed with the conduct and evaluation of stand-alone reviews in the IS field. However, while we regard the list of attributes in Table 3 to be a positive sign, we caution IS researchers not to treat this list as a cookbook recipe. While these guidelines might contribute to rigor, they do not guarantee it. Indeed, simply reporting a procedure does not necessarily guarantee that it was performed appropriately or effectively. Nevertheless, for the further maturation of the IS field, we hope our framework will help the research community make an informed judgment about their respective contributions to a "cumulative tradition" in our field. Further research could test the applicability of our framework by exploring the current practices of IS researchers and assessing the extent to which they adopted and implemented the recommended approaches and guidelines in conducting stand-alone reviews. Using our list of guidelines, future work could also develop and validate an instrument and apply it to the IS research in order to provide an in-depth evaluation of the methodological rigor of stand-alone reviews. In addition, future research could be directed toward the relevance dimension of quality. As mentioned previously, a review rigorously conducted but addressing a problem that is not relevant would have low value for its audience. Stand-alone literature reviews play an important role in the evolution of a research domain by inspiring and providing directions for further research [Webster and Watson, 2002]. In this way, review articles frequently become "core" or "milestone" papers in a field [Garfield, 1982; Paré et al., 2012]. Relevance is quite possibly a substantial explanation for this kind of influence of review articles on research streams. Therefore, the issue of relevance deserves further scrutiny and more careful consideration.

To conclude, we expect this research essay to contribute to the growing interest in stand-alone literature reviews and the recent trends of evidence-based management. Like Paré et al. [in press] and Rowe [2014], we believe that the enhanced role of IS review articles requires that this expository form be given careful scrutiny. We hope the framework and series of detailed guidelines proposed here will serve as a valuable framework for those interested in evaluating or properly conducting literature reviews both within and outside our field.

2.6 References

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3 Essay #2: A systematic assessment of rigor in IS literature reviews

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3.1 Abstract

Given that the synthesis of cumulated knowledge is an essential condition for any field to grow and develop, we believe that the enhanced role of IS reviews requires that this expository form be given careful scrutiny. In the past decades, a particular attention has been paid to the issues of methodological rigor in the IS field. However, we know little about the level of rigor in our use and application of the literature review techniques and methods. Therefore, the primary objective of this essay is to evaluate the extent to which IS researchers implemented the various methodological guidelines available. In short, we performed a systematic assessment of rigor in IS stand-alone reviews using the guidelines developed in the preceding essay. Our results emphasize the strengths and weaknesses of review practices in IS. In particular, we strongly encourage prospective authors to pay a particular attention to the justification of the choice of the review type and make sure it is aligned with the primary objective(s) of the study, as well as the description of the methodological procedure used to search, identify, and select the relevant studies, as well as to extract and analyze the data.

Keywords: Literature review, stand-alone review article, research synthesis, review methodology, methodological guidelines, information systems, review quality, rigor assessment.

3.2 Introduction

The information systems (IS) field is relatively young compared to other social science disciplines (King and He, 2005). However, the IS domain has grown considerably since its initial development. The maturity of the field is evidenced by the increasing volume of IS research, the emergence of well-established journal outlets (Chen and Hirschheim, 2004), and the development of its own research perspectives and theories (Baskerville and Myers, 2002; Webster and Watson, 2002). More recently, IS research has established itself as a reference discipline for other fields, such as psychology, education, marketing and other management domains (King and He, 2005; Paré, Trudel et al., in press).

However, to enhance its current stage of progress, our domain still needs to consolidate its research tradition. Due to the recent trends, it has become difficult for researchers to remain knowledgeable of the various topics and methods of IS research. Indeed, according to Card (2012), one obstacle to scientific progress is that researchers have limited abilities to retain, organize and synthesize previous knowledge, as well as to stay informed of the new scientific contributions. Similarly, Cooper (2009) notices that the increased quantity of scientific inquiry resulted in a growing specialization within the social sciences. As a result, “time constraints make it impossible for most social scientists to keep up with primary research except within a few topic areas of special interest to them” (Cooper, 2009, p. 2). Since individual studies contribute one step at a time to a larger understanding of a phenomenon of interest, the building of scientific knowledge therefore requires cooperation and interdependent research work (Cooper, 2009). By uncovering prior knowledge, literature reviews offer foundations for further scientific research and are therefore essential to the development of a field. In short, research syntheses are playing an important role in the process of building scientific knowledge and cumulating tradition (Benbasat and Zmud, 1999). Within the IS field, the increasing amount of research and its rapid diffusion also calls for reliable ways to integrate the findings of prior empirical or conceptual studies (Bandara, Miskon, and Fielt, 2011). In this era of information overload, it is thus necessary for the IS field that individual researchers engage in the process of research synthesis.

Hart (1999) broadly defines a literature review as "the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfill certain aims or express certain views on the nature

of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed" (p.13). A literature review might appear either as the background for an empirical study or as an independent, stand-alone piece that provides a valuable contribution in its own right (Jesson, Matheson, and Lacey, 2011; Okoli and Schabram, 2010). The former is the most common form of literature review. This type of review could take the form of a section of a journal article or a chapter of a graduate thesis.

The second type of review, called the "stand-alone literature review," is a "journal-length article whose sole purpose is to review the literature in a field, without any primary data […] collected or analyzed" (Okoli and Schabram, 2010, p. 2). Stand-alone reviews are conducted for many different reasons, such as to make sense of existing knowledge on a particular topic, facilitate theory development, synthesize the extant literature on widely studied and mature areas, or identify research domains where further investigation is needed (King and He, 2005; Okoli and Schabram, 2010; Webster and Watson, 2002). In short, effective stand-alone reviews provide a valuable and trustworthy account of past research that other researchers might seek out for inspiration and use to position their own investigation. In this line of thought, citation analyses have shown that review articles frequently become "core" or "milestone" papers in a field (Garfield, 1982; Paré et al., in press).

Moreover, the publication of stand-alone literature reviews supports the recent and growing movement toward evidence-based practice (e.g., Atkins and Louw, 2000; Oates, 2011) and, hence, provides an effective way to address the gap between IS research and practice. On the one hand, several scholars have acknowledged that the IS literature lacks relevance for practice (Baskerville and Myers, 2002; Benbasat and Zmud, 1999; Lyytinen, 1999). On the other hand, practitioners also have difficulties finding, reading and using academic research literature (Pearson, Pearson, and Shim, 2005). As one solution, Oates (2011) calls for the use of evidence-based practice and, hence, more review articles which synthesize available knowledge for professional practice, provide support to managerial decision-making, and inform policy management (Okoli and Schabram, 2010).

The benefits and relevance of literature reviews have also been stressed in the IS field by the creation of the *Management Information Systems Quarterly* (MISQ) Review department in 2001. As part of its mission, the department, later converted to MISQ Theory and Review, proposes an outlet dedicated to review articles that aims to provide robust syntheses of prior research and

facilitate the dissemination of that knowledge (Watson, 2001). The department intended to "accelerate the accumulation of IS knowledge" and "provide important input in setting directions for future research" (Webster and Watson, 2002, p. xiii).

Despite the recognized importance of stand-alone literature reviews, we still see few published review articles in the IS field (Bandara et al., 2011; Rowe, 2014; Webster and Watson, 2002). Levy and Ellis (2006) suggest that the recurrent lack of proper research syntheses might hinder theoretical and conceptual progress in a field. This is a concern in the IS domain, where progress is being impeded by the low number of published review articles (Webster and Watson, 2002). Therefore, several senior scholars have made calls for more IS reviews as a way to foster the development of our discipline (e.g., King and He, 2005; Watson, 2001; Webster and Watson, 2002). The recent call from *Communications of the Association for Information Systems* for a Special Issue on literature reviews and the publication of *Foundations and Trends in Information Systems*, a recently-launched journal dedicated to review articles are strong signals of the growing importance of review articles in our field.

According to Webster and Watson (2002), one of the challenges in integrating previous research and advancing knowledge is our lack of familiarity with the methods used to structure and present a review. Paré et al. (in press) also argue that the issue of methodological quality is a critical aspect that should be discussed and examined when conducting or assessing stand-alone literature reviews. Indeed, the issue of methodological rigor and quality is particularly important for reviews intended as milestones for future research in the domain. Considering that literature reviews also represent a “benchmark” for other researchers in the field (Webster and Watson, 2002), they should cover the relevant literature to date and earn the confidence of readers regarding the reliability and relevance of their findings. However, as mentioned by Paré et al. (in press), the general discussion of methodological quality and rigor of review articles remains highly abstract, and thus prone to subjectivity and judgment on the side of the authors, assessors and editors. The lack of familiarity and the misconceptions regarding the methods for conducting stand-alone literature reviews also raise issues toward the reputation of the methodology, therefore sensitive to be judged as less rigorous. In that regard, literature reviews are not different from other types of methodologies. Indeed, as in the case of other research methods, the quality and coherence of a review emerge from the application of a structured approach with specific guidelines. As stated by Cooper (2009), “integrating separate research projects into

a coherent whole involves inferences as central to the validity of knowledge as the inferences involved in drawing conclusions from primary data analysis" (p.3). Therefore, in light of the growing interest in stand-alone reviews in our field, we posit that greater attention should be paid to the specific guidelines, methods and tools used to conduct them.

Several fields, such as the health sciences (e.g., Liberati et al., 2009; Higgins and Green, 2008), nursing (e.g., Cronin, Ryan, and Coughlan, 2008; Kirkevold, 1997; Whittemore, 2005), software engineering (e.g., Kitchenham and Charters, 2007), education (e.g., Jackson, 1980; Rossman and Yore, 2009), and social psychology (e.g., Cooper, 1982), have developed a strong tradition of review methods. Within the IS field, the question of what constitutes a rigorous review has received very little attention. Indeed, whereas several researchers have discussed or investigated the nature, types and contributions of IS stand-alone reviews (e.g., Oates, 2011; Okoli, 2012; Rowe 2014; Paré et al., in press) and that the numerous benefits of literature reviews have been widely documented, the question of what does represent a high-quality review paper is still debated. To the best of our knowledge, the work of vom Brocke et al. (2009) is the sole contribution toward the evaluation of review methods and practices in the IS field. However, vom Brocke et al.'s (2009) paper focuses on the literature search process and therefore falls short on investigating the remaining steps of the review process. As mentioned in the previous essay, future work could help operationalize the guiding principles into practical strategies for conducting reviews and discuss the range of methodological practices available at each stage.

In the past decades, a particular attention has been paid to the issues of methodological rigor in the IS field (e.g., Boudreau, Gefen, and Straub, 2001; Dubé and Paré, 2003; Lee and Hubona, 2009; Paré et al., 2013a; Pinsonneault and Kraemer, 1993). However, we know little about the level of rigor in our use and application of the literature review techniques and methods. It seems therefore appropriate and timely to explore the current practices of IS researchers when conducting a review article and assess the extent to which they implemented the various available guidelines. In this essay, we propose to assess the extent to which IS stand-alone reviews are rigorously conducted using the guidelines developed in the preceding essay. As mentioned previously, no prior research has conducted such formal and comprehensive assessment of the review practices in our field and, hence, this essay attempts to fill this important gap.

The remainder of this article is organized as follows. The following section presents the attributes that were used to evaluate the rigor of IS literature reviews and specifies to which forms of reviews they apply. Then, we describe the research method, namely how the review articles were selected and evaluated. This will be followed by a presentation and discussion of the results and some concluding remarks.

3.3 Review process and categories of reviews

In the first essay, we proposed a set of 19 criteria that can be used to assess the methodological rigor and quality of stand-alone literature reviews. These criteria were organized along two dimensions, namely, the general steps of the review process and the various categories of reviews. In the following paragraphs we summarize the general process for doing a review along with the four main categories of reviews.

The six steps comprised in our review process reflect the main activities involved in developing and conducting a research synthesis: (1) formulation of the problem, (2) search of the literature, (3) screening for inclusion, (4) quality assessment, (5) data extraction, and (6) data analysis and synthesis. It must be noted at this point that the proposed sequence of steps should not be followed in a strictly linear manner. Indeed, another important trait of the review process is its iterative nature, since many activities are initiated during the planning phase and later refined during subsequent phases (Kitchenham and Charters, 2007).

The first step refers to the **formulation of the problem**. This phase requires the authors to justify the need for a stand-alone literature review (Kitchenham and Charters, 2007; Webster and Watson, 2002), identify the purpose of the review (Okoli and Schabram, 2010) and provide definitions of the concepts or constructs at the heart of the review (Cooper, 2009; Webster and Watson, 2002). The next two phases are concerned with the collection of appropriate data. The data in a literature review consists of the information included in each primary study that the reviewers have decided is relevant to the problem of interest (Cooper, 2009). The first step in data collection involves a **search of the literature**. In this step, researchers identify the range of information sources and identify from those sources the studies that require further analysis. The major decision at this stage is the choice of a population of studies (Cooper, 1982). The second step in data collection involves **screening relevant studies for inclusion**. This step includes both evaluating the applicability or relevance of primary studies to the review and

justifying which studies will be considered for review and which will be excluded (Kitchenham and Charters, 2007; Levy and Ellis, 2006; vom Brocke et al., 2009). Next, researchers may need to perform a formal **quality assessment** of primary studies in order to refine their inclusion/exclusion decisions, investigate whether the differences in quality affect the results of the review, or guide the analysis of data and interpretation of the findings (Kitchenham and Charters, 2007). The next step, **data extraction**, involves gathering applicable information from each primary study included in the review. This step mainly requires deciding what information is relevant to the problem of interest (Cooper, 1982). Finally, the last step involves **analyzing and synthesizing data**. Researchers must collate, summarize, aggregate, organize and compare the evidence previously extracted from the primary studies. The ultimate objective is to present the information extracted from the primary studies in a meaningful way that suggests a new contribution to knowledge (Jesson et al., 2011).

In the previous essay, we also distinguished between four broad categories of stand-alone reviews that differ considerably in terms of their fundamental objectives and motivations and how they are conducted. First, **narrative reviews** provide verbal summaries of previously published research on a particular topic of interest, either focusing on concepts and theories, research methods or research outcomes (Paré et al., in press). Their main goal is to assemble and synthesize the extant literature on a particular topic of interest to provide the readers with a comprehensive background for understanding the current state of knowledge in that area. Second, **developmental reviews** aim to provide a research community with new conceptualizations, research models, theories, frameworks or methodological approaches. The primary contribution of developmental reviews usually lies in the novelty of the proposed ideas and therefore goes beyond the gathering and synthesis of prior studies. Third, **cumulative reviews** seek to compile empirical evidence in order to map bodies of literature and draw overall conclusions regarding particular streams of research. Last, **aggregative reviews** aim to aggregate prior findings and test specific research hypotheses or propositions. Well conducted aggregative reviews have been advocated as essential tools for synthesizing the cumulated knowledge related to a particular question, and supporting evidence-based management (Briner, Denyer and Rousseau, 2009).

3.4 Methods

In order to assess the level of rigor of stand-alone reviews published in the IS field, we performed a cumulative review and, as detailed below, we followed the associated process and prescribed guidelines.

3.4.1 Search and selection of IS review articles

Cumulative reviews aim to be comprehensive and cover all relevant literature on a specific topic. The underlying objective is to assure the generalizability of their results and conclusions to a particular population of studies. We will therefore follow structured search methods and selection procedures. Our review covers IS review articles that were published until January 1, 2013. Five main sources were used to locate the relevant reviews. At first, we reviewed the references included in a previous review conducted by Paré et al. (2013b). This review includes articles published until January 2012. The authors retrieved the review articles through a search of the *Web of Knowledge (Thompson Reuters)*, restricted to two disciplines/subject areas, namely "Computer Science, Information Systems" and "Information Science and Library Science". They complemented the electronic search with a manual examination of all volumes and issues of *MISQ Theory and Review*. As a next step, we updated their search to include the review articles published between January 2012 and January 2013 and available in those sources. In order to ensure comprehensiveness, we also performed a search on the *ABI/Inform Global (Proquest)* database. Indeed, Shea et al. (2007b) suggest the use of at least two complementary electronic databases in order to cover the extant literature on a given topic. Finally, we screened the articles available through *ABI/Inform Global (Proquest)* to identify the articles already retrieved from previous sources. We only found a total of 28 identical articles out of 610 (5 percent), which suggests a low overlap between these two sources. Therefore, we decided to perform another complementary search on the *Business Source Complete (EBSCO)* database. As a result, we retrieved 312 articles, including 123 articles already found in previous sources (39 percent), showing a significant increase in the number of duplicates. Table 3.1 describes the five sources used in our search. All database searches were conducted using the keywords "review", "research synthesis" or "meta-analysis" in conjunction with "information system", "information technology" or "information technologies".

Table 3.1 – Sources used to locate relevant review articles

Source	Type	Restrictions	N	Duplicate
Paré et al. (2013b)	Previous review	n/a	130	2
MISQ T & R	Manual search	Years = 2012	2	0
Web of Knowledge	Database	- Keywords in topic - Years = 2012 - Research areas = "Computer Science", "Information Science and Library Science" - Peer-reviewed articles	146	2
ABI/Inform Global	Database	- Keywords in abstract - Years = before 2012/12/31 - Peer-reviewed articles - Publication = academic journals	610	28
Business Source Complete	Database	- Keywords in abstract - Years = before 2012/12/31 - Research topics = "Information technology", "Management information systems" - Peer-reviewed articles - Publication = academic journals	312	123

As suggested by Kitchenham and Charters (2007) and Okoli and Schabram (2010), our procedure for study selection involved an initial screening of the titles and abstracts against the proposed inclusion criteria, followed by a thorough examination of the full papers to ensure the appropriateness of inclusion. In this process, we relied on the following inclusion criteria: (1) English language publications, (2) studies published in peer-reviewed journals, (3) studies related to IS topics (e.g., articles related to computer and library sciences were excluded), and (4) review papers (e.g., empirical studies, commentaries and conceptual papers were excluded). One of the authors performed these two steps. A total of 688 articles were excluded during the initial screening and 132 articles were further excluded after thorough examination. A difficult distinction is between review articles and purely conceptual papers. In fact, a total of 18 articles were judged ambiguous and decisions regarding those articles were resolved through discussion between the two authors. To do so, we referred to the ideal types introduced by Rivard (2014). According to the author, "a theory manuscript differs from a review manuscript by putting somewhat less emphasis on the synthesis of prior literature and more emphasis on theoretical development" (Rivard, 2014, p. iv). At this stage, we excluded 5 articles that were purely conceptual papers. Finally, our database includes a sample of 222 review articles. Figure 3.1

displays the diagram flow associated with our process. The complete list and references of the review articles included in the analysis are provided in appendices A and B.

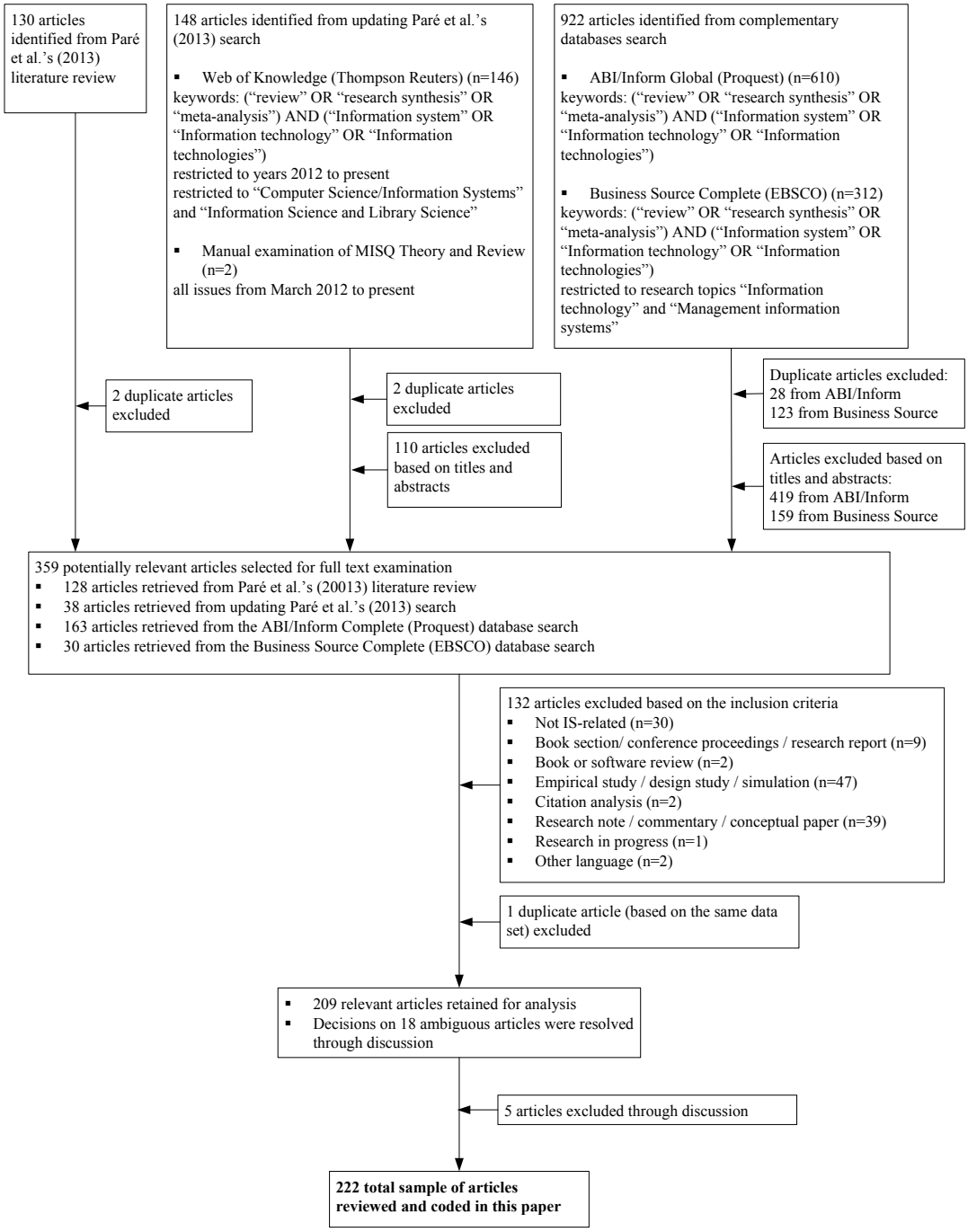

Figure 3.1 – Diagram Flow of the search and selection process

3.4.2 Development of a coding scheme for data extraction

In order to answer our research question, we developed an instrument that encompasses all rigor criteria developed in the first essay. As shown in Table 3.2, the final list of 19 guidelines proposed in the first essay is divided into the different phases and steps depicted in our general framework. We also identified those criteria that apply to particular forms of reviews. Each criterion will be described further in the results section. Based on those detailed guidelines, we built for each category of reviews a comprehensive coding scheme to be used for data extraction purposes.

Next, we validated the coding scheme using the following steps. At first, five articles were selected from the references included in the review conducted by Paré et al. (2013b). In order to validate the four coding schemes and cover as many applications as possible, we purposefully selected five reviews to include one narrative review, two developmental reviews, one cumulative review and one meta-analytic review. Next, the two authors independently coded the five papers and jointly discussed and resolved disagreements. Small adjustments were made to the coding scheme in order to increase its precision and clarity. The coding schemes for each category of review are presented in appendices C to F.

In order to ensure accuracy in the classification of each review category, 15 articles were randomly selected and then coded by the first author and two independent coders. From this process, we computed an inter-rater agreement rate and a Cohen's Kappa for each pair of coders, as well as a Fleiss' Kappa for the three raters. Table 3.3 summarizes these statistics. These results indicate a moderate to substantial agreement between the three coders (Landis and Koch, 1977). All of the disagreements were discussed and reconciled during meetings. As a result, a small adjustment was made to the definition of narrative reviews, in order to clarify the distinction between narrative and cumulative reviews.

Next, using the final coding scheme, the first author coded all the remaining review articles. We believe this coding scheme helped us accurately gathering all the relevant and necessary information in order to assess the review articles included in our study. The coding of an article began with the method section, but it was expanded to include the whole paper if an attribute was not clearly mentioned. Finally, we analyzed data and computed statistics using SPSS software.

Table 3.2 – Proposed set of criteria to evaluate the rigor of IS literature reviews

	Narrative	Developmental	Cumulative	Aggregative
Step 1: PROBLEM FORMULATION				
Q1.1 Are the primary goals of the review clearly stated?	✓	✓	✓	✓
Q1.2 Are definitions of the key concepts provided?	✓	✓	✓	✓
Q1.3 Is the focus of the review stated?	✓	✓	✓	✓
Step 2: LITERATURE SEARCH				
Q2.1 Is a description of the search procedure provided?			✓	✓
Q2.2 Were multiple data sources and search approaches used to locate relevant studies?	✓	✓	✓	✓
Q2.3 Does the search procedure include restrictions?	✓	✓	✓	✓
Q2.4 Were strategies adopted to minimize publication bias?				✓
Step 3: SCREENING FOR INCLUSION				
Q3.1 Is a description of the screening and selection procedure provided?			✓	✓
Q3.2 Is the number of included and excluded studies explicitly reported?			✓	✓
Q3.3 Was a parallel independent assessment of studies for inclusion performed?			✓	✓
Q3.4 Do the inclusion criteria reflect the research question(s)?	✓	✓	✓	✓
Q3.5 Were duplicate studies explicitly identified?			✓	✓
Q3.6 Were studies from reputable sources preferentially selected?	✓	✓		✗[4]
Step 4: QUALITY ASSESSMENT				
Q4.1 Was the quality of the included studies assessed using recognized tools?				✓
Q4.2 Was the quality of the included studies used to select the studies?				✓
Q4.3 Was the quality of the included studies used to interpret the findings?				✓
Step 5: DATA EXTRACTION				
Q5.1 Is a description of the type of data to be extracted provided?			✓	✓
Q5.2 Was a structured procedure used to gather data from the included studies?	✓	✓	✓	✓
Q5.3 Was a parallel independent data extraction process performed?		✓	✓	✓
Step 6: DATA ANALYSIS AND SYNTHESIS				
Q6.1 Were the characteristics of the included studies provided?	✓	✓	✓	✓
Q6.2 Were the appropriate standards for the synthesis of the results reported?				✓
Q6.3 Were the logical reasoning and justifications behind the findings reported?		✓		

[4] Such a guideline is detrimental in the case of aggregative reviews and, hence, should be avoided.

Table 3.3 – Inter-rater agreement rate, Cohen's Kappa and Fleiss' Kappa

Coders	**1 & 2**	**1 & 3**	**2 & 3**
Agreement rate	0,67	0,80	0,80
Cohen's Kappa	0,55	0,73	0,73
Fleiss' Kappa	For 3 raters, K = 0,66		

3.5 Results

3.5.1 Descriptive summary

All selected reviews were first classified according to publication dates, journal names, review types and the presence or absence of a section describing the review methodology. Table 3.4 shows the general profile of the reviews included in our sample.

The data shows that, even though literature reviews have been published as early as 1979, the method started to become popular in the 1990s. Review articles published between 1991 and 2012 represent 97% of our sample. The number of published reviews also grew significantly in the last years (2006 to 2012), representing 59% of the sample. Interestingly, Figure 3.2 shows the number of published literature review has increased exponentially over the years.

The data also show that review articles have been published in a large variety of outlets, including top-ranked IS journals. Indeed, the eight journals included in the Senior Scholars' basket published altogether 68 review articles, accounting for 31% of our sample. Further, the number of review articles differs widely from one journal to another. *MIS Quarterly* contains by far the largest number of review articles, with 12.5% of the review papers appearing in its issues.

In terms of review types, all four categories are fairly represented in our sample. Developmental reviews are leading, accounting for 34% of the reviews in our sample, followed by narrative (25%), cumulative (23%) and aggregative (18%) reviews. Further, our data exhibits a relationship between the type of review article and the journal were it is published. Indeed, as shown in Table 3.5, journals included in the IS Senior Scholars' basket published in proportion less narrative reviews (16% of the 55 narrative reviews in our sample) than other types of review articles (between 30% and 39% of other types of reviews in our sample).

Table 3.4 – Profile of the selected review articles (n=222)

		N	%
Year of publication	1979-1980	2	< 1%
	1981-1985	3	1%
	1986-1990	3	1%
	1991-1995	15	7%
	1996-2000	19	9%
	2001-2005	49	22%
	2006-2010	90	41%
	2011-2012	40	18%
Journal	MIS Quarterly	28	12,5%
	Journal of Information Technology	10	4,5%
	Information & Management	9	4%
	Journal of Management Information Systems	8	3,5%
	Business Process Management Journal	8	3,5%
	Information Systems Research	6	3%
	European Journal of Information Systems	5	2%
	Journal of Strategic Information Systems	5	2%
	Management Science	5	2%
	Data Base for Advances in Information Systems	5	2%
	Government Information Quarterly	5	2%
	Business & Information Systems Engineering	4	2%
	Information and Software Technology	4	2%
	Information Systems Journal	3	1,5%
	Journal of the Association for Information Systems	3	1,5%
	Communications of the Association for Information Systems	3	1,5%
	Other	108	49%
Review type	Narrative	55	25%
	Developmental	75	34%
	Cumulative	52	23%
	Aggregative	40	18%
Methods section	No description of the method	94	42%
	Includes a methodology section	128	58%

Investigating this question further, we would expect that some outlets mostly publish certain types of reviews. For instance and as evidenced in Figure 3.3, the majority of the review papers published in *MIS Quarterly* was developmental in nature. This result reflects the mission and evolution of the MISQ Theory and Review department which is dedicated to review articles and

theory papers that develop new ideas and offer a significant theoretical contribution (Rivard, 2014).

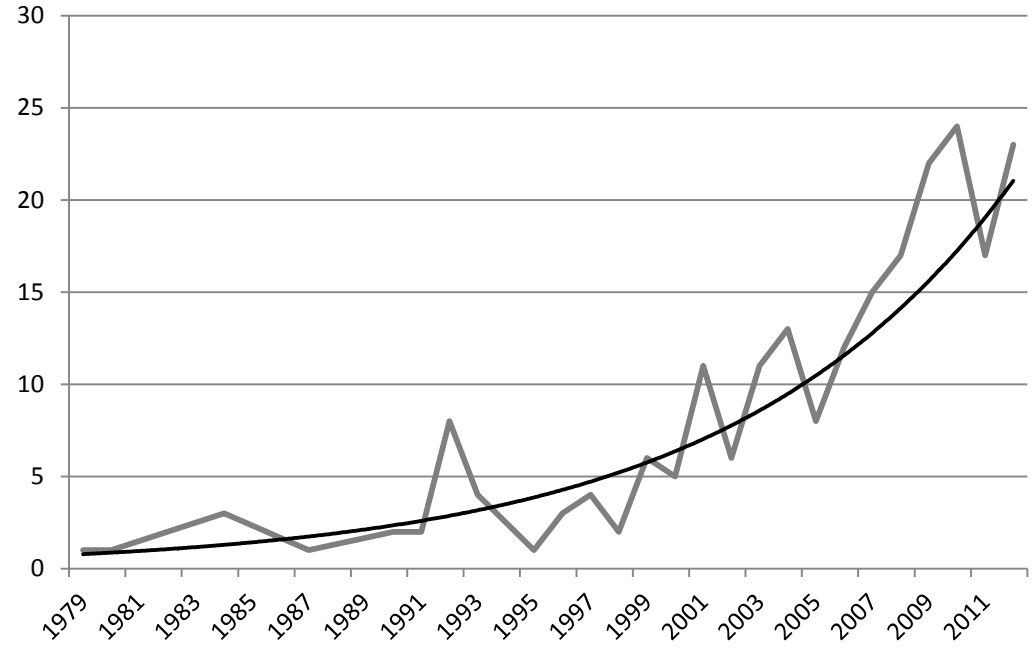

Figure 3.2 – Number of review articles per year (n=222)

Table 3.5 – Type of review by journals included in the Senior Scholars' basket (n=222)

	Senior scholars' basket of journals	
Review type	Yes	No
Narrative	9 16%	46 84%
Developmental	29 39%	46 61%
Cumulative	18 35%	34 65%
Aggregative	12 30%	28 70%
Pearson's chi-square test		
Valeur	*df*	*Asympt. Sig. (2-sided)*
7,94	*3*	*0,047*

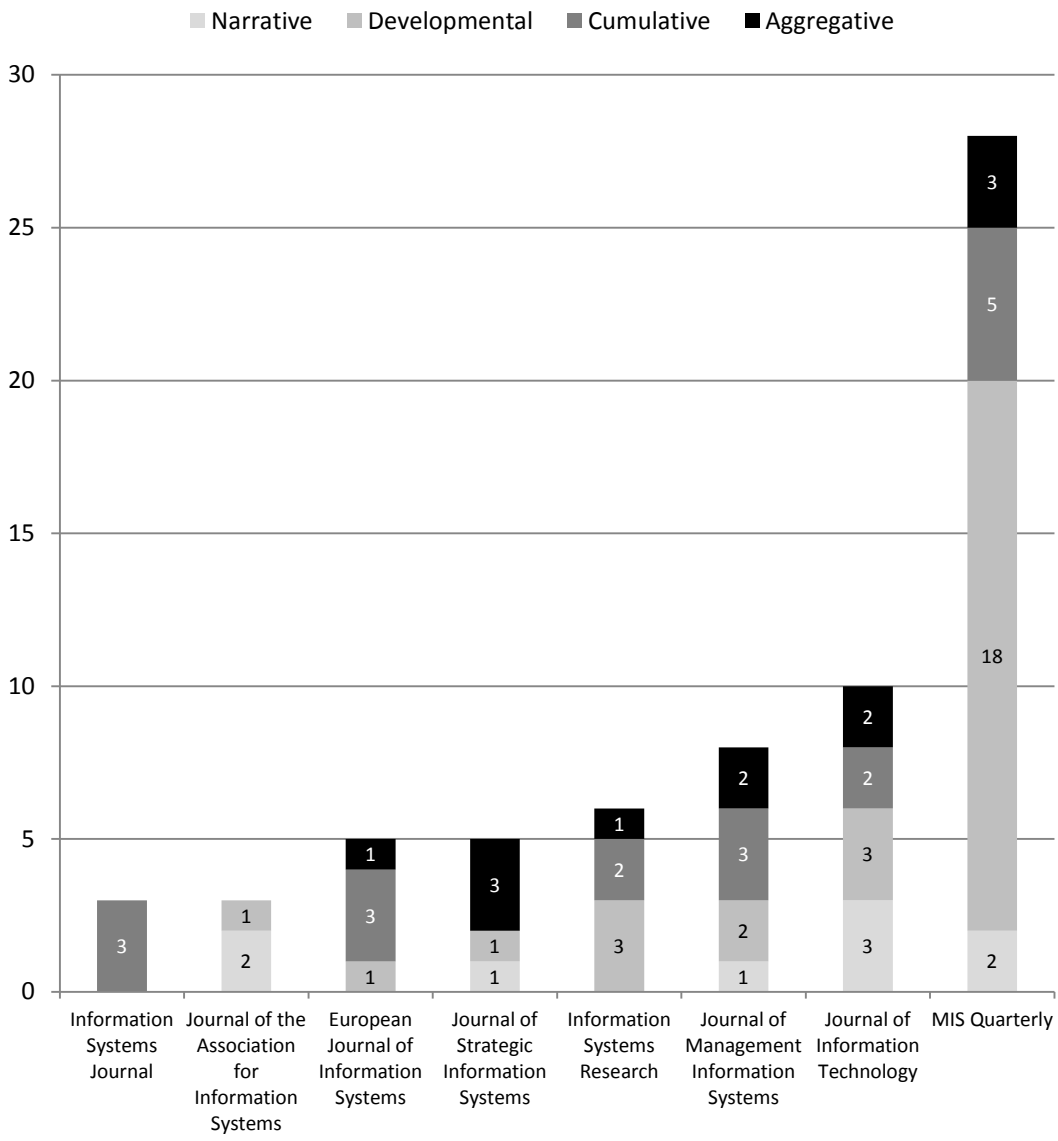

Figure 3.3 – Number of review articles per journals included in the Senior Scholars' basket (n=68)

Finally, all articles were coded according to the presence or absence of a section describing the review methodology. Table 3.4 shows that only 58% of the papers in our sample include a methodology section. We looked for potential trends in terms of the presence of a methodology section. As shown in Table 3.6, our data did not support a significant relationship between the presence or absence of a methods section and the inclusion of the journal in the Senior Scholars' basket. Indeed, an important number of articles (35%) published in the Senior Scholar's basket of IS journals did not describe their review methodology.

Table 3.6 – Inclusion of a methodology section by journal ranking (n=222)

	Senior scholars' basket of journals	
Methods section	Yes	No
Yes	44 65%	84 55%
No	24 35%	70 45%
Pearson's chi-square test		
Valeur	*Df*	*Asympt. Sig. (2-sided)*
1,99	*1*	*0,158*

For its part, Table 3.7 shows a highly significant relationship between the presence of a methodology section and the type of review. Interestingly, almost all cumulative and aggregative reviews (98% and 97%, respectively) provided a description of their review method. Contrastingly, the majority of narrative and developmental reviews (75% and 68%, respectively) did not describe their methodology.

Table 3.7 – Inclusion of a methodology section by type of review (n=222)

	Methods section	
Review type	Yes	No
Narrative	14 25%	41 75%
Developmental	24 32%	51 68%
Cumulative	51 98%	1 2%
Aggregative	39 97%	1 3%
Pearson's chi-square test		
Valeur	*df*	*Asympt. Sig. (2-sided)*
104,39	*3*	*0,000*

For the remaining analyses, we thus decided to exclude those articles that did not include a methodology section, letting us with a sub-sample of 128 articles. Indeed, including all reviews would have introduced a major bias for several analyses that only apply to subgroups of studies. However, this decision also increases significantly the overall performance of the reviews

regarding the rigor criteria. This decision will be taken into account when interpreting our key findings.

3.5.2 Step 1: Problem formulation

As mentioned previously, problem formulation refers to the attributes associated with the identification of the purpose and the definition of the central topic of the review. This step is one of the most sensitive in the review process and is required for all categories of reviews. In short, reviewers must motivate the problem as being both timely and appropriate and accordingly justify why the review is conducted. Table 3.8 presents the distribution of the studies according to the three problem formulation criteria.

Table 3.8 – Problem formulation criteria (n=128)

	All review types
Q1.1 Are the primary goals of the review clearly stated?	
Yes	**128**
	100%
No	**0**
	0%
Q1.2 Are definitions of the key concepts provided?	
Yes	**126**
	99%
No	**2**
	1%
Q1.3 Is the focus of the review stated?	
Yes	**128**
	100%
No	**0**
	0%

3.5.2.1 Specify the primary goal(s) of the review

Authors must be explicit about the pursued objectives since they are closely related to the form or type of review that is called upon. All of the articles in our database (n=128) specified the primary goal(s) for conducting the review. Stand-alone review articles can be undertaken to identify gaps in prior research, to analyze the progress of a specific stream of research, to review or critique the application of one theoretical model or one methodological approach, to develop a research model or framework, or to aggregate findings or reconcile equivocal results (Cooper,

1988). Table 3.9 presents the major reasons for conducting a review reported by the articles in our sample. As expected, we observed variations across review types in terms of their primary objective. Indeed, our results closely match the definitions and overarching objectives of our review types. For instance, 86% of the narrative reviews reported "to summarize the state of knowledge" as the main underlying motivation, 88% of the developmental reviews aimed "to develop a research model or framework", 94% of the cumulative reviews intended "to analyze a stream of research", and 95% of the aggregative reviews reported "to validate propositions or hypotheses" as one of the primary reasons for conducting the synthesis. While the abovementioned reasons appear as the main overarching goals associated with each review types, we also noted that there was a diversity of supplementary reasons for conducting reviews. For instance, 70% of all reviews also reported "to make future recommendations" as an important motivation.

Table 3.9 – Reasons for conducting a review (n=128)

Reasons for conducting the review	**Review types**				
	Narrative (n=14)	Developmental (n=24)	Cumulative (n=51)	Aggregative (n=39)	Total
To identify gaps in prior research	5 36%	2 8%	7 14%	2 5%	16 12%
To analyze a stream of research	8 57%	6 25%	**48** **94%**	3 8%	65 51%
To summarize the state of knowledge	**12** **86%**	2 8%	1 2%	2 5%	17 13%
To define an emerging research area	0 0%	0 0%	2 4%	0 0%	2 2%
To critique the application of a theory	0 0%	3 13%	0 0%	0 0%	3 2%
To critique the application of a method	0 0%	2 8%	2 4%	2 5%	6 5%
To develop a research model or framework	1 7%	**21** **88%**	1 2%	1 3%	24 19%
To make future recommendations	12 86%	21 88%	35 69%	22 56%	90 70%
To validate propositions or hypotheses	0 0%	0 0%	0 0%	**37** **95%**	37 29%

3.5.2.2 Clearly define the key concept(s) of the review

In order to exclude the previous work that lies near the boundary of their problem domain, researchers must define the key concept(s) at the heart of their review (Arksey and O'Malley, 2005; Cooper, 2009; Webster and Watson, 2002). The key concept(s) were defined in virtually all of the reviews (99%) in our sample.

3.5.2.3 Establish the boundaries of the review

Another characteristic refers to the research materials to which the review directs its main attention, namely the boundaries or focus of the synthesis. Drawing on Cooper (1988) and Whittemore (2005), literature reviews can potentially direct their focus in one or more of the following areas: research findings or outcomes; concepts, theories or research models; and research methods. All of the articles in our database (n=128) describe either explicitly or implicitly (through the description of the data extracted) the main focus of the review.

3.5.3 Step 2: Literature Search

Literature search refers to the attributes associated with the identification of potentially relevant studies. The search for relevant literature is critical for all categories of reviews, though the choice about the population of studies will differ according to the review's objectives. Table 3.10 presents the distribution of the studies according to the literature search criteria.

3.5.3.1 Specify the search procedures in sufficient details

The search and identification of relevant studies is one of the most critical tasks of the review process. To ensure a high level of rigor during this process, it is recommended to determine and follow a rigorous search strategy (Kitchenham and Charters, 2007). The authors must clearly answer questions such as "where to search, which terms to use, which sources are to be searched, time span, and language" (Levac, Colquhoun, and O'Brien, 2010, p. 3). A thorough documentation of the search process is particularly critical for cumulative and aggregative reviews to contribute to the objective of reproducibility. Therefore, authors of such reviews must be explicit in describing their approach and justifying their decisions (Kitchenham and Charters, 2007; Okoli and Schabram, 2010). According to Table 3.10, virtually all of the cumulative and aggregative reviews in our sample provided a description of their search procedure.

Table 3.10 – Literature search criteria (n=128)

	Review types				Overall
	Narrative	Develop.	Cumulative	Aggregative	
Q2.1 Is a description of the search procedure provided?					
Yes			**50**	**38**	88
	n/a	n/a	**98%**	**97%**	98%
No			**1**	**1**	2
			2%	**3%%**	2%
Q2.2 Were multiple data sources and search approaches used to locate relevant studies?					
Yes	**10**	**11**	**15**	**25**	61
	71%	**46%**	**29%**	**64%**	48%
No	**4**	**13**	**36**	**14**	67
	29%	**54%**	**71%**	**36%**	52%
Q2.3 Does the search procedure include restrictions?					
No	**0**	**0**	**0**	**1**	1
	0%	**0%**	**0%**	**3%**	1%
Restrictions justified	**4**	**8**	**26**	**8**	46
	29%	**33%**	**51%**	**20%**	36%
Restrictions not justified	**2**	**9**	**22**	**17**	50
	14%	**38%**	**43%**	**44%**	39%
Not specified	**8**	**7**	**3**	**13**	31
	57%	**29%**	**6%**	**33%**	24%
Q2.4 Were strategies adopted to minimize publication bias? (n=39)					
Yes				**18**	18
	n/a	n/a	n/a	**46%**	46%
No or not specified				**21**	21
				54%	54%

3.5.3.2 Use a combination of data sources and search approaches

A high-quality review should cover all aspects of the relevant literature related to the initial research questions (Webster and Watson, 2002). Retrieval from any single source is likely to be incomplete (Kitchenham and Charters, 2007; Liberati et al., 2009). It is therefore important to combine multiple sources and approaches to ensure the comprehensiveness of the search. As shown in Table 3.10, 48% of the reviews used multiple sources and approaches to locate relevant studies. Surprisingly, 71% of the narrative reviews used multiple sources while only 29% of the cumulative reviews reported the use of multiple sources. It should be noted at this point that several cumulative reviews aims to analyze the publications of a specific set of journals (e.g.,

Paré, Bourdeau, Marsan, Nach, and Shuraida, 2008) and therefore performed a manual search of those journals. According to Okoli and Schabram (2010), the most common sources in stand-alone reviews are electronic databases. Alternative search approaches that are recommended include scanning "manually" journals and conference proceedings and contacting experts on the topic of interest (Kitchenham and Charters, 2007; Okoli and Schabram, 2010). Webster and Watson (2002) also propose that backward searches (identifying and examining references cited in an article of interest) and forward searches (identifying and considering articles that cite a particular article) be conducted. As shown in Table 3.11, Electronic database (69%) is the most used source by the reviews in our sample, however closely followed by manual search (60%). Other sources include backward search (25%), contact with experts (9%), references from previous reviews (9%), and forward search (2%). Interestingly, there is a noticeable difference between review types in terms of preferred data sources. Indeed, while database search is the most used source for developmental (76%) and aggregative reviews (95%), the most common data source for cumulative reviews is manual search (70%). As noted previously, several cumulative reviews only performed a manual search of a set of journals, as their objective is to synthesize the articles published in a specific journal or a few major IS journals (e.g., the Senior scholars' basket of IS journals).

Table 3.11 – Sources and approaches used to locate studies (n=123)

Sources and approaches used to locate studies	**Review types**				
	Narrative (n=14)	Developmental (n=21)	Cumulative (n=50)	Aggregative (n=38)	Total
Database	9 64%	16 76%	27 54%	36 95%	88 69%
Manual search	9 64%	15 71%	35 70%	15 39%	74 60%
Backward search	5 36%	5 24%	7 14%	13 34%	30 25%
Contact with expert	1 7%	1 5%	2 4%	7 18%	11 9%
Previous review or seminal article	2 14%	0 0%	0 0%	6 16%	11 9%
Forward search	1 7%	1 5%	1 2%	0 0%	3 2%

For those reviews using electronic databases, important information that should be reported include the name and number of databases searched, as well as the search terms used (Kitchenham and Charters, 2007; Okoli and Schabram, 2010). Table 3.12 presents the data in the 88 reviews that used electronic databases as a data source. A large majority of the reviews in this sub-sample (78%) specified the search terms used. Further, Shea et al. (2007) suggest that at least two complementary electronic databases must be used to scan the extant literature on a given topic. Commonly used databases include *ABI/Inform*, *ISI Web of Knowledge*, *PubMed*, *JSTOR*, and *IEEE Xplore*, to name but a few (Okoli and Schabram, 2010). As shown in Table 3.12, the majority of the reviews searched at least two databases. Among these, 42 reviews (48%) searched between 2 and 5 databases, 8 reviews (9%) searched between 6 and 10 databases, and 4 reviews (4%) searched more than 11 databases. Table 3.12 also indicates that 23% of the reviews in this sub-sample searched a single database, while 16% did not specify the number of databases searched.

Table 3.12 – Information provided on database searches (n=88)

		N	%
Search terms specified	Yes	69	78%
	No	19	22%
Number of databases searched	11 and over	4	4%
	6-10	8	9%
	2-5	42	48%
	1	20	23%
	Not specified	14	16%

3.5.3.3 Avoid restrictions on language, publication status and dates

When a review is concerned with the generalizability of its findings, then it should ideally capture all studies of interest. Ideally, restrictions pertaining to the publication language, status and date should be avoided unless the limitations correspond to the boundaries of the review itself (Higgins and Green, 2008). When restrictions are applied, authors should report them (Liberati et al., 2009) and provide clear justifications (Kitchenham and Charters, 2007). Table 3.10 shows that 31 reviews (24%) in our sample did not report the restrictions applied to the search. Further, among the 97 articles describing that criteria, only 1 review explicitly mention that no restriction was applied to the search, 46 reviews (37%) justified their restrictions and 50 reviews (39%) did

not provide justifications. Surprisingly, the proportion of cumulative reviews following recommendations from methodologists on that criterion is much higher than for other review types. According to Table 3.10, only 3 cumulative reviews out of 51 (6%) did not report restrictions, and 51% of the cumulative reviews justified their restrictions. Interestingly, although restrictions to the search are highly detrimental for aggregative reviews, one third (33%) of those reviews did not report any restrictions and only 20% justified the applied restrictions.

Table 3.13 presents the data in the 96 reviews that reportedly applied restrictions to the search. The most commonly used restrictions are, in order of importance: specific date range (73%), set of publication titles (45%), type of publication (34%), status of the publication (31%) and language (14%). Figure 3.4 presents the number of years covered by the 70 review articles in our sample that reported such restriction. The majority of the studies (n=39) reported range of years between 6 and 15, 11 studies reported a number of years of 5 or less, and only 7 reviews reported a coverage above 20 years.

Table 3.13 – Types of restrictions applied to the search (n=96)

Restrictions applied to the search	**Review types**				
	Narrative (n=6)	Developmental (n=17)	Cumulative (n=48)	Aggregative (n=25)	Total
Specific date range	5 83%	12 71%	36 75%	17 68%	70 73%
Set of publication titles	2 33%	8 47%	30 63%	3 12%	43 45%
Type of publication	3 50%	5 29%	15 31%	10 40%	33 34%
Status of the publication	2 33%	1 6%	21 44%	6 24%	30 31%
Language	0 0%	2 12%	5 10%	6 24%	13 14%

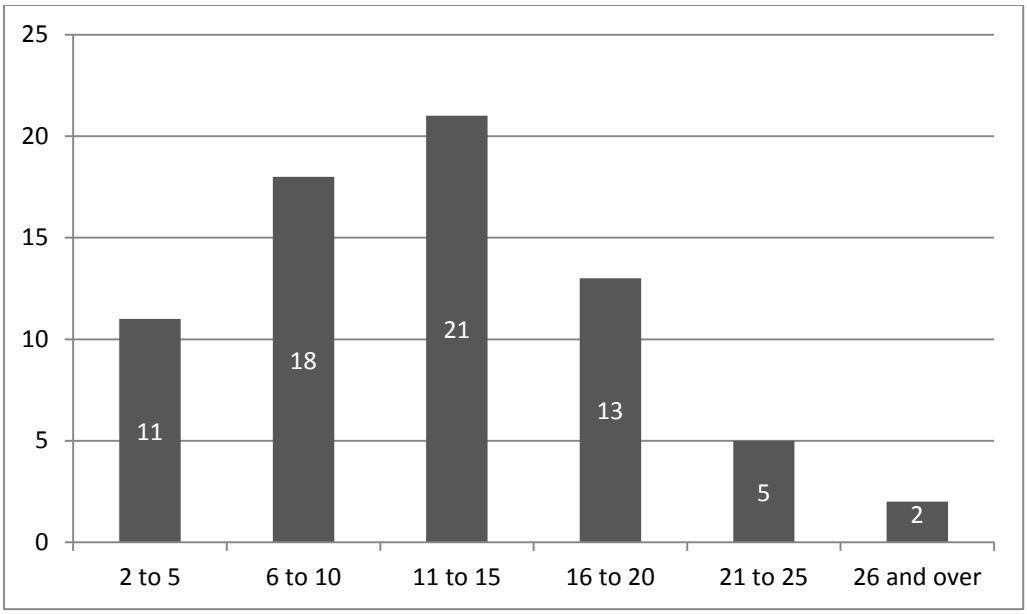

Figure 3.4 – Number of reviews articles by number of years covered (n=70)

As shown in Figure 3.5, among the 43 reviews that restricted their search to a specific set of publications titles, 4 reviews searched in only one outlet, while 9 articles (21%) and 15 articles (35%) reviewed between 2 and 5 publications outlets and between 6 and 10 publications outlets, respectively.

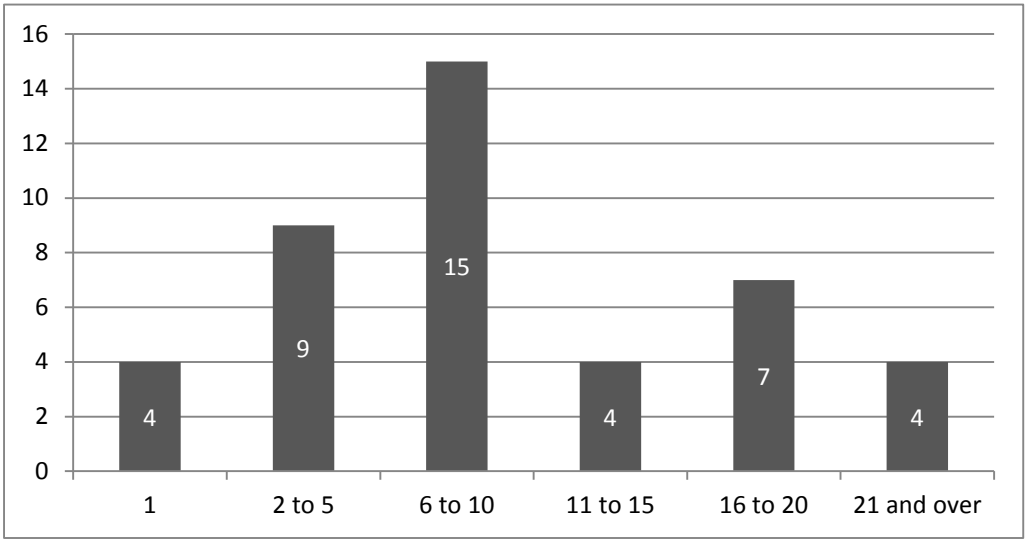

Figure 3.5 – Number of review articles by size of the publication titles set (n=43)

3.5.3.4 Adopt strategies to minimize publication bias

Publication bias, which arises from the tendency to publish significant rather than non-significant results, is particularly harmful for aggregative reviews that aim to test hypotheses and theories. Therefore, researchers should address this issue by adopting strategies such as scanning grey and unpublished literature or contacting experts on the topic of interest to locate unpublished material (Kitchenham and Charters, 2007; Liberati et al., 2009). Table 3.10 shows that only 18 aggregative reviews (46%) acknowledged the potential for publication bias and reported the use of strategies to minimize such bias. As shown in Table 3.14, the most commonly used strategies to reduce publication bias are, in order of importance: inclusion of conference proceedings (83%) and dissertations/theses (61%), request for unpublished studies to a community (39%), and inclusion of technical reports (17%).

Table 3.14 – Strategies adopted to reduce publication bias (n=18)

Strategies adopted to reduce publication bias	Aggregative reviews (n=18)
Inclusion of conference proceedings	15 83%
Inclusion of dissertations and/or theses	11 61%
Request for unpublished studies to a community	7 39%
Inclusion of technical reports	3 17%

3.5.4 Step 3: Screening for inclusion

Screening for inclusion refers to the attributes associated with the judgment and selection of studies that are appropriate for further analysis. Indeed, a broad and comprehensive search is likely to yield many articles that are not relevant to the research question (Oxman and Guyatt, 1988). Therefore, the reviewer must select the appropriate articles among those retrieved during the initial search. To claim internal validity of their results, all review types aim to include only those articles that are appropriate and relevant for the conduct of the synthesis. For each study, reviewers should ask themselves if it addresses the problem under inquiry and helps answer the research question (Pawson, Greenhalgh, Harvey, and Walshe, 2005). Table 3.15 presents the distribution of the reviews according to the screening for inclusion criteria.

Table 3.15 – Screening for inclusion criteria (n=128)

	Review types				Overall
	Narrative	Develop.	Cumulative	Aggregative	
Q3.1 Is a description of the screening and selection procedure provided?					
Yes			**30**	**19**	49
	n/a	n/a	**59%**	**49%**	54%
No			**21**	**20**	41
			41%	**51%**	46%
Q3.2 Is the number of included and excluded studies explicitly reported?					
Yes			**6**	**11**	17
	n/a	n/a	**12%**	**28%**	19%
No			**45**	**28**	73
			88%	**72%**	81%
Q3.3 Was a parallel independent assessment of studies for inclusion performed?					
Yes			**7**	**6**	13
	n/a	n/a	**14%**	**15%**	14%
No or not specified			**44**	**33**	77
			86%	**85%**	86%
Q3.4 Do the inclusion criteria reflect the research question(s)?					
Yes, only	**6**	**18**	**34**	**19**	77
	43%	**75%**	**67%**	**49%**	60%
Yes, with practical criteria justified	**2**	**1**	**2**	**14**	19
	14%	**4%**	**4%**	**36%**	15%
Yes, with practical criteria not justified	**0**	**0**	**1**	**2**	3
	0%	**0%**	**2%**	**5%**	2%
No, only practical criteria	**0**	**0**	**4**	**0**	4
	0%	**0%**	**8%**	**0%**	3%
Not specified	**6**	**5**	**10**	**4**	25
	43%	**21%**	**19%**	**10%**	20%
Q3.5 Were duplicate studies explicitly identified? (n=90)					
Yes			**4**	**19**	23
			8%	**49%**	26%
Unnecessary	n/a	n/a	**31**	**0**	31
			61%	**0%**	34%
No			**16**	**20**	36
			31%	**51%**	40%
Q3.6 Were studies from reputable sources preferentially selected? (n=38)					
Yes	**10**	**13**			23
	71%	**54%**	n/a	n/a	61%
No or not specified	**4**	**11**			15
	29%	**46%**			39%

3.5.4.1 Specify the screening and selection procedures in sufficient details

Researchers should be explicit about how the studies were selected or chosen to ensure greater transparency and allow replicability (Oxman, 1994; Okoli and Schabram, 2010; Higgins and Green, 2008). As shown in Table 3.15, a majority of cumulative and aggregative reviews (54%) provided a description of the screening and selection procedures. Further, authors are recommended to adopt a multistage process (Kitchenham and Charters, 2007). First, they should perform an initial screening of the titles and abstracts against the inclusion criteria to decide whether they are worth reading or not (Okoli and Schabram, 2010). Next, they should thoroughly examine the full papers to ensure compliance with the inclusion criteria (Higgins and Green, 2008). Table 3.16 presents the data in the 30 cumulative and 19 aggregative reviews that described their screening and selection procedures. The majority of the reviews in our sample (69%) performed an initial screening. However, only 37% of the reviews reported a thorough examination of the full papers.

Table 3.16 – Steps in the screening and selection procedure (n=49)

Steps performed during the selection process	**Review types**		
	Cumulative (n=30)	Aggregative (n=19)	Total
Initial screening	21 70%	13 68%	34 69%
Thorough screening	10 33%	8 42%	18 37%

3.5.4.2 Report the number of included and excluded studies

In addition to the screening procedure, the authors of cumulative and aggregative reviews should also report appropriate information such as the number of excluded studies at each stage with reasons for exclusion (Kitchenham and Charters, 2007; Liberati et al., 2009) and the final number of included studies (Liberati et al., 2009). Liberati et al. (2009) also advise using a diagram flow to summarize the study selection process. We computed information regarding the number of included studies and the full list of selected references for all reviews, as such information is also important for narrative and developmental reviews. As shown in Table 3.17, the vast majority of the reviews (90%) reported the final number of included studies. Also, 56 reviews (44%) provided the full list of selected references. Surprisingly, cumulative reviews rank lower on that criterion, compared to other types of review. Regarding the information required

for cumulative and aggregative reviews, only 17 of these reviews (19%) reported the number of excluded studies per criteria, and only 5 reviews (6%) used a diagram flow.

Table 3.17 – Information provided on the selection process (n=128)

Information provided regarding the selection process	Review types				
	Narrative (n=14)	Developmental (n=24)	Cumulative (n=51)	Aggregative (n=39)	Total
Number of included studies	10 71%	18 75%	49 96%	38 97%	115 90%
Full list of selected references	7 50%	12 50%	12 24%	25 64%	56 44%
Number of excluded studies per criteria	n/a	n/a	6 12%	11 28%	17 19%
Diagram flow	n/a	n/a	3 6%	2 5%	5 6%

3.5.4.3 Conduct parallel independent assessment of studies for inclusion

Parallel independent assessment of the studies is recommended to minimize the risk of errors and judgments from the researchers (Kitchenham and Charters, 2007; Okoli and Schabram, 2010). The objective is to ensure and validate the objectivity and consistency of the screening and selection process. As shown in Table 3.15, only 14% of the cumulative and aggregative reviews in our sample performed a parallel independent assessment of studies for inclusion.

3.5.4.4 Use inclusion criteria that reflect the research question(s)

According to Okoli and Schabram (2010), researchers must explicitly state on what criteria judgement will be based. As shown in Table 3.15, the vast majority of the reviews (80%) specified their inclusion criteria. Further, as mentioned by Oxman (1994), "the criteria used to select studies for inclusion should be consistent with the [research] focus" (p. 649). Therefore, the criteria required for study inclusion are usually based on the content of the study and refer to the research questions (Cooper, 2009; Kitchenham and Charters, 2007; Liberati et al., 2009; Okoli and Schabram, 2010; Petersen, Feldt, Mujtaba, and Mattsson, 2008). Other criteria might be based on practical considerations such as the publication status, language, years considered and a lack or missing of information (Liberati et al., 2009; Okoli and Schabram, 2010). The use of such pragmatic selection criteria reflects trade-offs between satisfactorily answering the research question and practically managing the review (Okoli and Schabram, 2010). They should be appropriately justified and used with caution (Liberati et al., 2009). Here again, a majority of

reviews (75%) either used only criteria that reflect the research question or justified clearly the choice of inclusion criteria for practical purposes.

3.5.4.5 Identify and be explicit about duplicate studies

There exist various forms of duplicate publication, including identical manuscripts retrieved from different sources and distinct reports of similar or different results from the same sample (Higgins and Green, 2008). Cumulative reviews are much concerned with the first form of duplicates (i.e., identical articles that might be retrieved from different sources) as such reviews attempt to generalize inferences to a particular population of studies. Therefore, when such reviews only search manually one or several publication outlets, identifying identical manuscripts is not necessary. As shown in Table 3.15, 4 cumulative reviews out of 51 (8%) explicitly identified duplicate studies while 31 reviews (61%) only scanned manually journals or conference proceedings. The latter form of duplicates (i.e., multiple publications associated with the same data set) can be very harmful especially for aggregative reviews which pool prior data and findings to test theories and hypotheses. Therefore, authors of such reviews should find ways to identify duplicates and then make proper decisions regarding their inclusion or not (Kitchenham and Charters, 2007). As shown in Table 3.15, 19 aggregative reviews out of 39 (49%) explicitly identified duplicate studies, be it identical manuscripts or distinct reports based on the same data set.

3.5.4.6 Include studies from reputable sources

This recommendation is specific to narrative and developmental reviews because they adopt coverage strategies that place a strong emphasis on important contributions to the topic of interest. Since such reviews usually do not perform a formal quality assessment of the primary studies they include, they must find other ways to ensure the quality of the evidence on which they base their conclusions (Levy and Ellis, 2006). Contrarily, this guideline should be avoided in the case of aggregative reviews, as it could introduce a form of publication bias. Levy and Ellis (2006) recommend that researchers limit their search to top-tier journals and conferences. In the same vein, Webster and Watson (2002) suggested to start the search process with leading journals where the major contributions are most likely to be found. As shown in Table 3.15, the vast majority of narrative reviews (71%) preferentially selected studies from reputable sources, while 13 developmental reviews out of 24 (54%) mention they included studies from peer-reviewed and top-ranked journals or conferences.

3.5.5 Step 4: Quality assessment

Whereas the previous step is mainly concerned with the search and selection of primary studies, this step includes guidelines associated with the evaluation of the rigor of the selected articles. The quality assessment process refers to a formal evaluation of the methodological quality, as it has been defined by leading methodologists (e.g., Higgins and Green, 2008; Kitchenham and Charters, 2007; Shea et al., 2007). Over the years, the process of quality appraisal has emerged as a formal and recommended guideline particularly for certain types of aggregative reviews, such as systematic reviews and meta-analyses (Whittemore, 2005). Indeed, in order to claim internal validity of their findings, aggregative reviews require high quality primary evidence that they pool to validate theories and hypotheses. Table 3.18 presents the distribution of the reviews according to the quality assessment criteria.

Table 3.18 – Quality assessment criteria (n=39)

	Aggregative reviews
Q4.1 Was the quality of the included studies assessed using recognized tools?	
Yes	**2**
	5%
No or not specified	**37**
	95%
Q4.2 Was the quality of the included studies used to select the studies?	
Yes	**1**
	2,5%
No	**1**
	2,5%
Not specified	**37**
	95%
Q4.3 Was the quality of the included studies used to interpret the findings?	
Yes	**2**
	5%
No	**0**
	0%
Not specified	**37**
	95%

3.5.5.1 Use recognized quality assessment tools

If individual studies included in a review contain methodological deficiencies or invalid results due to systematic errors and flawed designs, then these studies might distort the findings of the review and introduce bias in its conclusions (Liberati et al., 2009). Therefore, when conducting aggregative reviews, researchers should assess the quality of the primary studies using recognized assessment tools and checklists such as those proposed by Pinsonneault and Kraemer (1993) for survey research, Dubé and Paré (2003) for positivist case research, and Paré, Cameron, Poba-Nzaou and Templier (2013b) for ranking-type Delphi studies. As shown in Table 3.18, only 2 aggregative reviews out of 39 (5%) performed a formal quality assessment of the included studies.

3.5.5.2 Consider the quality assessment in the selection of studies

At first, the results of quality assessment might assist researchers during the selection of primary studies (Okoli and Schabram, 2010). Table 3.18 shows that one of the 2 studies that performed a quality assessment used the results to previously exclude primary studies.

3.5.5.3 Consider the quality assessment in the interpretation of the findings

Researchers might also consider the potential impact of methodological quality on the findings of their review (Kitchenham and Charters, 2007). Table 3.18 shows that the 2 studies performing a quality assessment considered the evaluation in the interpretation of the findings.

3.5.6 Step 5: Data extraction

Data extraction refers to the attributes associated with the gathering and extraction of applicable information from each study. According to Bandara et al. (2011), this step consists of determining what to capture and how to capture data effectively. All categories of reviews are concerned with this step because the outcome of data extraction is the primary material for analysis, and therefore they aim to record accurate and meaningful information (Kitchenham and Charters, 2007). Table 3.19 presents the distribution of the reviews according to the data extraction criteria.

Table 3.19 – Data extraction criteria (n=128)

	Review types				Overall
	Narrative	Develop.	Cumulative	Aggregative	
Q5.1 Is a description of the type of data to be extracted provided?					
Yes			**47**	**35**	82
	n/a	n/a	**92%**	**90%**	91%
No			**4**	**4**	8
			8%	**10%%**	9%
Q5.2 Was a structured procedure used to gather data from the included studies?					
Yes	**6**	**15**	**28**	**22**	71
	43%	**63%**	**55%**	**56%**	56%
No or not specified	**8**	**9**	**23**	**17**	56
	57%	**37%**	**45%**	**44%**	44%
Q5.3 Was a parallel independent data extraction process performed?					
Yes		**5**	**22**	**18**	45
	n/a	**21%**	**43%**	**46%**	39%
No or not specified		**19**	**29**	**21**	69
		79%	**57%**	**54%**	61%

3.5.6.1 Specify the type of data to be extracted

Authors of cumulative and aggregative reviews should plan and specify the type of data to be extracted from the primary studies (Kitchenham and Charters, 2007; Higgins and Green, 2008). Most of the recorded data usually provide evidence about the *a priori* research questions (Okoli and Schabram, 2010). Nevertheless, important information about how the primary study was conducted, the research design and methods, or statistical results might also be gathered (Cooper, 2009). As shown in Table 3.19, the vast majority of the cumulative and aggregative reviews in our sample (91%) specified the type of data to be extracted.

3.5.6.2 Use a structured procedure for data extraction

The data extraction procedure should allow researchers to collect all the information needed to address the research questions. Table 3.19 shows that a short majority of reviews reported the use of a structured procedure to extract data from primary studies. Interestingly, there is also no important difference between the four review types on that criterion. Further, Table 3.20 presents the data in the 71 reviews that reported the use of a structured data extraction procedure. The use of a standardized "data extraction form" (Bandara et al., 2011; Higgins and Green, 2008; Kitchenham and Charters, 2007; Okoli and Schabram, 2010), a set of "bespoke

forms" (Pawson et al., 2005), or a "data charting form" (Arksey and O'Malley, 2005; Levac et al., 2010) is a recommended approach for cumulative and aggregative reviews, in order to structure the process of data gathering. As shown in Table 3.20, only 36% of the cumulative and aggregative reviews provided the form or system that was used to collect data. Interestingly, a few reviews (n=7) pretested the data extraction procedure on a sample of primary studies.

Table 3.20 – Information provided on data extraction (n=71)

Additional information regarding the data extraction process	**Review types**				
	Narrative (n=6)	Developmental (n=15)	Cumulative (n=28)	Aggregative (n=22)	Total
Data extraction form provided	n/a	n/a	13 46%	5 23%	18 36%
Pretest to the data extraction performed	0 0%	3 20%	3 11%	1 4%	7 10%

3.5.6.3 Conduct parallel independent data extraction

Authors of developmental, cumulative and aggregative reviews also aim in this step to avoid bias and errors and to ensure consistency in the execution of the data extraction. This criterion is particularly important for cumulative and aggregative reviews as they base their conclusions on the repetition of evidence. Therefore, a repeated error in data gathering will have high impacts on the results. Further, this criterion is also key for developmental reviews. Indeed, such process is similar as the one of coding data from qualitative case studies, where the use of multiple researchers will maximize reliability and foster greater confidence in the findings (Patton, 1999; Dubé and Paré, 2003). Kitchenham and Charters (2007) recommend that two researchers independently perform the data extraction exercise in order to minimize errors and reduce potential bias introduced by reviewers. The authors suggest that at least a random sample of the primary studies be cross-checked by two or more reviewers. Further, data from the researchers should be compared and disagreements discussed and resolved (Kitchenham and Charters, 2007). As shown in Table 3.19, the proportion of developmental reviews performing a parallel independent data extraction process (21%) is somehow lower than in the case of cumulative reviews (43%) and aggregative reviews (46%).

3.5.7 Step 6: Data analysis and synthesis

Data analysis and synthesis refers to the use of appropriate techniques to make sense of the information gathered as well as the appropriate reporting of the review results. "During data analysis, the separate data points collected by the researcher are summarized and integrated into a unified picture" (Cooper, 2009, p. 16). Analysis and synthesis can be done following different methods and approaches. For instance, narrative and developmental reviews usually present verbal descriptions of the data contained in primary studies, whereas cumulative and aggregative reviews might complement the narrative summary with quantified data, such as a frequency analysis or more complex statistical methods (King and He, 2005). Consequently, even though all forms of reviews attempt to synthesize prior evidence and present findings that are both valid and reliable, objectives in terms of rigor and methodological guidelines will significantly vary among the different categories of reviews. Table 3.21 presents the distribution of the reviews according to the data analysis and synthesis criteria.

Table 3.21 – Data analysis and synthesis criteria (n=128)

	Review types				Overall
	Narrative	Develop.	Cumulative	Aggregative	
Q6.1 Were the characteristics of the included studies provided?					
Yes	**7**	**17**	**42**	**24**	90
	50%	**71%**	**82%**	**62%**	70%
No	**7**	**7**	**9**	**15**	38
	50%	**29%**	**18%**	**38%**	30%
Q6.2 Were the appropriate standards for the synthesis of the results reported?					
Detailed				**21**	21
	n/a	n/a	n/a	**54%**	54%
Minimum				**18**	18
				46%	46%
Q6.3 Were the logical reasoning and justifications behind the findings reported?					
Yes		**20**			20
	n/a	**83%**	n/a	n/a	83%
No		**4**			4
		17%			17%

3.5.7.1 Provide a detailed summary of the included studies

All forms of reviews should contain figures or tables that provide a descriptive summary pertaining to the characteristics and findings of the included studies (Higgins and Green, 2008; Levac et al., 2010; Pawson et al., 2005). As shown in Table 3.21, a majority of the articles in our sample (70%) provided a descriptive summary of the studies included in their review. Interestingly, a large number of cumulative reviews provided descriptive information on their primary studies (82%), while 62% of the aggregative reviews presented such information, although reporting study-level characteristics is highly recommended for this type of review (Cooper, 2009; Liberati et al., 2009). Authors of all types of reviews should describe several characteristics of the included studies, such as the overall number of studies, years of publication, research methods, context of the studies or characteristics relevant to the population (Arksey and O'Malley, 2005; Levac et al., 2010; Liberati et al., 2009). Table 3.22 presents information on the characteristics of the included studies that are reported by the reviews in our sample. General characteristics, such as the year and the name of the journal or conference, is the most reported information (59%), followed by the research method (50%), the context of the study 47%), the study findings (37%) and information regarding the perspectives, theories or concepts used by the study (10%).

Table 3.22 – Characteristics of the included studies (n=90)

Characteristics of the included studies provided	**Review types**				
	Narrative (n=7)	Developmental (n=17)	Cumulative (n=42)	Aggregative (n=24)	Total
General characteristics (year, journal, etc.)	4 57%	2 12%	33 79%	14 58%	53 59%
Research methods	1 14%	9 53%	25 60%	10 42%	45 50%
Context of the study	4 57%	8 47%	15 36%	15 63%	42 47%
Study findings	3 43%	10 59%	6 14%	14 58%	33 37%
Perspectives, theories, concepts	1 14%	2 12%	6 15%	0 0%	9 10%

3.5.7.2 Report the appropriate standards for the synthesis of the results

Errors in data analysis and synthesis are particularly detrimental for aggregative reviews where the objective is to validate theories and test hypotheses. A strategy to protect the analysis from potential validity threats is to be as explicit as possible about the approaches, procedures and assumptions for analyzing the data (Cooper, 1982; Kitchenham and Charters, 2007). Therefore, the review results should be reported in sufficient details so to allow the reader to critically assess the foundations of the authors' conclusions (Oxman and Guyatt, 1988). As shown in Table 3.21, all aggregative reviews in our sample reported the standards for the synthesis of the results. Among these, 54% reported detailed information on the review results, while 46% provided only limited details. Further, Liberati et al. (2009) propose a list of appropriate standards that should be reported when presenting the main results of the review. Table 3.23 presents additional information regarding report of results for the 39 aggregative reviews in our sample.

Table 3.23 – Information on reporting results for aggregative reviews (n=39)

		Aggregative review types		Total	
		Systematic and vote-counting (n=20)	Meta-analysis (n=19)	N	%
Qualitative inferences	Yes	20	n/a	20	100%
	No	0	n/a	0	0%
Similarities/differences between studies	Yes	18	n/a	18	90%
	No	2	n/a	2	10%
Statistical model	Fixed effects	n/a	11	11	58%
	Random effects	n/a	4	4	21%
	Not specified	n/a	4	4	21%
Information reported	Sample size	n/a	6	6	32%
	Estimated ES	n/a	6	6	32%
	Pooled ES	n/a	19	19	100%
	Forest plot	n/a	1	1	5%
Homogeneity assessment	Index (Q, I^2, etc.)	n/a	11	11	58%
	Conceptual	n/a	12	12	63%
	Not specified	n/a	5	5	26%
Sensitivity analysis performed	Yes	1	7	8	21%
	Not specified	19	12	31	79%
Conflicting results reported	Yes	11	12	23	59%
	No	9	7	16	41%

In the case of narrative or vote-counting systematic reviews, it is recommended that authors explicitly present the qualitative inferences, make their conclusions as transparent as possible, and provide explanations for the conflicting results (Cooper, 2009; Liberati et al., 2009; Oxman and Guyatt, 1988). As shown in Table 3.23, all of the systematic and vote-counting reviews in our sample (n=20) described their qualitative inferences and virtually all of these (90%) presented similarities and differences between studies.

In the case of a meta-analytic review, authors should first specify the statistical model used for analysis. Indeed, "rules for summarizing and integrating data from the individual studies might be inappropriate and lead to incorrect cumulative results" (Cooper, 2009, p. 249). There are two common statistical models for meta-analytic reviews, namely, the fixed-effects and the random-effects models. Whereas the fixed-effects model assumes that the true effect size is the same for all studies in the analysis, the random-effects model assumes variations among effect sizes (King and He, 2005). King and He (2005) recommend the use of a random-effects model for IS meta-analysis. Indeed, studies in the IS field are rarely pure replications of one another and there usually exist variations in terms of design, methods, and population of interest. Surprisingly, Table 3.23 shows that 11 meta-analyses out of 19 (58%) used a fixed-effects model, 4 used a random-effects model and 4 did not provide any information on their statistical model. Next, authors of meta-analyses should present information such as the sample size and the estimated effect for each study (effect size) with their confidence intervals, as well as the pooled effect estimates across studies (summary) with a confidence interval for each relationship (Liberati et al., 2009). Following this guideline makes the review process less difficult to replicate and it helps the readers evaluate the conclusions of the review (Cooper, 2009). Such information is commonly shown in a table or a forest plot (Kitchenham and Charters, 2007; Liberati et al., 2009). All of the meta-analyses in our sample reported the pooled effect estimates across studies. However, only 6 meta-analyses (32%) presented the sample size and the effect size for each study, and only one meta-analysis used a forest plot diagram to present their results. Further, authors of meta-analyses should validate the assumption that combined studies were indeed comparable (Lipsey and Wilson, 2001). At first, a conceptual validation involves a comparison of the conceptual and operational definition across studies. Next, researchers should provide an assessment of the consistency of the data using statistics such as the Q or the I^2 indices (Liberati et al., 2009). As shown in table 3.23, 26% of the meta-analyses did not report any homogeneity assessment, while 63% performed a conceptual assessment and 58% provided

statistical indices such as Q and I^2. Finally, for both types of reviews, a sensitivity analysis should also be undertaken, for instance by repeating the analysis and comparing the results for subgroups of studies (Kitchenham and Charters, 2007; Liberati et al., 2009). As shown in Table 3.23, only 21% of the aggregative reviews reported the use of a sensitivity analysis in order to assess publication bias or test the robustness of their results.

3.5.7.3 Describe the logical reasoning and justifications behind the findings

As developmental reviews mainly focus on the creation of new research concepts, models, theories or frameworks, the authors should clearly demonstrate how key outcomes emerged from the synthesis of the extant literature. As shown in Table 3.21, a majority of developmental reviews in our sample (83%) described the logical reasoning behind the findings. Further, Table 3.24 presents additional information on data analysis and synthesis for developmental reviews.

Table 3.24 – Information on data analysis for developmental reviews (n=24)

		N	%
Organization of the output	Concept-centric	24	100%
	Chronological	0	0%
	By author	0	0%
Grounds for reasoning	Guiding theory	18	75%
	Previous empirical evidence	16	67%
	Practical example	1	4%

The outcomes of a developmental review are usually validated against criteria of analytical logic, creativity and added-value. Webster and Watson (2002) recommend a concept-centric approach for analyzing and organizing the results. Table 3.24 shows that all of the 24 developmental reviews in our sample used a concept-centric approach to analysis. Further, various forms and methods of logical reasoning may be used in order to make sense of the evidence from previous studies. For instance, Webster and Watson (2002) suggest that reviewers should provide justifications for their findings and propositions by using a combination of theoretical explanations, past empirical findings, and practical examples. Other approaches are suggested by Torraco (2005); they include the use of a guiding theory or competing models in order to provide a coherent structuring of the evidence. As shown in Table 3.24, the support of a guiding theory or a theoretical framework is the most common ground for reasoning, as it was observed

in 75% of the developmental reviews in our sample, closely followed by the use of previous empirical evidence (67%). Surprisingly, only one review in our sample used practical examples to support the authors' reasoning.

3.6 Discussion and concluding remarks

Literature reviews have long been recognized as a major driver of scientific progress and growth (Cooper, 2009; Watson, 2001). Indeed, review methods are well suited as means of unveiling research gaps, developing theories and frameworks and identify new research directions (Rowe, 2012; Webster and Watson, 2002). However, while the method received support from the IS community (Oates, 2011; Rowe, 2012; vom Brocke, 2009), the issue of methodological rigor has remained highly abstract which has raised concerns with the reputation of the methodology and the accuracy of its findings (Paré et al., in press). Like Cooper (2009), we posit that literature reviews are not different from other types of research methodologies and that the quality of a review is in part correlated with the application of a structured and rigorous approach.

In the first essay, we distinguished among four broad categories of reviews and proposed a list of 19 methodological guidelines that cover all steps of the review process and are grouped under the six following general headings: (1) formulation of the problem, (2) literature search, (3) screening for inclusion, (4) quality assessment, (5) data extraction, and (6) data analysis and synthesis. Based on this framework, we developed an instrument in the form of 22 questions that evaluate the level of rigor in our use and application of the literature review techniques and methods. In the present essay, we applied the newly-developed instrument to a large sample of IS stand-alone literature reviews.

At least two considerations should be kept in mind when interpreting the results of this study. First, we realize that our search strategy might not cover all relevant IS literature reviews. Therefore, we should be cautious when discussing the generalizability of our findings and conclusions. Indeed, there may be IS literature reviews that are not indexed in *ABI/Inform Global (Proquest)*, *Web of Knowledge (Thompson Reuters)* and *Business Source Complete (EBSCO)*. Further, our choice of keywords might also represent a limitation. Paré et al. (in press) mention that "several IS authors do not explicitly state the nature of their reviews in the titles, abstracts or the articles themselves" (p.21). Therefore, an alternative to keyword searches might be to conduct a manual search within a selection of journals over a specific date range. By doing so,

we would be able to capture review articles not reported as such by the authors. Second, we recognize that the exclusion of the review articles not including a methodology section in the second part of our analyses might trigger an important bias. Indeed, this decision somehow artificially improves the overall level of rigor of IS reviews. This bias is related to a common limitation in this type of research. Indeed, our evaluation was performed in the light of the information that was reported in the articles, not on the basis of what was actually done by the researchers. This limitation outline the importance of documentation and transparency in future IS literature reviews. In the following paragraphs, we will summarize and discuss our findings and identify a series of recommendations regarding the main issues that need to be addressed in future IS literature reviews.

3.6.1 Summary of findings

In this section we highlight the main patterns and trends in the use and application of literature review methods in our field. First, an increasing trend is observed over time in terms of the number of published IS review articles. This in itself is an encouraging sign, especially in light of the calls of IS Senior Scholar's to encourage such development. Further, like Paré et al. (in press), we expect this trend to continue due to the growing interest toward the evidence-based management movement and the importance of review articles for the progress and growth of our field. Our assessment also reveals that all review categories are fairly represented. Interestingly, our findings show that the eight journals included in the IS Senior Scholars' basket are more prone to publish developmental, cumulative and aggregative reviews than narrative reviews. This may be partly associated with the methodological shortcomings usually associated with narrative reviews. Indeed, narrative reviews are more vulnerable than other review types in terms of rigor and methodological consistency (Paré et al, in press). A few authors also note a lack of commonly accepted or standardized procedures to conduct narrative reviews (Baumeister and Leary, 1997; King and He, 2005). However, our assessment also reveals that most narrative and developmental reviews published in our field do not provide any explanations as to how the review process was conducted. Yet, developmental reviews represent the most prevalent category of review published in leading IS journals. Therefore, another explanation for the publication trends of narrative reviews lies in the inherent nature of such reviews that aim to assemble and synthesize the extant literature and provide a comprehensive report on the current state of knowledge, without proposing new

conceptualizations or theories. As stressed by Rowe (2014), "to be worthy of appearing in top journals there is a need to go beyond the descriptive literature type" (p.251). In this regard, the publication rate of developmental reviews should be associated with the emphasis of leading journals toward theory development, illustrated by the creation of specialized tracks in the *Journal of the Association for Information Systems* (Review & Theory Development) and *MIS Quarterly* (Theory and Review). However, whereas the contribution and its relevance is a key element of any research work, we still encourage authors of developmental reviews to document more explicitly their methods and process, as discussed in greater detail below.

Importantly, review articles that included a methodology section globally performed well in terms of problem formulation and reporting of the results. However, for what constitutes the core of the review process, our results are mainly disappointing considering our analyses are based only on the reviews providing a methodology section. The following discussion will be organized around three steps (i.e., literature search, screening for inclusion, and data extraction) of the review process that exhibits the major concerns observable in our findings.

Regarding the literature search, the majority of the review articles are not doing well in terms of search restrictions. As explained earlier, the search and identification of relevant literature represent important steps of the entire review process and restrictions applied to the search induce generalizability concerns. Whereas restrictions should be avoided when conducting aggregative reviews (Kitchenham and Charters, 2007), they should be clearly documented and justified in other review categories. Two issues specific to particular review types should be discussed with regard to this step. First, while cumulative reviews do not pretend to be comprehensive as aggregative reviews, the search process should lead to a representative sample of a larger group of studies related to a particular question or area of investigation. We observed that most cumulative reviews in our sample analyzed publications in a limited number of IS journals. We argue that decisions to restrict the search strategy to a specific set of journals (or to a specific period of time) in cumulative reviews must be clearly motivated or justified. For instance, after conducting a pilot search using the *ISI Web of Science* database which revealed itself to be inadequate (i.e. several review articles could not be captured with the use of broad terms such as *review*, *research synthesis*, *literature survey*, and *meta-analysis*), Paré et al. (in press) decided to manually search a limited set of top IS journals over a 15-year period. Second, a majority of aggregative reviews in our sample did not report strategies to minimize publication

bias nor acknowledge the potential impacts of such bias. Yet, publication bias is particularly harmful for the internal validity of aggregative reviews. Therefore, future IS aggregative reviews must adopt strategies to avoid publication bias, such as scanning conference proceedings and unpublished literature like dissertations or technical reports, as well as contacting experts on the topic of interest to locate unpublished material (Kitchenham and Charters, 2007; Liberati et al., 2009). Wu and Lederer's (2009) meta-analysis provides a good example of the application of this criterion. To locate articles, they searched several bibliographic databases such as ABI/Inform, Business Source Premier, and Science Direct as well as databases referencing dissertations and thesis (e.g.,). They also performed manual searches whenever back issues of the journals were unavailable in bibliographic databases. Last, they sent a general inquiry for working papers and conference proceedings to the IS community through the AISWorld mailing list.

With respect to the following step of the review process, screening for inclusion, it should be noted that review articles in our sample have done relatively well regarding the use of inclusion criteria. According to several methodologists, researchers must explicitly state the inclusion and exclusion criteria that are applied (e.g., Oxman, 1994; Kitchenham and Charters, 2007; Petersen et al., 2008). Further, researchers should preferentially use criteria that reflect the research question and justify clearly the choice of inclusion criteria associated with pragmatic reasons. Except for narrative reviews that do not report their criteria as often as other review categories, our analysis shows that a vast majority of reviews have rigorously applied this guideline. However, two issues regarding the screening process that are specific to particular review types are worth noting. First, most of the cumulative and aggregative reviews in our sample did not report the appropriate information regarding the selection process. More specifically, a majority of review articles in these categories did not document the number of excluded studies at each stage of the selection process along with the reasons for exclusion. Second, very few cumulative reviews in our sample provided the complete list of included studies. Both guidelines are critical for transparency and replicability reasons. Therefore, we recommend that future cumulative and aggregative reviews in our field document more thoroughly the screening for inclusion process by reporting the number and references of included and excluded studies. As an example, we refer the reader to the work of Hauge, Ayala and Conradi (2010) who used a diagram flow to summarize the study selection process and reported the number of studies that were excluded as a result of the selection process.

We now turn our attention to the data extraction process. As explained earlier, all categories of reviews are concerned with this important step. The first issue related to this step refers to the use of a structured approach or procedure. Our analyses show that just over the half of review articles documented the use of such a structured procedure. Given the fact that we restricted our analyses to those studies with a methodology section, our findings are rather disappointing. Suggestions and recommendations on how to structure the data extraction process are plentiful. Within the IS domain, we can refer to Webster and Watson (2002), Okoli and Schabram (2010), and Bandara et al. (2011) for details on practical procedures for extracting data. Particularly, Webster and Watson (2002) suggest a concept-centric approach to developmental reviews that involves the use of a matrix to extract key information from the selected studies. Bandara et al. (2001) also provide useful information and guidance on the use of electronic tools (e.g., ENDNOTE, NVIVO) to support the coding process. Future IS review articles should document their data extraction more thoroughly, for instance through the report of a detailed "coding-protocol" (Bandara et al., 2011). Jeyaraj et al.'s (2006) review on IT innovation adoption and diffusion provides a good example of how to structure the data extraction process. The authors first identified a list of dependent and independent variables from the primary studies. Then, they created a coding template "in order to uniformly code the findings between independent variables and dependent variables" (p. 5). They further developed a coding scheme that helped them assign values to the relationship between variables. The authors also provided practical examples of how they used the coding scheme in their review. The second issue is related to the validation of the data extraction process *per se*. As mentioned previously, the validity and accuracy of the data material and, hence, the validity of the study's findings, are in part determined by the soundness of the data gathering process. Conducting parallel independent data extractions and cross-checking their outcomes is a good strategy to avoid potential biases and errors. Our results show that most of the developmental, cumulative and aggregative review articles in our sample rarely apply such a validation step. The result is particularly problematic for developmental reviews, with less than 25% that conducted any form of data extraction validation. Based on our observations, we thus suggest that authors of developmental, cumulative and aggregative reviews validate the outcome of their data extraction process, at least by cross-checking the data extracted from a random sample of studies (Kitchenham and Charters, 2007). Further, while Bandara et al. (2011) suggest that the "[coding] protocol should be tested (preferably with two or more coders) prior to entering the actual coding phase" (p.8),

virtually none of the reviews in our sample pre-tested the coding process. Dubé and Paré's (2003) review provides a good example of how the guidelines can be applied. The authors first coded a few case studies to pre-test and make clarifications to the coding scheme. Next, to validate the extraction process, they randomly selected a sample of studies, independently coded those, then calculated an inter-rater agreement rate, and ultimately reconciled discrepancies through discussion.

3.6.2 Concurrent issues

The preceding essay briefly referred to three key dimensions of quality that apply across all types of review articles, namely, rigor, relevance, and methodological coherence. In the following paragraphs, we will focus our attention on the notions of relevance and methodological coherence and their respective implications for review articles.

First, relevance is defined here as the utility and usefulness of the review and refers to its contribution to knowledge. Even if it is rigorously conducted, a review addressing a problem that is not germane and relevant would have low value for its audience. As mentioned by Paré et al. (in press), "in order to evaluate relevance and utility, it is critical to know upfront why the review is conducted and what its primary goal is" (p.31). According to Rowe (2012), contributions of existing literature reviews in our field are often "trivial" and not "significant" (p.470). Thus, he recommends that authors of review articles should provide a substantial effort, "that is, done with some intelligence and applied to a sufficient set of papers", but most crucially, they should first "identify relevant phenomena that are amenable to such effort" (p.470-471). Similarly, Rivard (2014) recently illustrates with a fictitious example a type of review article that does not fit with the primary mission of *MISQ Theory and Review*. While the fictitious example certainly falls short in terms of theoretical development, it also arguably falls short in terms of contribution in general, as the paper does not specify any problem nor motivate its purpose. Indeed, whatever its type, a review should always reflect on a problem and address research questions that trigger some value to a particular domain. In this regard, several developmental reviews (e.g., DeLone and McLean, 1992; Alavi and Leidner, 2001; Wade and Hulland, 2004), cumulative reviews (e.g., Orlikowski and Baroudi, 1991; Dubé and Paré, 2003), and aggregative reviews (e.g., Orlikowski and Baroudi, 1991; Dubé and Paré, 2003; Jeyaraj et al., 2006) that address a significant and relevant problem have had considerable impacts (if judged by citation counts) in our field. Having these exemplars in mind, we recommend that prospective authors

of a review article adequately motivate the research problem and questions underlying their work and explain why conducting their review is timely.

Second, methodological coherence can be broadly defined as the "congruence between the research question and the components of the method" (Morse et al., 2002, p. 18). It outlines the core characteristics that are specific to each review type, which are elaborated in the preceding essay, and may act as guidelines for scholars planning to develop reviews. For instance, authors who aim to aggregate prior empirical results with the hope to resolve inconsistencies will be inconsistent if they couple this goal with a selective coverage of the literature. Likewise, comprehensive coverage and citation of prior literature would be counter-productive for a theoretical review. To ensure a high level of "fit" or methodological coherence, IS researchers need to increase their awareness and knowledge of the various types of review articles. In this regard, Paré et al. (in press) noticed inconsistencies in the terminology used by IS authors to describe their reviews. According to these authors, "there may have been some confusion over the nature of these [IS] reviews, the reasons why they are conducted, and how they are developed" (p.26). Similarly, Rowe (2014) observed a diversity of literature reviews and stressed the importance of better understanding their similarities and differences. As of today, Rowe (2014), Paré et al. (in press) and the preceding essay provide valuable contributions that prospective authors of stand-alone reviews can use to situate their own contribution. And based on the results observed in the present essay, we strongly encourage prospective authors to pay a particular attention to the following recommendations as they see fit:

- Justify explicitly the choice of the review type and make sure it is aligned with the primary objective(s) of the study;
- Report a description of the methodological procedure used to search, identify, and select the relevant studies, as well as to extract and analyze the data;
- Provide a detailed description of the procedures used to locate relevant studies, and especially being transparent about the restrictions applied to the search;
- Provide the list of inclusion and exclusion criteria;
- Provide in appendix the list of included and excluded studies along with the reasons for exclusion; and
- Document thoroughly the data extraction procedures.

In short, we concur with Paré et al. (in press) and Rowe (2014) that the enhanced role of review articles in our field requires that this expository form be given careful scrutiny. Given the

importance of well-conducted literature reviews to build a cumulative tradition, the IS discipline will greatly benefit from a more rigorous approach to designing, conducting and reporting on this genre of articles. In this line of thought, we hope this essay and its companion (the preceding essay) will serve as valuable framework and assessment tool for those interested in conducting or evaluating review articles.

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3.8 Appendix A – List of review articles included in the analysis

#	First author	Year	Description of the review methodology	Category of review
1	Gupta	2010	Yes	Narrative
2	Kauffman	2010	No	Developmental
3	Casanovas	2010	Yes	Cumulative
4	Leidner	2010	No	Narrative
5	Schryen	2010	Yes	Narrative
6	Vest	2010	Yes	Developmental
7	Gneiser	2010	No	Developmental
8	Turner	2010	Yes	Aggregative
9	Standing	2010	Yes	Cumulative
10	Platzer	2009	Yes	Cumulative
11	Fedorowicz	2010	Yes	Cumulative
12	Weerakkody	2009	Yes	Cumulative
13	Mignerat	2009	Yes	Narrative
14	Lacity	2009	Yes	Aggregative
15	Urbach	2009	Yes	Cumulative
16	Wu	2009	Yes	Aggregative
17	Trkman	2009	No	Developmental
18	Williams	2009	Yes	Cumulative
19	Dwivedi	2008	Yes	Cumulative
20	Lloria	2008	No	Developmental
21	Donner	2008	Yes	Narrative
22	Sanford	2007	Yes	Cumulative
23	Chan	2007	No	Narrative
24	Joseph	2007	Yes	Aggregative
25	Srivardhana	2007	No	Developmental
26	Xiao	2007	Yes	Developmental
27	Schepers	2007	Yes	Aggregative
28	King	2006	Yes	Aggregative
29	Leidner	2006	Yes	Developmental
30	Jeyaraj	2006	Yes	Aggregative
31	Piccoli	2005	Yes	Developmental
32	Nilakanta	2006	No	Developmental
33	Gil-García	2005	Yes	Developmental
34	Eppler	2004	Yes	Narrative
35	Melville	2004	Yes	Developmental
36	Kleist	2003	No	Developmental
37	Kohli	2003	Yes	Aggregative
38	Mingers	2003	Yes	Cumulative
39	Mahmood	2001	Yes	Aggregative

#	First author	Year	Description of the review methodology	Category of review
40	Alavi	2001	No	Developmental
41	Dennis	2001	Yes	Aggregative
42	Chan	2000	Yes	Cumulative
43	Hwang	1999	Yes	Aggregative
44	Lai	1997	Yes	Cumulative
45	Smith	1996	No	Developmental
46	Winter	1996	No	Developmental
47	Verner	1996	No	Developmental
48	Chiasson	2004	Yes	Cumulative
49	Te'eni	2001	No	Developmental
50	Venkatesh	2007	No	Narrative
51	Robey	2008	Yes	Narrative
52	Marakas	1998	Yes	Developmental
53	Alavi	1992b	Yes	Aggregative
54	Lim	1992	No	Developmental
55	Pinsonneault	1993	Yes	Cumulative
56	Alavi	1992a	Yes	Cumulative
57	Paré	2008	Yes	Cumulative
58	Dubé	2003	Yes	Cumulative
59	Kappos	2008	Yes	Developmental
60	Cheon	1993	Yes	Cumulative
61	Fjermestad	1998	Yes	Aggregative
62	McLeod	1992	Yes	Aggregative
63	Galliers	2007	Yes	Cumulative
64	Ma	2004	Yes	Aggregative
65	McAdam	1999	No	Developmental
66	Avison	2008	No	Cumulative
67	Lim	1993	Yes	Aggregative
68	Legris	2003	Yes	Aggregative
69	DeLone	1992	Yes	Developmental
70	Dehning	2002	No	Narrative
71	Dedrick	2003	No	Narrative
72	Seddon	1999	Yes	Developmental
73	Evaristo	1997	Yes	Cumulative
74	Benbasat	1987	Yes	Cumulative
75	Orlikowski	1991	Yes	Cumulative
76	Choudrie	2005	Yes	Cumulative
77	Chen	2004	Yes	Cumulative
78	Clark	2007	No	Developmental
79	Nevo	2010	No	Developmental
80	Ford	2003	Yes	Cumulative

#	First author	Year	Description of the review methodology	Category of review
81	Lending	1992	Yes	Cumulative
82	Ives	1984	No	Developmental
83	Dennis	2008	No	Developmental
84	Mingers	2010	No	Narrative
85	Schultze	2002	Yes	Developmental
86	Pozzebon	2005	Yes	Narrative
87	Zmud	1979	No	Aggregative
88	Claver	2000	Yes	Cumulative
89	Vogel	1984	Yes	Cumulative
90	DeLone	2003	No	Developmental
91	Brynjolfsson	1993	No	Narrative
92	Wade	2004	No	Developmental
93	Jones	2008	Yes	Cumulative
94	McKinney	2010	Yes	Cumulative
95	Xiao	2011	No	Developmental
96	Shin	2001	No	Developmental
97	Ives	1980	Yes	Cumulative
98	Parker	2009	No	Developmental
99	Lee	2006	Yes	Aggregative
100	Díez	2009	Yes	Aggregative
101	Oliveira	2011	No	Narrative
102	Prescott	1995	Yes	Cumulative
103	Ramdani	2007	No	Narrative
104	Ongori	2010	No	Narrative
105	Chitura	2008	No	Narrative
106	Barba-Sánchez	2007	No	Narrative
107	Yang	2008	No	Narrative
108	Nguyen	2009	No	Narrative
109	Hauge	2010	Yes	Cumulative
110	Palvia	2003	Yes	Cumulative
111	Palvia	2004	Yes	Cumulative
112	Chowdury	2012	No	Developmental
113	Wu	2011	Yes	Aggregative
114	Bélanger	2011	Yes	Developmental
115	Lacity	2011a	Yes	Aggregative
116	Alaghehband	2011	Yes	Aggregative
117	Gianchandani	2011	No	Narrative
118	Lacity	2011b	Yes	Aggregative
119	Menon	2011	No	Developmental
120	Zurada	2011	No	Narrative
121	Lee	2011	Yes	Cumulative

#	First author	Year	Description of the review methodology	Category of review
122	Smith	2011	Yes	Cumulative
123	Jasperson	2005	No	Developmental
124	Wu	2012b	Yes	Aggregative
125	Ada	2012	Yes	Aggregative
126	Horsky	2012	Yes	Narrative
127	Kummer	2012	Yes	Narrative
128	Wu	2012a	Yes	Aggregative
129	Meidani	2012	Yes	Narrative
130	Luna-Reyes	2012	Yes	Developmental
131	Medaglia	2012	Yes	Cumulative
132	Valaski	2012	Yes	Aggregative
133	Booth	2012	Yes	Aggregative
134	Heradio	2012	Yes	Aggregative
135	Marschollek	2012	Yes	Narrative
136	Yen	2012	Yes	Developmental
137	Weir	2012	Yes	Cumulative
138	McKibbon	2012	Yes	Aggregative
139	Roberts	2012	Yes	Narrative
140	von Krogh	2012	Yes	Developmental
141	Rosebush	2012	No	Narrative
142	Richards	2012	No	Developmental
143	Gunasekaran	2005	Yes	Developmental
144	Norshidah	2012	Yes	Developmental
145	Hazen	2012	Yes	Aggregative
146	Jackson	2011	Yes	Narrative
147	Jacks	2011	Yes	Developmental
148	vom Brocke	2011	Yes	Developmental
149	Buntin	2011	Yes	Aggregative
150	Ghapanchi	2011	Yes	Aggregative
151	Liang	2010	Yes	Aggregative
152	Varadarajan	2010	No	Developmental
153	Alsudairi	2010	Yes	Cumulative
154	Leon-Soriano	2010	No	Developmental
155	Blaya	2010	Yes	Aggregative
156	Lucas	2010	Yes	Aggregative
157	Madani	2009	No	Developmental
158	Subramonian	2009	No	Narrative
159	Adams	2009	Yes	Aggregative
160	Chadee	2009	Yes	Cumulative
161	Law	2009	Yes	Cumulative
162	Saatçioglu	2009	Yes	Narrative

#	First author	Year	Description of the review methodology	Category of review
163	Goldzweig	2009	Yes	Cumulative
164	Kans	2009	Yes	Cumulative
165	Doomun	2008	No	Developmental
166	Jean	2008	No	Developmental
167	Blankley	2008	No	Developmental
168	McCrohan	2008	No	Narrative
169	Aggelidis	2008	No	Narrative
170	Chow	2007	No	Narrative
171	Wang	2007	Yes	Aggregative
172	Wan	2007	No	Narrative
173	Sabherwal	2006	Yes	Aggregative
174	Simon	2006	No	Narrative
175	Gunasekaran	2006	No	Developmental
176	Siha	2006	Yes	Cumulative
177	Benbya	2006	No	Narrative
178	Adya	2005	No	Developmental
179	Peslak	2005	No	Narrative
180	Gunasekaran	2004	Yes	Developmental
181	Mossialos	2004	No	Narrative
182	Tomasi	2004	Yes	Cumulative
183	Keat	2004	No	Developmental
184	Shehab	2004	No	Narrative
185	Ngai	2003	Yes	Cumulative
186	Krishnan	2003	No	Narrative
187	Jasperson	2002	Yes	Developmental
188	Au	2002	No	Developmental
189	Mukherji	2002	No	Narrative
190	Ahuja	2002	No	Developmental
191	Dewett	2001	No	Developmental
192	Costa	2001	No	Narrative
193	Rouse	2001	No	Developmental
194	Fagan	2001	No	Developmental
195	Thong	2000	No	Developmental
196	Pun	2000	No	Developmental
197	Olson	2000	No	Narrative
198	Balakrishnan	1999	No	Developmental
199	Winston	1999	Yes	Developmental
200	Dewhurst	1999	No	Narrative
201	Choi	1997	No	Narrative
202	Deakins	1997	Yes	Cumulative
203	Grimshaw	1992	Yes	Developmental

#	First author	Year	Description of the review methodology	Category of review
204	Powell	1992	No	Narrative
205	Symons	1991	No	Narrative
206	Nelson	1990	No	Developmental
207	Al-Mashari	2001	No	Narrative
208	Cox	1984	No	Narrative
209	Mylonakis	2010	No	Narrative
210	Duggan	2004	No	Developmental
211	Davern	2010	No	Developmental
212	Chae	2006	No	Developmental
213	Shih	2009	No	Narrative
214	Orlikowski	2001	Yes	Cumulative
215	Melone	1990	No	Narrative
216	Buttle	2006	No	Developmental
217	Boateng	2008	Yes	Cumulative
218	Whelan	2007	No	Developmental
219	Palanisamy	2009	No	Developmental
220	Gallivan	2005	Yes	Developmental
221	Oliveira	2010	Yes	Cumulative
222	Curtis	2009	No	Narrative

3.9 Appendix B – References of the review articles included in the analysis

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3.10 Appendix C – Coding scheme for narrative reviews

Instrument to evaluate the rigor of IS literature reviews (Narrative)

Article #: _____	Author(s): _____
Journal: _____	Year: _____
Rater: _____	Date: _____

Type of review: Author(s): _____ Paré et al.'s (2013) typology: _____

STEP 1: FORMULATE THE PROBLEM

Primary goal(s)

Are the primary goals of the review clearly stated? ☐ yes ☐ no

Main reason(s) for conducting the review: [circle all that apply]

1. To identify gaps in prior research
2. To analyze the current state of a stream of research
3. To define an emerging research area
4. To critique the application of a theoretical model
5. To critique the application of a research method
6. To develop a research model or framework
7. To make recommendations for future research
8. To validate pre-specified propositions or hypotheses

Key concept(s) and focus of the review

Are definitions of the key concepts provided? ☐ detailed definition(s) ☐ minimum ☐ no

Is the focus (i.e., boundaries) of the review stated? ☐ yes, explicit ☐ yes, implicit ☐ no

Main focus of the review: [circle all that apply]

1. Concepts
2. Theories
3. Findings
4. Methods
5. General characteristics (e.g., year, journal)
6. Other: _____

STEP 2: SEARCH OF THE LITERATURE

Description of the search procedure: ☐ detailed description ☐ minimum ☐ no

Description of the sources: ☐ yes ☐ no

Sources and approaches used: [circle all that apply]

1. Databases (n = _____)
2. Manual search
3. Contact experts
4. Backward
5. Forward
6. Other: _____

If electronic databases were searched,

Description of the search terms: ☐ yes ☐ no

Were multiple data sources and search approaches used to locate relevant studies? ☐ yes ☐ no ☐ not specified

Type of publication included: [circle all that apply]

1. Scholarly journals
2. Conference proceedings
3. Dissertations/thesis
4. Working papers
5. Other: _____

Description of the restrictions to the search: ☐ yes ☐ no

Restrictions applied to the search: [circle all that apply]

1. Language
2. Publication type (e.g., journal, conference)
4. Publication titles (n = _____)
5. Date range (_____ - _____)
6. Other: _____

If restrictions are applied,

Justification or rationale provided? ☐ yes ☐ no

Does the search procedure include restrictions? ☐ yes ☐ no ☐ not specified

STEP 3: SCREEN FOR INCLUSION

Description of the screening and selection procedure: ☐ detailed description ☐ minimum ☐ no
Information reported on the screening process: [circle all that apply]
1. Number of excluded studies per exclusion criterion 3. Diagram flow
2. Final number of included studies: n = _____ 4. Other: _____
List of references for included studies provided? ☐ yes, explicit ☐ yes, implicit ☐ no

Parallel independent assessment of studies for inclusion performed? ☐ yes ☐ no ☐ not specified
If yes, Methods used to conduct an independent assessment:
1. Complete parallel independent assessment 2. Random sample was cross-checked
Description of the methods to resolve disagreement ☐ yes ☐ no
Level of agreement provided? ☐ yes ☐ no
If yes, method of calculation:
1. Cohen Kappa = _____ 2. Other: _____ = _____

Explicit description of the inclusion criteria: ☐ detailed description ☐ minimum ☐ no
Basis of the inclusion criteria: [circle all that apply]
1. Research question 5. Other: _____
2. Practical considerations
If criteria based on practical considerations,
Justification or rationale provided? ☐ yes ☐ no
Do the inclusion criteria reflect the research question(s)? ☐ yes ☐ no ☐ not specified

Reputation of the sources
Were studies from reputable sources preferentially selected? ☐ yes, explicit ☐ yes, implicit ☐ not specified
Methods to evaluate the reputation of sources: [circle all that apply]
1. Peer-reviewed 3. Formal ranking (_____) (n= _____)
2. Leading journals or conferences (n= _____) 4. Other: _____

STEP 5: DATA EXTRACTION

Data extraction procedure
Was a structured procedure used to gather data from the included studies? ☐ yes ☐ no ☐ not specified
Data extraction form/coding scheme provided? ☐ yes ☐ no
Pretesting of the data extraction process: ☐ yes ☐ not specified

Parallel independent data extraction performed? ☐ yes ☐ no ☐ not specified
If yes, Methods used to conduct an independent data extraction:
1. Complete parallel independent data extraction 2. Random sample was cross-checked
Description of the methods to resolve disagreement ☐ yes ☐ no
Level of agreement provided? ☐ yes ☐ no
If yes, method of calculation:
1. Cohen Kappa = _____ 2. Other: _____ = _____

STEP 6: DATA ANALYSIS AND SYNTHESIS

Organization of the output:
1. Concept-centric 3. By author
2. Chronological 4. Other: _____

Summary
Characteristics of the included studies provided: [circle all that apply]
1. General characteristics (e.g., year, journal) 4. Findings
2. Research methods 5. Other: _____
3. Context
Were the characteristics of the included studies provided? ☐ detailed summary ☐ minimum ☐ no

3.11 Appendix D – Coding scheme for developmental reviews

Instrument to evaluate the rigor of IS literature reviews (Developmental)

Article #: _____	Author(s): _____
Journal: _____	Year: _____
Rater: _____	Date: _____

Type of review: Author(s): _____ Paré et al.'s (2013) typology: _____

STEP 1: FORMULATE THE PROBLEM

Primary goal(s)

Are the primary goals of the review clearly stated? ☐ yes ☐ no

Main reason(s) for conducting the review: [circle all that apply]

1. To identify gaps in prior research
2. To analyze the current state of a stream of research
3. To define an emerging research area
4. To critique the application of a theoretical model
5. To critique the application of a research method
6. To develop a research model or framework
7. To make recommendations for future research
8. To validate pre-specified propositions or hypotheses

Key concept(s) and focus of the review

Are definitions of the key concepts provided? ☐ detailed definition(s) ☐ minimum ☐ no

Is the focus (i.e., boundaries) of the review stated? ☐ yes, explicit ☐ yes, implicit ☐ no

Main focus of the review: [circle all that apply]

1. Concepts
2. Theories
3. Findings
4. Methods
5. General characteristics (e.g., year, journal)
6. Other: _____

STEP 2: SEARCH OF THE LITERATURE

Description of the search procedure: ☐ detailed description ☐ minimum ☐ no

Description of the sources: ☐ yes ☐ no

Sources and approaches used: [circle all that apply]

1. Databases (n = _____)
2. Manual search
3. Contact experts
4. Backward
5. Forward
6. Other: _____

If electronic databases were searched,

Description of the search terms: ☐ yes ☐ no

Were multiple data sources and search approaches used to locate relevant studies? ☐ yes ☐ no ☐ not specified

Type of publication included: [circle all that apply]

1. Scholarly journals
2. Conference proceedings
3. Dissertations/thesis
4. Working papers
5. Other: _____

Description of the restrictions to the search: ☐ yes ☐ no

Restrictions applied to the search: [circle all that apply]

1. Language
2. Publication type (e.g., journal, conference)
4. Publication titles (n = _____)
5. Date range (_____ - _____)
6. Other: _____

If restrictions are applied,

Justification or rationale provided? ☐ yes ☐ no

Does the search procedure include restrictions? ☐ yes ☐ no ☐ not specified

STEP 3: SCREEN FOR INCLUSION

Description of the screening and selection procedure: ☐ detailed description ☐ minimum ☐ no
Information reported on the screening process: [circle all that apply]
1. Number of excluded studies per exclusion criterion 3. Diagram flow
2. Final number of included studies: n = _____ 4. Other: _____
List of references for included studies provided? ☐ yes, explicit ☐ yes, implicit ☐ no

Parallel independent assessment of studies for inclusion performed? ☐ yes ☐ no ☐ not specified
If yes, Methods used to conduct an independent assessment:
1. Complete parallel independent assessment 2. Random sample was cross-checked
Description of the methods to resolve disagreement ☐ yes ☐ no
Level of agreement provided? ☐ yes ☐ no
If yes, method of calculation:
1. Cohen Kappa = _____ 2. Other: _____ = _____

Explicit description of the inclusion criteria: ☐ detailed description ☐ minimum ☐ no
Basis of the inclusion criteria: [circle all that apply]
1. Research question 5. Other: _____
2. Practical considerations
If criteria based on practical considerations,
Justification or rationale provided? ☐ yes ☐ no
Do the inclusion criteria reflect the research question(s)? ☐ yes ☐ no ☐ not specified

Reputation of the sources
Were studies from reputable sources preferentially selected? ☐ yes, explicit ☐ yes, implicit ☐ not specified
Methods to evaluate the reputation of sources: [circle all that apply]
1. Peer-reviewed 3. Formal ranking (_____) (n= _____)
2. Leading journals or conferences (n= _____) 4. Other: _____

STEP 5: DATA EXTRACTION

Data extraction procedure
Was a structured procedure used to gather data from the included studies? ☐ yes ☐ no ☐ not specified
Data extraction form/coding scheme provided? ☐ yes ☐ no
Pretesting of the data extraction process: ☐ yes ☐ not specified

Independent data extraction
Was a parallel independent data extraction performed? ☐ yes ☐ no ☐ not specified
If yes, Methods used to conduct an independent data extraction:
1. Complete parallel independent data extraction 2. Random sample was cross-checked
Description of the methods to resolve disagreement ☐ yes ☐ no
Level of agreement provided? ☐ yes ☐ no
If yes, method of calculation:
1. Cohen Kappa = _____ 2. Other: _____ = _____

STEP 6: DATA ANALYSIS AND SYNTHESIS

Logical reasoning
Organization of the output:
1. Concept-centric 3. By author
2. Chronological 4. Other: _____

Were the logical reasoning and justifications behind the findings reported? ☐ yes, detailed ☐ yes, minimum ☐ no
Explanations of the findings and propositions: [circle all that apply]
1. Guiding theory or model 3. Practical example
2. Previous empirical evidence 4. Other: _____

Summary

Characteristics of the included studies provided: [circle all that apply]

1. General characteristics (e.g., year, journal)
2. Research methods
3. Context
4. Findings
5. Other: _____

Were the characteristics of the included studies provided? ☐ detailed summary ☐ minimum ☐ no

3.12 Appendix E– Coding scheme for cumulative reviews

Instrument to evaluate the rigor of IS literature reviews (Cumulative)

Article #: _____	Author(s): _____
Journal: _____	Year: _____
Rater: _____	Date: _____

Type of review: Author(s): _____ Paré et al.'s (2013) typology: _____

STEP 1: FORMULATE THE PROBLEM

Primary goal(s)

Are the primary goals of the review clearly stated? ☐ yes ☐ no

Main reason(s) for conducting the review: [circle all that apply]

1. To identify gaps in prior research
2. To analyze the current state of a stream of research
3. To define an emerging research area
4. To critique the application of a theoretical model
5. To critique the application of a research method
6. To develop a research model or framework
7. To make recommendations for future research
8. To validate pre-specified propositions or hypotheses

Key concept(s) and focus of the review

Are definitions of the key concepts provided? ☐ detailed definition(s) ☐ minimum ☐ no

Is the focus (i.e., boundaries) of the review stated? ☐ yes, explicit ☐ yes, implicit ☐ no

Main focus of the review: [circle all that apply]

1. Concepts
2. Theories
3. Findings
4. Methods
5. General characteristics (e.g., year, journal)
6. Other: _____

STEP 2: SEARCH OF THE LITERATURE

Search procedure

Is a description of the search procedure provided? ☐ detailed description ☐ minimum ☐ no

Description of the sources: ☐ yes ☐ no

Sources and approaches used: [circle all that apply]

1. Databases (n = _____)
2. Manual search
3. Contact experts
4. Backward
5. Forward
6. Other: _____

If electronic databases were searched,

Description of the search terms: ☐ yes ☐ no

Total number of hits reported? ☐ yes: _____ ☐ not specified

Were multiple data sources and search approaches used to locate relevant studies? ☐ yes ☐ no ☐ not specified

Type of publication included: [circle all that apply]

1. Scholarly journals
2. Conference proceedings
3. Dissertations/thesis
4. Working papers
5. Other: _____

Description of the restrictions to the search: ☐ yes ☐ no

Restrictions applied to the search: [circle all that apply]

1. Language
2. Publication type (e.g., journal, conference)
3. Publication status (e.g., rank, peer-review)
4. Publication titles (n = _____)
5. Date range (_____ - _____)
6. Other: _____

If restrictions are applied,

Justification or rationale provided? ☐ yes ☐ no

Does the search procedure include restrictions? ☐ yes ☐ no ☐ not specified

STEP 3: SCREEN FOR INCLUSION

Screening and selection procedure

Is a description of the screening and selection procedure provided? ☐ detailed description ☐ minimum ☐ no

Stages performed to screen and select the studies: [circle all that apply]

1. Initial screening (e.g., titles, abstracts, quick read)
2. Thorough screening of the full papers
3. Other: _____

Information reported on the screening process: [circle all that apply]

1. Number of excluded studies per exclusion criterion
2. Final number of included studies: n = _____
3. Diagram flow
4. Other: _____

List of references for included studies provided? ☐ yes, explicit ☐ yes, implicit ☐ no

Parallel independent assessment of studies for inclusion performed? ☐ yes ☐ no ☐ not specified

If yes, Methods used to conduct an independent assessment:

1. Complete parallel independent assessment
2. Random sample was cross-checked

Description of the methods to resolve disagreement ☐ yes ☐ no

Level of agreement provided? ☐ yes ☐ no

If yes, method of calculation:

1. Cohen Kappa = _____
2. Other: _____ = _____

Explicit description of the inclusion criteria: ☐ detailed description ☐ minimum ☐ no

Basis of the inclusion criteria: [circle all that apply]

1. Research question
2. Practical considerations
5. Other: _____

If criteria based on practical considerations,

Justification or rationale provided? ☐ yes ☐ no

Do the inclusion criteria reflect the research question(s)? ☐ yes ☐ no ☐ not specified

Duplicate studies

Were duplicate studies explicitly identified? ☐ yes ☐ no ☐ n/a

If yes, procedures to manage duplicates: [circle all that apply]

1. Remove duplicate results
2. Average results from the same sample
3. Other: _____

Description of the strategies to identify duplicate studies: ☐ yes ☐ no

STEP 5: DATA EXTRACTION

Type of data

Is a description of the type of data to be extracted provided? ☐ detailed description ☐ minimum ☐ no

Data extraction procedure

Was a structured procedure used to gather data from the included studies? ☐ yes ☐ no ☐ not specified

Data extraction form/coding scheme provided? ☐ yes ☐ no

Pretesting of the data extraction process: ☐ yes ☐ not specified

Independent data extraction

Was a parallel independent data extraction performed? ☐ yes ☐ no ☐ not specified

If yes, Methods used to conduct an independent data extraction:

1. Complete parallel independent data extraction
2. Random sample was cross-checked

Description of the methods to resolve disagreement ☐ yes ☐ no

Level of agreement provided? ☐ yes ☐ no

If yes, method of calculation:

1. Cohen Kappa = _____
2. Other: _____ = _____

STEP 6: DATA ANALYSIS AND SYNTHESIS

Description of the data analysis method: ☐ narrative ☐ statistical ☐ not specified

Summary

Characteristics of the included studies provided: [circle all that apply]

1. General characteristics (e.g., year, journal)
2. Research methods
3. Context
4. Findings
5. Other: _____

Were the characteristics of the included studies provided? ☐ detailed summary ☐ minimum ☐ no

3.13 Appendix F – Coding scheme for aggregative reviews

Instrument to evaluate the rigor of IS literature reviews (Aggregative)

Article #: _____	Author(s): _____
Journal: _____	Year: _____
Rater: _____	Date: _____

Type of review: Author(s): _____ Paré et al.'s (2013) typology: _____

STEP 1: FORMULATE THE PROBLEM

Primary goal(s)

Are the primary goals of the review clearly stated? ☐ yes ☐ no

Main reason(s) for conducting the review: [circle all that apply]

1. To identify gaps in prior research
2. To analyze the current state of a stream of research
3. To define an emerging research area
4. To critique the application of a theoretical model
5. To critique the application of a research method
6. To develop a research model or framework
7. To make recommendations for future research
8. To validate pre-specified propositions or hypotheses

Key concept(s) and focus of the review

Are definitions of the key concepts provided? ☐ detailed definition(s) ☐ minimum ☐ no

Is the focus (i.e., boundaries) of the review stated? ☐ yes, explicit ☐ yes, implicit ☐ no

Main focus of the review: [circle all that apply]

1. Concepts
2. Theories
3. Findings
4. Methods
5. General characteristics (e.g., year, journal)
6. Other: _____

STEP 2: SEARCH OF THE LITERATURE

Search procedure

Is a description of the search procedure provided? ☐ detailed description ☐ minimum ☐ no

Description of the sources: ☐ yes ☐ no

Sources and approaches used: [circle all that apply]

1. Databases (n = _____)
2. Manual search
3. Contact experts
4. Backward
5. Forward
6. Other: _____

If electronic databases were searched,

Description of the search terms: ☐ yes ☐ no

Total number of hits reported? ☐ yes: _____ ☐ not specified

Were multiple data sources and search approaches used to locate relevant studies? ☐ yes ☐ no ☐ not specified

Type of publication included: [circle all that apply]

1. Scholarly journals
2. Conference proceedings
3. Dissertations/thesis
4. Working papers
5. Other: _____

Description of the restrictions to the search: ☐ yes ☐ no

Restrictions applied to the search: [circle all that apply]

1. Language
2. Publication type (e.g., journal, conference)
3. Publication status (e.g., rank, peer-review)
4. Publication titles (n = _____)
5. Date range (_____ - _____)
6. Other: _____

If restrictions are applied,

Justification or rationale provided? ☐ yes ☐ no

Does the search procedure include restrictions? ☐ yes ☐ no ☐ not specified

Publication bias

Were strategies adopted to minimize publication bias? ☐ yes ☐ no ☐ not specified

Strategies to reduce publication bias: [circle all that apply]

1. Request for unpublished studies to a community
2. Dissertations and thesis
3. Conference proceedings
4. Contact authors for missing data
5. Other: _____

STEP 3: SCREEN FOR INCLUSION

Screening and selection procedure

Is a description of the screening and selection procedure provided? ☐ detailed description ☐ minimum ☐ no

Stages performed to screen and select the studies: [circle all that apply]

1. Initial screening (e.g., titles, abstracts, quick read)
2. Thorough screening of the full papers
3. Other: _____

Information reported on the screening process: [circle all that apply]

1. Number of excluded studies per exclusion criterion
2. Final number of included studies: n = _____
3. Diagram flow
4. Other: _____

List of references for included studies provided? ☐ yes, explicit ☐ yes, implicit ☐ no

Independent assessment of studies for inclusion

Was a parallel independent assessment of studies for inclusion performed? ☐ yes ☐ no ☐ not specified

Methods used to conduct an independent assessment:

1. Complete parallel independent assessment
2. Random sample was cross-checked
3. Other:._____

Description of the methods to resolve disagreement ☐ yes ☐ no

Level of agreement provided? ☐ yes ☐ no

If yes, method of calculation:

1. Cohen Kappa = _____
2. Other: _____ = _____

Explicit description of the inclusion criteria: ☐ detailed description ☐ minimum ☐ no

Basis of the inclusion criteria: [circle all that apply]

1. Research question
2. Practical considerations
5. Other: _____

If criteria based on practical considerations,

Justification or rationale provided? ☐ yes ☐ no

Do the inclusion criteria reflect the research question(s)? ☐ yes ☐ no ☐ not specified

Duplicate studies

Were duplicate studies explicitly identified? ☐ yes ☐ no ☐ n/a

If yes, procedures to manage duplicates: [circle all that apply]

1. Remove duplicate results
2. Average results from the same sample
3. Other: _____

Description of the strategies to identify duplicate studies: ☐ yes ☐ no

STEP 4: QUALITY ASSESSMENT

Description of quality assessment process: ☐ yes ☐ not specified

Was the quality of the included studies assessed using recognized tools? ☐ yes ☐ no ☐ not specified

Instruments used to assess quality: [circle all that apply]

1. Checklists of methodological elements
2. Other: _____

Quality impacts

Was the quality of the included studies used to select the studies? ☐ yes ☐ no ☐ not specified

Was the quality of the included studies used in interpreting the findings? ☐ yes ☐ no ☐ not specified

STEP 5: DATA EXTRACTION

Type of data
Is a description of the type of data to be extracted provided? ☐ detailed description ☐ minimum ☐ no

Data extraction procedure
Was a structured procedure used to gather data from the included studies? ☐ yes ☐ no ☐ not specified
Data extraction form/coding scheme provided? ☐ yes ☐ no

Pretesting of the data extraction process: ☐ yes ☐ not specified

Independent data extraction
Was a parallel independent data extraction performed? ☐ yes ☐ no ☐ not specified
Methods used to conduct an independent data extraction:
1. Complete parallel independent data extraction
2. Random sample was cross-checked
3. Other:._____

Description of the methods to resolve disagreement ☐ yes ☐ no
Level of agreement provided? ☐ yes ☐ no
If yes, method of calculation:
1. Cohen Kappa = _____ 2. Other: _____ = _____

STEP 6: DATA ANALYSIS AND SYNTHESIS

Reporting of the results
If a systematic review or vote-counting,
Qualitative/quantitative inferences explicitly described? ☐ yes ☐ no
Similarities/differences between studies highlighted? ☐ yes ☐ no

If a meta-analysis,
Homogeneity assessment performed: ☐ yes ☐ no
Conceptual assessment? ☐ yes ☐ no
Homogeneity index calculated? ☐ yes ☐ no
1. Cochran's Q
2. I^2 statistic
3. Other: _____
Description of the model to be used: ☐ yes ☐ no
1. fixed effects
2. random effects
Information reported on the results: [circle all that apply]
1. Sample size for each study
2. Estimated effect for each study
3. Pooled effect estimate across studies
4. Forest plot

Sensitivity analysis performed? ☐ yes ☐ not specified
Explanations for conflicting results provided: ☐ yes ☐ no

Were the appropriate standards for the synthesis of the results reported? ☐ yes, detailed ☐ yes, minimum ☐ no

Summary
Were the characteristics of the included studies provided? ☐ detailed summary ☐ minimum ☐ no
Characteristics of the included studies provided: [circle all that apply]
1. General characteristics (e.g., year, journal)
2. Research methods
3. Context
4. Findings
5. Other: _____

4 Essay #3: A tutorial for rigorously investigating information system phenomena with meta-analyses

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4.1 Abstract

Meta-analytic reviews are among the most popular methods of research synthesis in many academic disciplines, and hold many potential advantages over other types of reviews. However, we still see few published meta-analyses in the IS field. To foster such developments, greater attention should be directed to the methods of performing a meta-analytic review of the IS literature. Threfore, the primary objective of this tutorial is to present and illustrate a step-by-step scientific methodology to conduct rigorous meta-analyses in our domain. In particular, our approach focuses on the main challenges for IS meta-analysts and important sources of potential bias that occur when methodological assumptions are erroneous or overlooked, when publication bias is not investigated and mishandled, or when study diversity or heterogeneity is ignored or incorrectly managed. We illustrate how this methodology can be applied in our field through a meta-analysis of the antecedents of organizational adoption of information technologies (IT). We hope this tutorial will further encourage the appropriate use and application of meta-analyses by IS researchers.

Keywords: Meta-analysis, meta-analytic method, methodological guidelines, information systems, organizational IT adoption.

4.2 Introduction

The information system (IS) field has considerably grown since its initial development. The maturity of the field is evidenced by the increasing volume of IS research and emergence of well-established journal outlets (Chen and Hirschheim, 2004), the development of its own research perspectives and theories (Baskerville and Myers, 2002; Webster and Watson, 2002), and the establishment of IS as a reference discipline for other fields (King and He, 2005). Yet to enhance its current stage of progress, our domain still requires the consolidation of its research tradition. By uncovering prior knowledge, literature reviews play an important role in scientific knowledge foundation and accumulation. Indeed, conducting literature reviews is an essential task for advancing knowledge on a particular topic, developing theories, identifying research domains where further investigations are needed, or synthesizing empirical evidence (King and He, 2005; Okoli and Schabram, 2010; Paré, Trudel, et al., 2013; Webster and Watson, 2002; Rowe, 2014).

In this era of information overload, synthesizing prior empirical knowledge is particularly important. Indeed, the increasing amount of research in the IS field calls for reliable ways to integrate prior findings. When the literature on a topic grows considerably and parts of knowledge remain isolated in primary research studies, synthesizing prior evidence deserves higher priority than conducting new inquiries and discovering evidence (Glass, 1976). In the first essay, we differentiated between four categories of reviews, namely narrative reviews, developmental reviews, cumulative reviews and aggregative reviews. Aggregative reviews, which take the form of either qualitative systematic reviews or quantitative meta-analyses, are particularly useful for synthesizing prior evidence. Such reviews attempt to provide answers to specific research questions and validate pre-specified propositions by pooling the empirical data from previous studies. Aggregative reviews might also help to diffuse knowledge throughout the scientific community and hold the potential to become a milestone for future research in the area. As the volume of IS research has grown considerably in the last decades and numerous journals have emerged, it has become difficult for researchers to remain knowledgeable about the various topics investigated and methods applied in IS research. Cooper (2009) notices that the increased quantity of scientific inquiry has resulted in growing specialization within the social sciences. As a result, “time constraints make it impossible for most social scientists to keep up with primary research except within a few topic areas of special interest to them” (Cooper, 2009, p. 2). Aggregative syntheses are therefore necessary to provide a new step from which to start

further investigation. Moreover, aggregative reviews constitute the primary material of evidence-based practice, that is, they aim to produce reliable summaries of findings that support decision-making and policy-making (Higgins and Green, 2008).

A particular type of aggregative review is called meta-analysis. Meta-analytic reviews use formal statistical methods to combine the results from primary studies into a single quantitative estimate (Paré, Trudel et al., in press). They are among the most popular methods of research synthesis in many research fields and academic disciplines, such as medicine, nursing, health informatics, or social psychology (King and He, 2005; Paré et al., 2013). Meta-analytic techniques usually fulfill four main purposes: (1) to evaluate the strength of a relationship between variables by estimating a common effect of the results of the included studies, (2) to evaluate the variability among the results of the included studies, (3) to investigate the causes of that variability, and (4) to assess the effects of external sources of bias on the observed common effect (Paré et al., in press).

Meta-analysis holds many potential advantages over other types of reviews. First, it represents an accurate and credible statistical approach for synthesizing available empirical evidence from previous studies (Paré et al., in press). Indeed, this technique is much less subjective than other review methods, as it must follow closely a set of scientific guidelines and aim to minimize errors and bias by using explicit, rigorous, and reproducible methods (Paré et al., in press). A variety of standards and methods have been proposed to conduct a sound and rigorous meta-analysis (e.g., Liberati et al., 2009; Higgins and Green, 2008; Cooper, 1982). Second, a meta-analysis attempts to maximize precision as it standardizes the research findings of individual studies in order to calculate an average effect size among a population of primary studies. Therefore, meta-analyses focus on the data instead of the interpretations and conclusions reached in primary studies (King and He, 2005). Whereas narrative systematic reviews usually focus on the significance of the research findings, meta-analyses change the focus to the direction and magnitude of the *effect* across the included studies. This method enables the aggregation of empirical results, particularly those from studies showing significant effects along with studies showing insignificant effects (King and He, 2005; Paré et al., in press). Third, meta-analyses are also able to explain the reasons for variability among studies showing inconsistent empirical findings (Rosenthal and DiMatteo, 2001). A common problem in mature fields with an ever-growing number of research studies is the emergence of incoherent and conflicting findings (King

and He, 2005). To deal with this, a meta-analysis enables the search for patterns, potential moderators and mediators that might explain such variability in prior findings.

Despite the recognized advantages and importance of meta-analytic reviews, we still see few published meta-analyses in the IS field (King and He, 2005). A recent review by Paré et al. (in press) reveals that only 14 meta-analyses were published in 5 top IS journals between 1999 and 2013. Some IS researchers argue that the relatively low number of applications decreases the use of meta-analyses in the IS field (Hwang, 1996; King and He, 2005). Indeed, a meta-analysis requires a large number of empirical and quantitative primary studies that examine the same, or a very similar, relationship between two constructs and report findings that can be compared and aggregated. Yet, research in IS does not usually produce true or very close replicates of a particular study. According to Hwang (1996), a meta-analysis is more frequently utilized in research fields like medicine and education where experiments are commonly used and replicated but much less in the social sciences that rely on other types of methodologies. Further, the lack of familiarity of IS scholars with meta-analytic review methods (Hwang, 1996; King and He, 2005; Paré et al., in press) might also explain why meta-analysis is rarely applied in our field. In this regard, Hwang (1996) stated: "Due to unfamiliarity with or misconceptions about meta-analysis, researchers usually bypass it in favor of more traditional qualitative reviews" (p. 35).

Meta-analytic reviews are commonly based on recognized procedures and analytical standards (King and He, 2005). However, King and He (2005) mention that some techniques of meta-analysis used in IS are conceptually and methodologically flawed. At least two issues require to adapt meta-analytic methods for the specificities of IS inquiries. First, the nature of the domain, from an epistemological wiewpoint, impacts the use and application of a methodology. The IS field places a strong emphasis on theoretical development and significance rather than factual evidence. Therefore, meta-analytic efforts in our field should favor some traits of the method, such as its ability to explain reasons for variability among results and to discover potential moderators. Second, the choice of the method, or at least some of its features, is dependent on the nature of the phenomena under investigation. For instance, statistical models are based on assumptions about the population from which the observations are taken. In light of these distinctive characteristics, it is important not only to refine and adapt the existing meta-analytic toolbox but also to illustrate the application of specific procedures in the conduct of a meta-analysis in IS. Indeed, the inappropriate application of existing methods runs the risks of

producing invalid and misleading results. According to Paré et al. (2013), invalid results mainly occur when study diversity or heterogeneity is ignored or incorrectly managed, when flawed data or poorly-conducted studies are included and analyzed, or when potential sources for bias, such as sampling bias, publication bias or methodological errors, are not investigated and are mishandled. Hence, the methodological standards and formalized procedures are critical to the quality and coherence of a meta-analysis. We therefore posit that greater attention should be directed to the methods of performing meta-analytic reviews in our discipline.

To the best of our knowledge, the work of King and He (2005) is the sole methodological contribution regarding the use of meta-analysis in the IS field. King and He's (2005) paper reviews the advantages of the meta-analytic method as well as the various meta-analytic models proposed in other scientific domains, yet it provides few recommandations and guidelines on the application and conduct of a meta-analysis in our field. We strongly believe the value of our work lies in its contribution to our collective understanding toward the distinctive features of the phenomenon we investigate and their impact on the choice of the components of the method. Following this line of thought, the primary objective of this tutorial is to present and illustrate a step-by-step scientific methodology to conduct rigorous meta-analyses for investigating IS phenomena. The method and procedure proposed here are based on the framework and instrument developed in the preceding essays and on the specific methodological guidelines commonly associated with meta-analytic methods. We illustrate how this methodology can be applied in our field through a meta-analysis of the antecedents of organizational adoption of information technologies (IT). More precisely, for the purpose of this tutorial, we searched the extant literature and collected data on the antecedents of IT adoption in organizations but applied the formal statistical methods associated with meta-analysis to combine the results associated with one particular antecedent, namely, perceived benefits of IT. This allows us to exhibit a significant effort in order to illustrate the conduct of the preliminary stages of a meta-analysis, as well as to explain into more details the distinctive features of the statistical methods. In short, this tutorial aims to provide IS researchers with a better understanding of what is a sound and rigorous meta-analysis as well as to facilitate the evaluation of meta-analytic reviews. In short, our primary goal is to further encourage the appropriate use and application of meta-analyses by IS researchers.

4.3 Methodological guidelines and illustrations

A variety of methods and guidelines have been proposed to conduct meta-analyses in scientific domains that have developed a tradition of experimental designs, such as education (e.g., Glass, McGaw, and Smith, 1981; Hedges and Olkin, 1985), medicine (e.g., Liberati et al., 2009; Higgins and Green, 2008; Borenstein, Hedges, Higgins, and Rothstein, 2009), and social psychology (e.g., Cooper, 2009; Hunter and Schmidt, 2004; Lipsey and Wilson, 2001; Rosenthal and DiMatteo, 2001; Rosenthal, 1991). In the IS field, we found only two references that provide recommendations and discuss meta-analytic methods. First, Hwang (1996) reviews the meta-analyses published in IS research prior to 1996 and discusses the potential uses of the method as well as the issues that are important when conducting or evaluating a meta-analysis. Second, King and He (2005) examine the advantages and limitations of meta-analyses and argue in favor of the wider application of meta-analytic methods in IS research. These authors also provide a few general recommendations on how to conduct a meta-analysis and briefly illustrate a standard procedure to conduct meta-analytic reviews in IS. According to Higgins and Green (2008), a meta-analysis is a particular form of systematic literature review that uses statistical methods instead of qualitative techniques in order to analyze and synthesize the results of previous studies. Therefore, the available guidelines and recommendations for conducting systematic reviews (e.g., Kitchenham and Charters, 2007; Oxman and Guyatt, 1988; Oxman, 1994; Shea et al., 2007; Whittemore, 2005) apply equally to meta-analyses, except those directives specific to data analysis and synthesis.

Building upon the framework presented in the first essay, we propose a detailed procedure for conducting IS meta-analyses (see Figure 1). It comprises 6 steps that reflect the main phases and activities involved in developing, conducting and writing a meta-analysis, that is, (1) formulation of the problem, (2) search of the literature, (3) screen for inclusion, (4) quality assessment, (5) data extraction, (6) data analysis and synthesis.

In step 1, authors of meta-analytic reviews should provide a clearly stated set of research objectives and questions, including a definition of the key concepts and boundaries of the study (Higgins and Green, 2008). The next three steps involve an exhaustive and comprehensive search to identify all relevant and appropriate literature available, the selection of pertinent studies using pre-specified eligibility criteria, and the evaluation of the quality of the included studies (Higgins and Green, 2008; Liberati et al., 2009; Lipsey and Wilson, 2001). Next, the data

extraction and synthesis processes require gathering and combining evidence from the included studies in a systematic and well-articulated way. The procedures for data analysis are also expected to consider the potential errors, biases or flaws in the available evidence (Liberati et al., 2009).

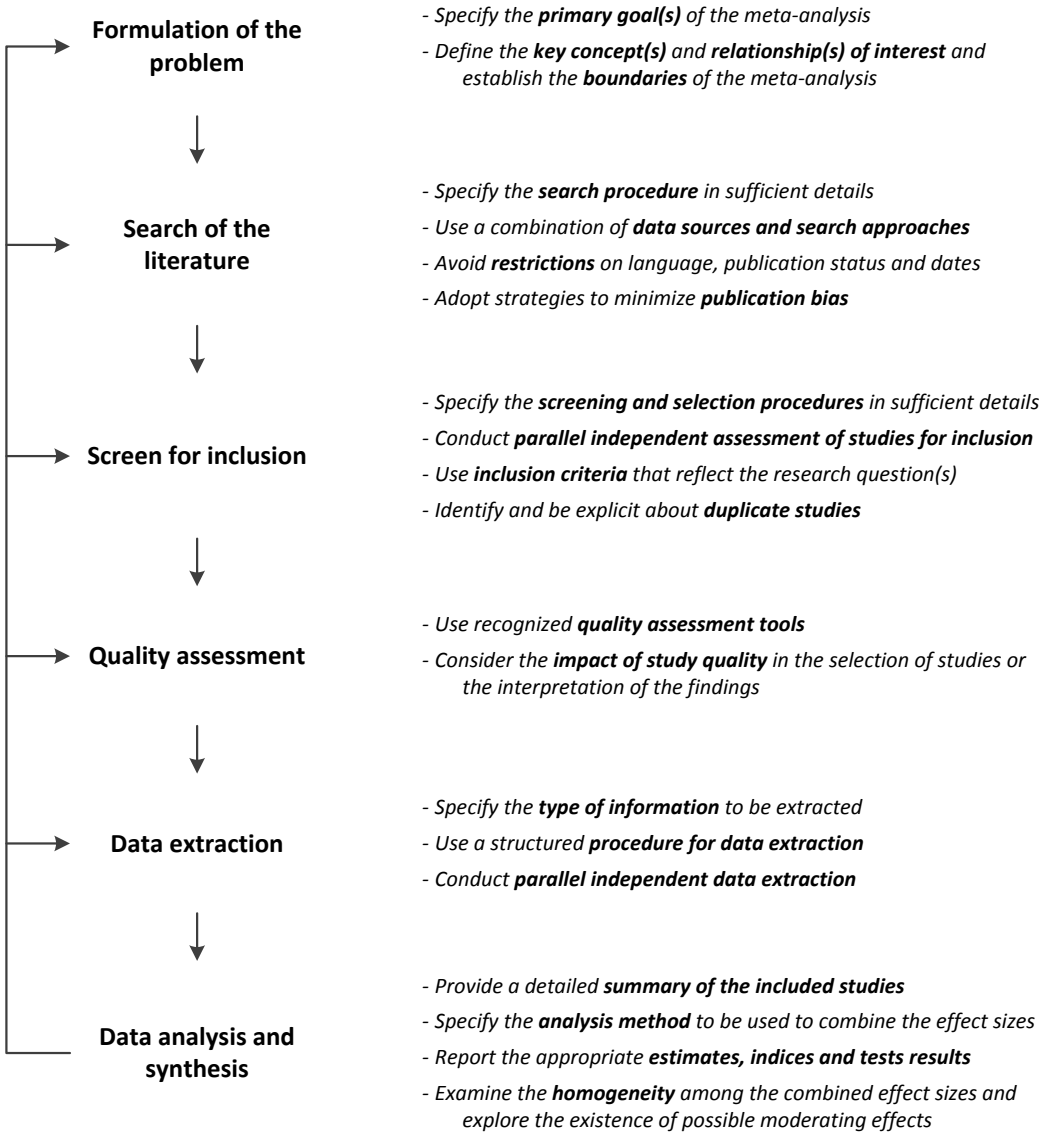

Figure 4.1 – Procedure for conducting a meta-analytic review in IS

It must be noted at this point that the proposed sequence of steps should not necessarily be followed in a strictly linear manner. Indeed, another important trait of any review process is its highly iterative nature. Many activities are initiated during the planning phase and later refined

during the subsequent phases of the review process (Kitchenham and Charters, 2007). Each of the 6 steps will be described in greater detail in the following paragraphs. As mentioned earlier, we also illustrate how each of theses steps can be applied in our field through a meta-analysis of the antecedents of IT organizational adoption. The illustrations of steps 1 to 5 apply to all antecedents of IT organizational adoption, whereas step 6 will focus on a single antecedent, for simplicity's sake.

4.3.1 Step 1: Formulation of the problem

The first step refers to the identification and motivation of the goal(s) of the meta-analysis as well as the definition of the central topic of the review. A clear formulation of the problem guides the researcher(s) in the choice of an appropriate design and provides the structure for the next steps of the review process. A clear definition of the problem and key concepts of interest should also help the reader better understand the meta-analytic process and its anticipated outcomes.

4.3.1.1 Primary goal(s)

First, researchers are required to specify the primary objectives of the meta-analysis. As mentioned earlier, meta-analyses usually aim at integrating research findings, validating a specific theory or hypotheses, and investigating moderator or mediator variables (Hwang, 1996; King and He, 2005). Importantly, authors of a meta-analysis are expected to explain why there is a need for a meta-analytic review. As mentioned by Hwang (1996), "the development of meta-analysis was motivated by the failure of traditional, narrative reviews to provide definite answers to the research questions examined by social scientists" (p. 36). Compared to other types of literature reviews, a meta-analytic review is particularly appropriate to integrate the evidence from a population of relatively similar studies that shows both significant and insignificant findings as well as conflicting results. According to King and He (2005), a "meta-analysis enables the combining of various results, […] permitting studies showing insignificant effects to be analyzed along with others that may show significant effects" (p. 670).

As shown below, the importance of our meta-analysis is associated with the need to focus on the organizational adoption of IT as a research topic in our field.

> *In recent years, organizations have been relying extensively on IT investments with the objective of increasing productivity and overall firm performance (Pinsonneault and Rivard, 1998). Indeed, IT has emerged in the past decades as a critical enabler of business performance, firm capabilities and competitive advantage (Banker, Bardhan*

et al., 2006; Melville, Kraemer, and Gurbaxani, 2004). Therefore, organizations have made huge investments in order to acquire, develop, replace, update and implement new computer-based applications. Today's challenges further stimulate the adoption of IT, which helps to cope with increasing competitiveness (Sambamurthy, Bharadwaj, and Grover, 2003) and the need for efficiency (Bharadwaj, Bharadwaj, and Bendoly, 2007). Facing the present difficulties, the benefits related to IT innovation accentuate the reasons for its adoption. Indeed, IT innovation had taken on a growing importance for corporate success over the last years (Fichman, 2004; Frambach and Schillewaert, 2002) as IT continues its fast and widespread penetration into work life. In that context, the adoption of IT innovations in organizations continues to be a timely and relevant area of investigation in our field.

Next, we justify the use of a meta-analysis to investigate the factors influencing IT adoption in organizations. To do so, we use three types of arguments: the richness and maturity of the literature in this area, the diversity of research perspectives and the existence of mixed findings.

Research on IT innovation adoption and diffusion has become increasingly popular during the past decades (Fichman, 2004), leading to the accumulation of a rich and diverse body of literature (Jeyaraj, Rottman, and Lacity, 2006). For more than three decades, the innovation research stream has retained continued attention in the field and IS scholars have significantly contributed to this area (Lucas, Swanson, and Zmud, 2007). Indeed, the adoption of IS innovations is one of the most widely studied and mature topics within the IS field (Ramdani and Kawalek, 2007; Venkatesh, Davis, and Morris, 2007).

Further, several empirical studies have focused on the factors facilitating or inhibiting the adoption of IT by organizations (Jeyaraj et al., 2006). Several perspectives have been proposed to explain and predict the adoption of IT, yielding important discussion on the best predictors of IT organizational adoption and the related theories and perspectives. The choice of a particular perspective defines the set of theories that are available to the researcher and thereby the particular predictors and constructs assumed to explain the innovation phenomenon. For instance, Fichman (2004) criticizes traditional models of innovation and posits their limits in accurately predicting innovation behaviors, in particular complex contexts of adoption. Traditional innovation research usually

follows the rational perspective and thus lies within what Fichman (2004) calls the "dominant paradigm." According to this author, emergent perspectives on innovation adoption allow researchers to take into account new aspects of the problem that might influence the innovation phenomenon. Furthermore, the current trajectory of the IT adoption research stream matches the shift from traditional models to more innovative and emergent models of adoption. As it allows testing the hypothesized relationships between the various predictors and the innovation dependent variable, the meta-analysis technique should thereby extend our understanding of the relative role of influential theories in explaining organizations' initial adoption of IT.

Lastly, several contradictory findings have been reported in prior research regarding what the most critical predictors are. Two important issues contribute to the mixed findings in that area. First, several contextual variables have been found to moderate the relationships between predictors and organizational IT adoption (Damanpour, 1991). In particular, Fichman (1992, 2000) states that the classical model of adoption does not apply equally well to all kinds of IT innovations in all adoption contexts. He found that the predictors of IT adoption vary according to the locus of adoption (e.g., individual, organizational) and the class of technology. Second, the lack of common definition of the concepts of interest is likely to cause conflicting findings and prevent comparison across studies (Fichman, 2000). As mentioned by Fichman (2000), there are important debates on whether different measures of adoption will "capture distinct notions of innovativeness that require distinct models and explanatory variables" or will show "considerable overlap and consistency in results" (p. 7). Similarly, Wilson, Ramamurthy and Nystrom (1999) emphasize the lack of a consistent relationship between the independent and dependent variables, mainly due to poor conceptualization and operationalization of the variables themselves and other methodological problems. In this regard, the present meta-analysis also aims to investigate how variants in the operationalization of the organizational IT adoption construct and explanatory variables or antecedents might have influenced previous findings in this area.

Lastly, we articulate the general objective of the study and specify a set of research questions that reflect the specific goals of the meta-analysis. We also suggest potential contributions for future research.

> *As a general objective, our meta-analysis aims to push further our understanding of the most important predictors of organizational IT adoption. More precisely, we attempt to provide answers to the following research questions: (1) What are the most influential predictors of IT organizational adoption? (2) To what extent do the contextual variables moderate the influence of the predictors of IT organizational adoption? (3) To what extent does the operationalization of the constructs influence the nature and strength of the relationships between independent and dependent variables in this particular area? Our meta-analysis also responds to the lack of theoretical integration in this area, as stressed by Lucas et al. (2007). Indeed, it might help researchers build a unifying theory of IT adoption in organizations. Finally, in line with the evidence-based movement (Rousseau, Manning and Denyer, 2008; Oates, Edwards and Wainwright, 2012), the results of our meta-analytic review can serve as a tool for practitioners to identify the factors facilitating or hindering the adoption of IT in organizations.*

4.3.1.2 Key concept(s), relationship(s) of interest and boundaries of the meta-analysis

As they specify their research goals, researchers should also make sure the key notions are not ambiguous or do not refer to different concepts. Indeed, authors of meta-analyses must necessarily distinguish relevant from irrelevant material and exclude a multitude of studies that lie near the boundaries of the problem domain. It is therefore important to consider the boundaries of a meta-analysis and, hence, articulate concrete definitions of the key concepts involved in the inquiry (Cooper, 2009). The boundaries of a study refer to the contextual conditions under which a focal phenomenon is studied. Researchers should clearly set the boundaries of their meta-analysis as they state the conditions under which the theories or hypotheses being tested are expected to hold. Vague or imprecise definitions of the concepts at the heart of a meta-analysis might reduce the likelihood of missing relevant articles, but could also foster the inclusion of irrelevant ones or cover an unmanageable number of articles. The boundaries of a meta-analysis should be sufficiently narrow for the researcher to argue that the collection of primary studies included in the meta-analysis examines the same relationship.

In our illustration of a meta-analysis, we first specify the boundaries by defining its core object of inquiry, namely, the innovation adoption phenomenon.

> *The present meta-analysis focuses on a particular facet of IT adoption research, namely the initial adoption of IT-driven innovations in organizations. The term innovation refers to the object that will be adopted, whereas the concept of adoption implies the process by which the innovation object will be introduced in a new context. Our meta-analysis delimits its boundaries on three fundamental aspects: the type of innovation, the unit of analysis, and the stage of innovation. Figure A positions the present study within the broader domain of innovation adoption research.*
>
> *First, it is important to distinguish between different types of innovations as the drivers and motivators might differ from one type to another. This is particularly problematic in the case of meta-analysis inasmuch as it can prevent comparison between findings. A widely accepted definition of innovation is provided by Rogers (1995), who frames the concept of innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 11). First, the concept of innovation implies the ideas of newness and change, "where the change is a novel or unprecedented departure from the past" (Birkinshaw, Hamel, and Mol, 2008, p. 826). Cooper (1998) stresses innovation is often treated as an "all-inclusive term, even though [it might refer] to very different events or processes" (p.494). The present meta-analysis focuses solely on IT-based innovations. Such innovations refer to technological artifacts as opposed to human-driven innovations that consist of new work practices, methods or tasks (Swanson, 1994). Examples of IT-based innovations include computers (e.g., Bretschneider and Wittmer, 1993; Gatignon and Robertson, 1989), spreadsheet software (e.g., Castner and Ferguson, 2000), email (e.g., Sillince, Macdonald et al. , 1998), relational database software (e.g., Grover and Teng, 1992), Enterprise Resource Planning (ERP) (e.g., Barbosa and Musetti, 2010; Pan and Jang, 2008), Customer Relationship Management (CRM) (e.g., Karakostas, Kardaras, and Papathanassiou, 2005; Ko, Kim et al., 2008) and Electronic Data Interchange (EDI) (e.g., Chau and Hui, 2001; Premkumar, Ramamurthy, and Crum, 1997; Saunders and Clark, 1992).*

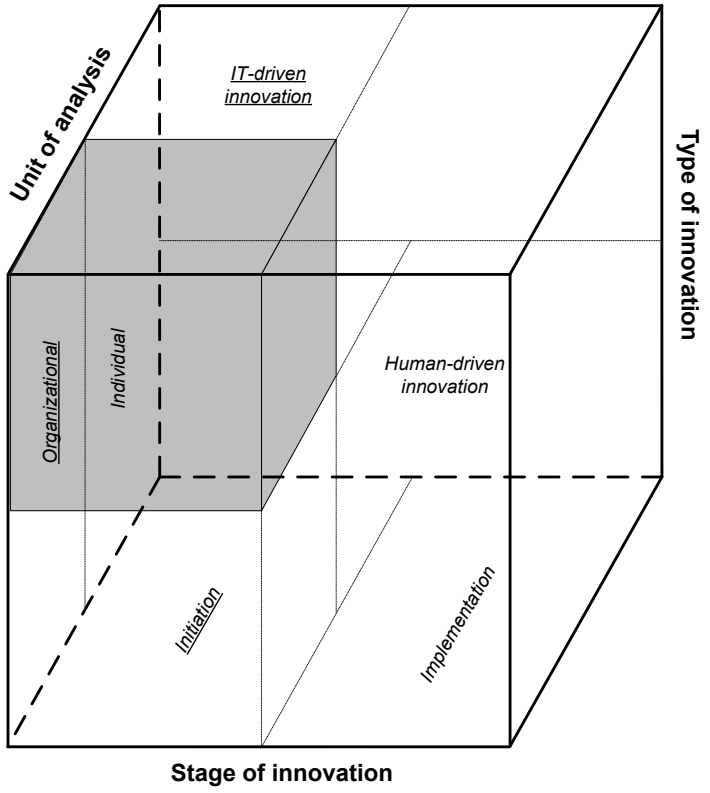

Figure A – Boundaries of the meta-analysis

Second, this study investigates the adoption of IT innovations at the organizational level, not the individual level. Considering the benefits and necessity of organizational innovations for a firm to respond to changes and pressures from its environment (Swanson, 1994), there is a need to account for organizational level phenomena in IS research. As mentioned previously, innovations only exist by means of an adopting unit that perceives the idea, practice or object as new to its environment. It is therefore essential to characterize innovations according to their adopting units. Studies on IT innovation have focused on different units of adoption, such as individual, group, organization or industry. Much of the early research addressed the individual adoption of ideas, practices or IT artifacts, whereas the organizational adoption of IT innovation remained comparatively unexplored (Slappendel, 1996; Lucas et al., 2007). More recently, research has shifted from the individual level to investigate adoption at the

organizational level and innovation patterns at the industry level (Slappendel, 1996). However, "much current research remains focused on individual and acceptance of IT, where the original implementation research began" (Lucas et al., 2007, p. 208).

Third, this meta-analysis focuses on the initial stage of the organizational adoption process proposed by Rogers (1995) who defines the innovation-decision process as "the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision" (p. 20). Based on this definition, the potential adopter (i.e. the organization) goes through a sequence of events or activities that purposefully leads to an outcome, as the commitment of resources toward the innovation. The initiation stage is defined as "all of the information gathering, conceptualizing, and planning for the adoption of an innovation, leading up to the decision to adopt" (p. 392), whereas the implementation stage refers to "all of the events, actions, and decisions involved in putting an innovation into use" (p. 392). While having a broader sense than the one specified in this research, the term adoption is used in the rest of the paper to refer to the concept of initial adoption.

Next, we develop a framework that typifies the relationships of interest for our meta-analysis. We also review past IT adoption research to identify commonly studied determinants of IT organizational adoption and discuss the types of measures that have been used to evaluate IT adoption in organizations. We provide definitions of the remaining key concepts, namely, the potential moderators of the relationship between the independent and the dependent variables of adoption.

As the present study aims to investigate the particular factors that predict the organizational adoption of IT, our framework represents the relationship between the potential predictors and the dependent variables of IT organization adoption. Contextual variables such as the adopter type, the industry sector or the technology type are hypothesized to moderate the general relationships. Further, the meta-analysis aims to assess the extent to which variations in the measurement of the independent or the dependent variables can moderate the nature and strength of the

relationships. Figure B presents the conceptual framework we used to guide the conduct of our meta-analysis.

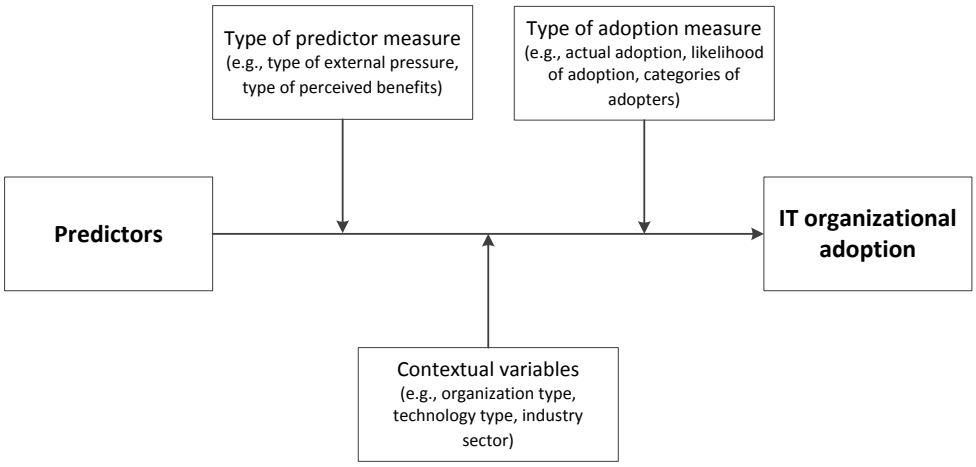

Figure B – Meta-analysis framework

Predictors of IT adoption. *Various factors have been proposed to predict the adoption of IT-based innovations in organizations (Jeyaraj et al., 2006). According to Teo, Wei and Benbasat (2003), much of the extant literature "assumed that innovation adoption is driven by a rationalistic and deterministic orientation guided by goals of technical efficiency" (Teo et al., 2003, p. 20). This literature belongs to what Fichman (2004) calls the "dominant paradigm." Recently, several alternative perspectives on innovation adoption have been proposed. For instance, Birkinshaw et al. (2008) identified three rival perspectives on management innovation, namely, the cultural perspective, the fashion perspective, and the institutional perspective. First, the rational perspective focuses mainly on innovation attributes and the generic characteristics of the adopting units as key drivers of and barriers to IT adoption (Fichman, 2000). Next, the cultural view mainly focuses on the cultural conditions surrounding the organization in which the innovation is introduced (Birkinshaw et al., 2008). The institutional perspective primarily emphasizes three groups of pressures that are likely to influence organizational actions: coercive, normative and mimetic pressures (DiMaggio and Powell, 1983; Mignerat and Rivard, 2009). Finally, the fashion perspective "focuses on how management innovations emerge through the dynamic interplay between the*

managers who use new management ideas and the 'fashion setters' who put forward those ideas" (Birkinshaw et al., 2008, p. 826). Each perspective encompasses distinct variables that explain or predict IT adoption in organizations. For their part, Tornatzky and Fleischer (1990) introduce the Technology-Organization-Environment (TOE) framework as a way to categorize the antecedents of IT innovation into three main categories. The technological domain refers to the attributes of the innovation as perceived by the potential adopters. Rogers (1995) identifies five major innovation attributes that contribute to its adoption: relative advantage, compatibility, complexity, triability and observability. Cost is another technological attribute that has been widely studied in previous literature (e.g., Nambisan and Wang, 2000; Premkumar et al., 1997). The organizational domain relates to the characteristics of the organization, such as firm size, championship, management support or IS experience and expertise (e.g., Damanpour, 1991; Jeyaraj, Balser et al., 2009). Finally, the environmental domain designates the larger context in which the organization conducts its business; it encompasses the influence from external actors, the structure of the organizational field and the specificities of the industry. Examples of environmental predictors include competitive pressures (e.g., Chwelos, Benbasat, and Dexter, 2001; Lee, 2004; Premkumar et al., 1997), government influence (e.g., Chau and Hui, 2001), vendor pressure (e.g., Lee and Shim, 2007) and knowledge transfers (e.g., Rai, 1995).

Type of adoption measures. *As mentioned previously, many concepts have been used by IS scholars to refer to the adoption phenomenon. For instance, studies examine the adoption of an innovation (e.g. Huang, Janz, and Frolick, 2008), the diffusion of innovation (e.g. Loh and Venkatraman, 1992), the implementation success (e.g. Premkumar, Ramamurthy, and Nilakanta, 1994), the level of usage (e.g. Hill, Zhang, and Scudder, 2009) or the level of IT sophistication (e.g. Raymond and Paré, 1992). Indeed, the term adoption has been used by investigators to refer to different concepts. Fichman (2000, 2001) reviews several measures that have been used to assess organizational adoption, such as earliness of adoption, aggregated adoption, internal diffusion, infusion, routinization and assimilation. Other examples of measure of adoption include the intention or the commitment of the firm toward the innovation (e.g., Teo et al., 2003), the actual purchase of software (e.g., Lee and Larsen, 2009) or*

the decision to acquire a specific innovation (e.g., Grover, 1993). Such diversity prevents the comparison between studies and yields potential conflicting findings in the area (Fichman, 2000). Therefore, researchers should clearly define and specify the concepts of adoption they include in their models and theories. The present meta-analysis analyzes how the included primary studies define the focal construct of adoption, and it takes into account the type of adoption measure as a potential moderator of the relationship between the selected predictors and the dependent variable.

Contextual variables. *Previous studies of IT organizational adoption suggested that the research context might influence the relationship between influential predictors and innovation adoption (Damanpour, 1991; Nystrom, Ramamurthy, and Wilson, 2002). Therefore, prior research on IT organizational adoption has examined the influence of several contextual elements, such as firm size (e.g., Daugherty, Germain, and Droge, 1995; Barbosa and Musetti, 2010) and industry sector (e.g., Bretschneider and Wittmer, 1993). The present meta-analysis thus investigates the moderating effect of three categories of contextual variables, namely, organization type, industrial sector, and type of technology.*

Organization type refers to the characteristics of the adopting unit, hence the organization in which the innovation is introduced. For instance, primary studies on IT organizational adoption have focused on small firms (e.g., Chau and Hui, 2001; Harrison, Mykytyn, and Riemenschneider, 1997) or large businesses (e.g., Lai and Guynes, 1997; Ramamurthy, Sen, and Sinha, 2008), and public or private organizations (e.g., Ozdemir and Abrevaya, 2007; Ugrin, 2009). Industry sector refers to the type of industry in which an organization is located. Adoption studies have been conducted on organizations in various industry sectors, such as manufacturing firms (e.g., Karimi, Somers, and Bhattacherjee, 2009), banks (e.g., Hwang, Ku et al., 2004; Pennings and Harianto, 1992), textile companies (e.g., Cho, 2006) and hospitals (e.g., Angst, Agarwal et al., 2010; Hu, Chau, and Sheng, 2002). The distinction between different types of organizations and industries is important as it might reveal idiosyncrasies that will impact their IT adoption behavior. Indeed, Damanpour (1991) mentions that "organizational factors may unequally influence innovation in different types of organizations, as extra-organizational context and the industry or sector in which an

organization is located influence innovativeness" (p. 557). Therefore, we consider the type of adopter as another potential moderator.

Last, we feel it is important to distinguish between different types of innovations because the antecedents might differ from one type to another (Downs and Mohr, 1976). Several taxonomies of IT innovation have been proposed in the IS literature. For instance, Swanson (1994) proposes a model that categorizes innovations according to their value, focus and objectives; Zmud (1982) distinguishes between product and process innovations; and Cooper (1998) proposes a multi-dimensional model of innovations: radical versus incremental, technological versus administrative and product versus process innovations. Focusing solely on technology innovations, Fichman (1992) suggests distinguishing between classes of technology along two dimensions, namely, the adopter interdependencies and the knowledge barriers to adoption. Innovations such as communication technologies or enterprise systems will involve important user interdependencies, meaning that the adopter becomes a member of a larger community of interdependent users. The knowledge barriers refer mainly to the ability of the organization to recognize the value of innovation, acquire it, and assimilate it. In short, the present meta-analysis considers the type of innovations investigated in prior studies as a potential moderator of the relationship between the selected predictors and organizational IT adoption.

4.3.2 Step 2: Search of the literature

The second step refers to the search of potential relevant studies. To do this, researchers identify the range of information sources and, from those sources, the studies that require further analysis. The major decision during this stage concerns the population of studies (Cooper, 1982). The search of the literature is a critical step when conducting a meta-analysis. The search strategy should allow researchers to generalize their findings (Card, 2012; Cooper, 2009). The decisions related to the search procedures, the data sources and the boundaries applied to the search are therefore critical for the researchers to identify and retrieve *all* studies deemed relevant to the research problem.

4.3.2.1 Search procedure

Meta-analytic reviews draw exclusively on the information included in empirical studies. To ensure a high level of rigor, it is recommended to determine and follow a rigorous search

strategy (Kitchenham and Charters, 2007). As mentioned by Okoli and Schabram (2010), "the reviewer needs to be explicit in describing the details of the literature search" (p. 7). This information is critical for comparison across reviews, replicating it or making further updates of the review more efficient (Liberati et al., 2009). Also, a statement of the search procedure is important to ensure that all relevant studies have been included (Oxman, 1994; Okoli and Schabram, 2010). In addition to the search strategy itself, authors of meta-analyses should report appropriate information on the search procedure, such as the data sources, the total number of hits and the search terms used to retrieve the primary studies (Liberati et al., 2009). They should provide sufficient details regarding the search for the literature review to be transparent and replicable (Higgins and Green, 2008; Kitchenham and Charters, 2007). Finally, they should specify the rationale for their choices regarding a particular search strategy (Kitchenham and Charters, 2007).

In our meta-analysis, we emphasize the link between the overall objective of the meta-analysis and the coverage of our search. Beyond the general statement of the search strategy, we specify the data sources, the search terms, the search options and restrictions and the total number of articles retrieved.

> *Our meta-analysis covers journal articles, conference proceedings, and doctoral dissertations that were published prior to May 2012. To answer our research questions, we focused on empirical articles that investigate the relationship between potential predictors and IT organizational adoption. Four main approaches were used to locate the relevant studies. First, we reviewed the references included in previous reviews on adoption. By consulting the Google Scholar search engine and conducting backward and forward searches, we identified seven reviews focusing on IT organizational adoption. Overall, those reviews covered articles and conference proceedings published prior to 2007. In order to ensure consistency in our process, we identified from previous reviews the articles published in peer-reviewed journals and the proceedings from the International Conference on Information Systems (ICIS). Overall, we identified 536 references from the previous literature reviews.*
>
> *Second, we updated the list of references by locating the articles published between January 2007 and May 2012. We performed the search in May 2012; therefore, because of delays in the publication process, some articles published before this date might not*

appear in our database. We performed searches on the Web of Knowledge (Thompson Reuters) and the ABI/Inform Complete (ProQuest) databases. We therefore followed Shea et al.'s (2007) recommendation to use at least two electronic databases to cover the extant literature on a given topic. We restricted our search to papers published after January 2007. We also restricted the search on the Web of Knowledge (Thompson Reuters) database to 29 journals since the first search yielded too many results to be manageable. These two searches were conducted using the term "adoption" in conjunction with "information system" or "information technology".

Third, in order to ensure comprehensiveness, we performed an additional search using ABI/Inform (ProQuest). The search was conducted using the keywords "adoption intention", "adoption decision" or "intention to adopt" or "decision to adopt" in conjunction with "information system" or "information technology".

Fourth, to minimize the risk for publication bias, we tried to locate unpublished studies using the Dissertations and Theses (ProQuest) database and by reviewing all years of the ICIS proceedings for relevant communications. These searches were conducted using the keyword "adoption" in conjunction with "information system" or "information technology". Overall, our searches yielded 1,216 citations.

4.3.2.2 Data sources and search approaches

As stressed by Liberati et al. (2009), retrieval from any single source is likely to be imperfect and incomplete. Therefore, it is important to combine multiple sources and approaches to ensure the comprehensiveness and completeness of the search process. The predominant sources to identify previous studies are the electronic databases (Okoli and Schabram, 2010). As no single database stores all the relevant literature, Shea et al. (2007) propose that at least two electronic sources should be searched. Further, electronic searches are usually incomplete and should be used in combination with alternative approaches (Kitchenham and Charters, 2007) including scanning manually journals and conference proceedings, contacting experts in the field for additional references, scanning the references of identified articles (i.e., backward searching) and/or looking for articles that cite the key articles previously identified.

Figure C provides a detailed description of the data sources and search approaches used in our meta-analysis.

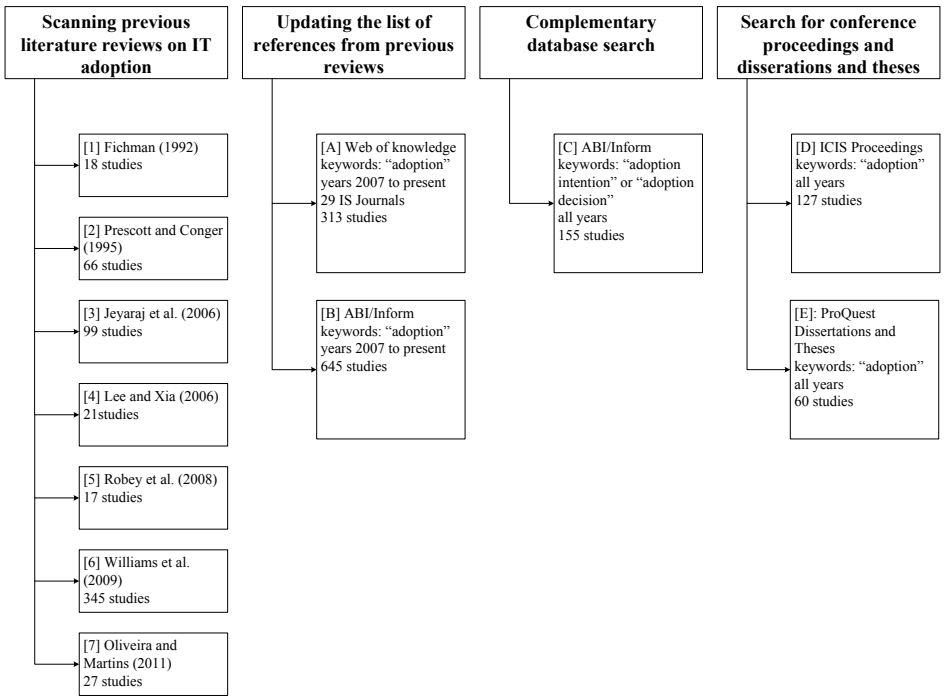

Figure C – Data sources and search approaches

As shown in Figure C, our meta-analysis combined four main approaches to locate the primary studies. We also consulted two general databases to identify relevant journal articles. The combining of multiple sources allows us to ensure the comprehensiveness and completeness of the search process.

4.3.2.3 Search restrictions

According to Kitchenham and Charters (2007), authors of meta-analyses "must select and justify a search strategy that is appropriate for [the] research question" (p. 17). Therefore, restrictions on the literature search should be avoided unless the limitations correspond to the boundaries of the research question. More specifically, no restrictions pertaining to the publication language, the publication status and date should ideally be included in the search strategy (Higgins and Green, 2008). When restrictions are applied, the reviewer should explicitly report (Liberati et al., 2009) and provide a rationale for those restrictions (Kitchenham and Charters, 2007).

As mentioned previously, we restricted two of our database searches to articles published after January 2007. However, the purpose of these searches was to update the references of previous studies that covered articles published prior to 2007.

Therefore, our strategy is comprehensive as it allows us to locate articles published until May 2012. We also restricted one search to 29 journals viewed as being important to IS/IT researchers (see Appendix A). The rationale for this limitation was to restrict the total number of articles so that the literature review would be practically manageable. Indeed, the first search using the "adoption" keyword in conjunction with the other terms and the time period restriction resulted in more than 4,000 publications. We therefore refined the search by restricting the results to a set of journals. We selected those 29 journals from which we already included studies after screening the references of the previous reviews.

4.3.2.4 Publication bias

Publication bias refers to the problem that significant and supporting results are more likely to be published in peer-reviewed journals than non-supporting or non-significant results. Publication bias is particularly harmful for meta-analyses as they attempt to validate theories and test hypotheses through using prior data. Therefore, researchers should address this problem by using strategies such as scanning unpublished literature, including doctoral theses, or contacting experts and researchers working in the same topic area to locate additional studies (Card, 2012; Liberati et al., 2009).

In our meta-analysis, we attempted to locate unpublished studies in order to minimize the risk for publication bias. In addition, we assessed statistically the potential for publication bias. Statistical analyses of publication bias are presented below, together with the other statistical results (see end of section 4.3.6.4).

As mentioned previously, we searched the Dissertations and Theses (ProQuest) database in order to locate research work not published in scholarly journals. We also reviewed the ICIS proceedings for relevant communications. Overall, we identified a total of 187 citations from those two sources. For pragmatic reasons of time and resources, we did not ask researchers directly for unpublished manuscripts, which is a strategy commonly recommended to minimize publication bias[5]. We thus acknowledge it might represent a limitation of our study. All in all, it is our contention that our search

[5] The interested reader will refer to the work of Wu and Lederer (2009). In order to minimize publication bias, the authors sent an inquiry for working papers and conference proceedings to the IS community through the AISWorld mailing list.

strategy allows us to maximize the number of studies, reduce the risk of publication bias, and thus increase the statistical power of the meta-analysis.

4.3.3 Step 3: Screen for inclusion

The third area refers to the attributes associated with the selection of potentially relevant studies from the pool of references identified during the search. In meta-analyses, the search and selection strategies attempt to avoid missing articles by first looking at all potential articles on a subject and then screening for the relevant ones. Indeed, a comprehensive search will likely yield many articles that are not relevant to the research question (Oxman and Guyatt, 1988). Therefore, the reviewer must select the appropriate articles among those retrieved during the literature search. Researchers should strive during the study selection to enhance objectivity and avoid mistakes (Liberati et al., 2009).

4.3.3.1 Screening and selection procedures

Systematic, explicit and rigorous screening and selection procedures are recommended to protect against biased selection of studies (Oxman and Guyatt, 1988). More precisely, researchers should be explicit about how the studies were chosen in order to ensure the process is transparent for the readers and the study is replicable (Oxman, 1994; Okoli and Schabram, 2010; Higgins and Green, 2008). According to Kitchenham and Charters (2007), "study selection is a multistage process" (p. 19). The reviewer should first perform an initial screening of the titles and abstracts against the inclusion criteria to decide whether or not they are worth reading (Liberati et al., 2009; Okoli and Schabram, 2010). Next, the reviewer should thoroughly examine the full papers to ensure compliance with the inclusion criteria (Higgins and Green, 2008). In addition to the screening procedure, the reviewer should report appropriate information on this stage, such as the inclusion criteria (Oxman and Guyatt, 1988; Liberati et al., 2009; Okoli and Schabram, 2010), the number of excluded studies at each stage with reasons for exclusion (Kitchenham and Charters, 2007; Liberati et al., 2009) and the final number of included studies (Liberati et al., 2009). Liberati et al. (2009) also advise using a flow diagram to summarize the study selection process.

In our meta-analysis, we specified the selection procedure in detail as well as the inclusion criteria along with the rationale explaining our choices. Hence, we underlined the link between our research question and the criteria for inclusion and provided justifications for practical criteria.

As recommended by Kitchenham and Charters (2007) and Okoli and Schabram (2010), our procedure for article selection involved an initial screening of the titles and abstracts against the proposed inclusion criteria, followed by a thorough examination of the full papers to ensure the appropriateness of inclusion.

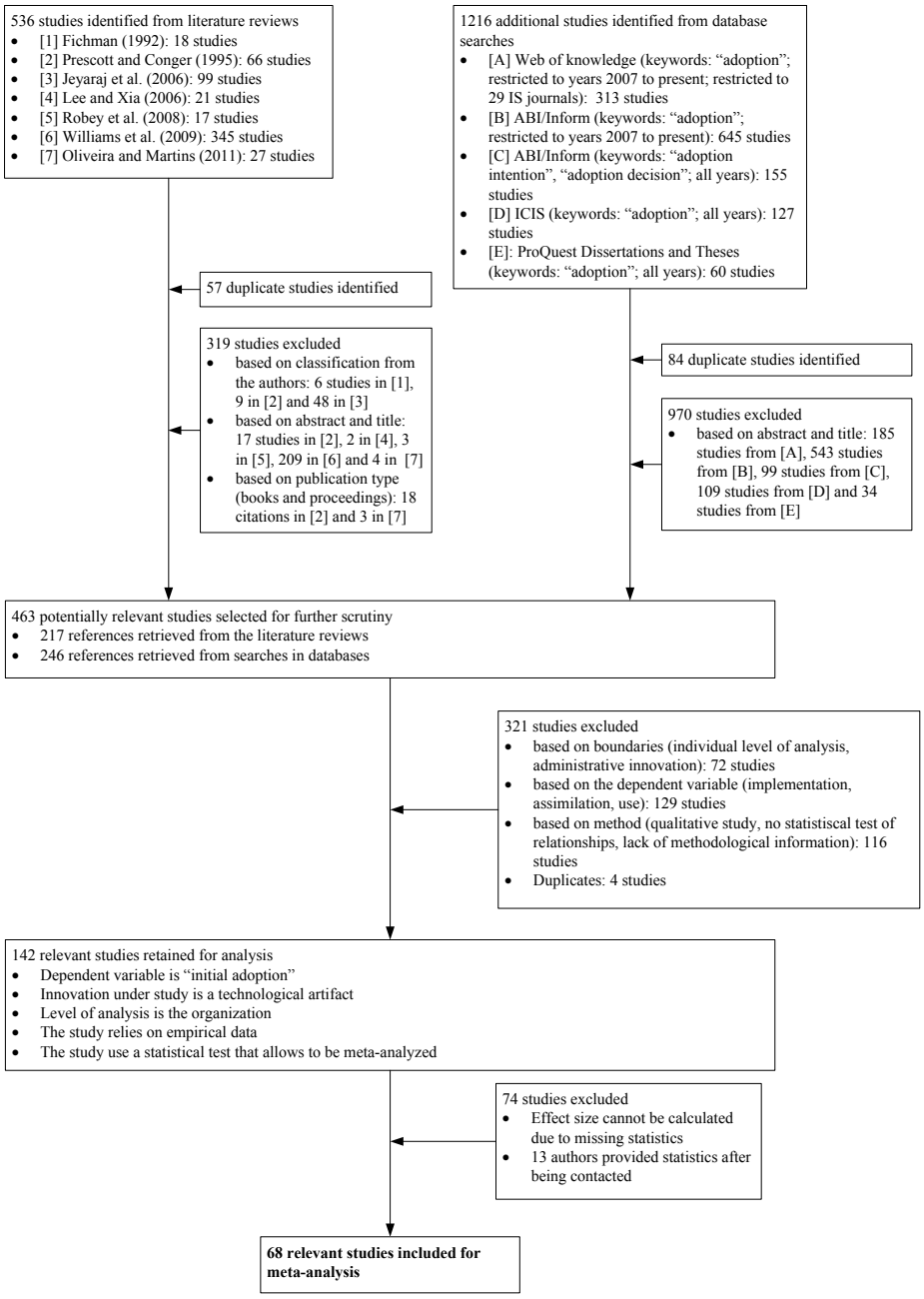

Figure D – Diagram Flow

For the purpose of this study, the inclusion criteria consisted of studies that: (1) are written in English or French, (2) investigate the initial adoption of IT, (3) focus on IT-based innovation, (4) investigate organizational level phenomena, (5) examine the factors that facilitate or prevent IT adoption, (6) present new empirical data, and (7) report sample sizes and correlation estimates for the relationship between at least one pair of independent-dependent variables. For the references identified from the previous studies, before screening the titles and abstracts, we excluded those studies that were classified by the authors as lying outside the boundaries of our meta-analysis. For instance, Jeyaraj et al. (2006) classify the studies included in their review according to the level of analysis. In that case, we reviewed only the studies included at the organizational level. Based on the careful examination of the full papers, we retained 142 studies judged relevant for further analysis. Each of these studies uses a statistical test that allows for being meta-analyzed. However, 87 studies out of the 143 were lacking in terms of necessary information. As a last step in our selection process, we thus contacted the authors of these studies and received positive answers for 13 of them. As a result, the final number of articles that were included in our sample is 68. As a way to synthesize our search and selection process, Figure D displays the diagram flow.

4.3.3.2 Parallel independent assessment of studies for inclusion

The procedure for study selection should minimize biases and the potential for judgment errors (Oxman, 1994). The objective is to ensure and validate the consistency of the inclusion process. According to Oxman and Guyatt (1988), "expert assessment of primary research studies generally results in a level of disagreement that is both extraordinary and distressing" (p. 700). Parallel independent assessment of the studies is therefore recommended to minimize the risk of errors and judgments from the researcher (Kitchenham and Charters, 2007; Okoli and Schabram, 2010). Further, each disagreement should be discussed and resolved using techniques such as consensus or arbitration (Higgins and Green, 2008; Kitchenham and Charters, 2007). The level of agreement between the researchers could also be measured using the Cohen Kappa statistic (Higgins and Green, 2008; Kitchenham and Charters, 2007).

In our meta-analysis, we performed and documented a cross-checking procedure to validate the consistency of the selection process.

In order to ensure the rigor of the selection process, we followed the recommendations of Kitchenham and Charters (2007) and independently cross-checked a random sample of the retained articles. At first, 35 studies were randomly selected among the 463 studies deemed relevant for further scrutiny after the initial screening. Next, one of the researchers and an independent reviewer independently coded their decisions regarding the inclusion or exclusion of each study along with the reasons for exclusion. An inter-rater agreement rate of .85 and a Cohen's Kappa of .62 were obtained from this process. These results indicate a substantial agreement between the two coders (Landis and Koch, 1977). All of the disagreements were discussed and resolved, and minor adjustments were made to the list of inclusion criteria for clarity purposes.

4.3.3.3 Inclusion criteria

The criteria required for study inclusion are usually based on the content of the study and therefore refer to the research question (Cooper, 2009; Kitchenham and Charters, 2007; Liberati et al., 2009; Okoli and Schabram, 2010). Other criteria might be based on practical considerations such as the publication status, language, years considered and a lack of or missing information (Liberati et al., 2009; Okoli and Schabram, 2010). The use of such pragmatic selection criteria reflects trade-offs between satisfactorily answering the research question and practically managing the review (Okoli and Schabram, 2010) and should be used with caution (Liberati et al., 2009). Importantly, for those studies that lack important information, the reviewer should first contact authors of primary studies to obtain the missing information before making a decision regarding exclusion (Oxman and Guyatt, 1988; Kitchenham and Charters, 2007).

As mentioned previously, our inclusion criteria were based mainly on our research question. For obvious practical reasons, we excluded studies written in a language other than English or French. We retrieved only one study in French that was later excluded because of missing data. Further, for the purpose of doing meta-analyses of the findings, we included only studies that reported the appropriate statistics, including the sample sizes and correlation estimates (or indices that can be transformed in effect sizes) for the relationship between at least one independent and one dependent variable. We contacted the authors of 87 studies that were lacking the necessary information. An example of email sent to authors in order to obtain the missing information is provided in Appendix B. Overall, we received 41 responses, showing an

impressive response rate of 47 percent. Many authors responded that they no longer had access to the data. All in all, 13 authors provided us with additional data.

4.3.3.4 Elimination of duplicate studies

The search process, especially when using multiple sources, is likely to identify identical publications. Duplicate studies involve multiple reporting of the same or different results from the same sample, for instance when conference proceedings are followed by full journal articles. The inclusion of multiple publications of the same data set would introduce serious biases in the meta-analysis results (Kitchenham and Charters, 2007; Higgins and Green, 2008). Therefore, meta-analytic procedures should ensure the identification of duplicate studies and exclude multiple reports of the same research (Kitchenham and Charters, 2007). Higgins and Green (2008) propose a list of items to help the reviewers detect duplicate publications including: author names, location and setting of the data collection (e.g. organization names), specific details regarding the data collection, number of participants, date and duration of the study. Further, various processes to deal with duplicate studies have been proposed, such as using the most complete report of the data, combining all versions of the study to obtain all the necessary data or contacting the authors of the studies to resolve remaining uncertainties (Kitchenham and Charters, 2007; Higgins and Green, 2008).

In our meta-analysis, we took into consideration the potential harm from duplicate studies. We present below a strategy to identify duplicates and explain how we managed such publications.

> *During our data selection process, we attempted to detect duplicate studies and multiple reports of the same data. We removed identical articles from the list of references identified through the multiple searches. This first step excluded 141 studies that were retrieved simultaneously from multiple sources. Next, we carefully checked the description of the included studies that had similar authors to make sure the multiple studies were not based on the same data set. When duplicates were identified, we considered only one report of the multiple studies. We chose the report those that seemed to be the most complete in terms of variables and statistics. As a result, we excluded four additional studies.*

4.3.4 Step 4: Quality assessment

Step 4 refers to the attributes associated with the appraisal of the methodological quality of the selected articles. Unlike the previous screening for inclusion that intended to select only those

studies providing evidence about the research question, the quality assessment pertains mostly to the appraisal of the research design and methods (Okoli and Schabram, 2010). As meta-analytic reviews intend to aggregate prior findings to validate pre-specified hypotheses, they require high quality evidence. Indeed, if the input is either incorrect or of low quality, the resulting output is likely to be invalid. Therefore, once the relevant primary studies have been selected, it is important to look at the articles carefully to assess their methodological quality (Okoli and Schabram, 2010) and to ensure that the included studies reach a sufficient level of methodological rigor. According to Oxman and Guyatt (1988), "important aspects of the design and conduct of each primary study should be critiqued and the standard used in these critiques made explicit" (p. 700).

4.3.4.1 Quality assessment tools

When conducting a meta-analysis, researchers should assess the primary studies against recognized methodological standards (Jesson et al., 2011; Kitchenham and Charters, 2007). Checklists of methodological elements are a recommended standard for assessing the quality of primary studies (Kitchenham and Charters, 2007; Okoli and Schabram, 2010). As a result, a quality score should be calculated for each study that reflects the extent to which it addresses bias and maximizes validity (Kitchenham and Charters, 2007). Furthermore, authors of meta-analyses should explicitly report the standards used for assessing the quality of the selected studies in order to allow the readers to judge the methodological quality of the primary studies (Oxman and Guyatt, 1988).

4.3.4.2 Impacts of study quality

Okoli and Schabram (2010) suggest that the quality assessment process might serve two non-mutually exclusive purposes. First, the results of the quality assessment might assist the researchers for the selection of primary studies. For instance, a review could apply a minimum quality threshold for the inclusion of articles for further analysis. Hence, quality scores serve a similar purpose to the inclusion criteria used during the screening and selection process. Second, researchers might consider the potential impact of methodological quality on the findings of their review. In fact, it is recommended to investigate whether quality differences in the included primary studies provide explanations for variations in the results (Kitchenham and Charters, 2007). Hence, quality scores might also serve to moderate the results of individual studies when

aggregating those results or further guide the interpretation of the findings and the recommendations for future research (Kitchenham and Charters, 2007).

In our meta-analysis, we used our assessment of the quality of primary studies both to select the studies and to interpret our results. To do so, we specified our procedure as well as the dimensions against which we would evaluate the methodological quality of the primary studies.

> *As a first step, we assessed the quality of the studies for the purpose of excluding papers in terms of the appropriate reporting of the results. Indeed, when important information and statistics are missing, effect sizes cannot be calculated for the purpose of meta-analyses. As shown in Figure D, we excluded 74 studies because the effect size could not be calculated due to missing information. As mentioned above, we contacted the authors of those studies not reporting the necessary data and received 13 answers.*
>
> *As a next step, we considered the quality of primary studies in the interpretation of our results. For each study, we coded whether the authors provided either the items or an explicit description of the measurement for the dependent variable of adoption, as well as for the predictor variables. We also coded whether the reliability of the measures for the predictor variables was reported, if necessary, and recorded the value of the reliability. We did not consider the reliability of the dependent variable, as the vast majority used a single item to measure it.*

4.3.5 Step 5: Data extraction

The fifth step refers to the attributes associated with the gathering and extraction of data from each study. Cooper (2009) suggests that errors or biases in the data extraction process could lead to a misrepresentation of the studies in the following analyses (step 6). It is therefore essential to follow a rigorous procedure that helps researchers to record accurate and meaningful information from the primary studies (Kitchenham and Charters, 2007).

4.3.5.1 Type of information

Researchers should specify the type of data to be gathered from the primary studies (Kitchenham and Charters, 2007; Higgins and Green, 2008). Indeed, the main decision during step 5 involves the choice of what information is relevant to the problem of interest. Therefore, researchers should decide what type of data will be required for their review and develop a strategy to obtain it (Higgins and Green, 2008). Most of the recorded data will provide evidence

about the research question (Okoli and Schabram, 2010). Nevertheless, important information about how each primary study was conducted, its research design and methods or its statistical results might also be gathered (Cooper, 2009).

In our meta-analysis, we specified and discussed the type of information gathered from the primary studies, as well as the structured procedure used to extract data (along with our data extraction form). We also documented the procedure we followed to validate the consistency of the data extraction process.

> *To extract information from primary studies, we followed the recommendations from Lipsey and Wilson (2001) and defined the major coding unit as an observation. We defined an observation as the investigation of a single relationship between one independent variable and a dependent variable. Therefore, a single study might involve multiple observations.*

Table A – List of coded variables

Study design	Research question Nature of theory Research method Demographics
Context	Type of technology Type of organization Industry sector
Dependent variable	Name Conceptual definition Operational definition
Independent variables	Name Conceptual definition Operational definition
Statistics	Statistical test Sample size Estimates Construct reliabilities

> *For the purpose of the meta-analysis, we gathered information on the independent and dependent variables and the appropriate statistics regarding the relationships. Common types of research findings that can be used to compute the effect size depend on the statistical test used in the primary study. When correlation matrices were provided, we extracted the Pearson correlation coefficients. When standardized mean differences were computed, we gathered the means and standards deviations, t-value*

and groups sizes or F-ratio and group sizes, depending on the information available. When the outputs of regressions were provided, if they involved only one independent variable or for the first variable in a multiple hierarchical regression, we extracted the β coefficients. We also coded important information about how the primary study was conducted, the research methods and the overall context of the study. Table A lists the coded variables that were included in our analysis.

4.3.5.2 Procedure for data extraction

In addition to the type of information extracted, researchers should document how the data was extracted to ensure the review is transparent and replicable (Higgins and Green, 2008). The use of a "data extraction form" (Higgins and Green, 2008; Kitchenham and Charters, 2007; Okoli and Schabram, 2010) is a widely recommended approach to structure the extraction process. The data extraction form should allow the authors to collect all the information needed to address the research question (Kitchenham and Charters, 2007). Further, the data extraction form or the coding scheme could be reported as a way to show the reader what information has been extracted and how (Liberati et al., 2009).

In order to answer our research questions, we developed an instrument that would help us to extract all the required information from the primary studies. We validated the data extraction form using the following steps. First, ten articles were randomly selected from the final list of references and were coded by the lead author who was responsible of the data extraction. Next, all authors jointly discussed and resolved difficulties and lack of comprehension in meetings. Small adjustments were made to the data extraction form in order to increase its precision and clarity. The form is presented in Appendix C.

Meta-analyses require managing a large amount of information. The data is also composed of many types of information. Therefore, in order to manage the data extraction process and facilitate our work, we developed a database using the Microsoft Access software. The structure of the database is provided in Appendix D.

4.3.5.3 Parallel independent data extraction

The procedure for data extraction should be reliable and avoid any biases and errors. Therefore, it is important to ensure that researchers extract the data in a consistent manner. Kitchenham and Charters (2007) recommend that two researchers independently participate to the data

extraction process in order to minimize errors and reduce potential bias. The authors suggest that at least a random sample of the primary studies be cross-checked by two independent coders. Further, as for the screening and selection procedures, findings should be compared and disagreements discussed and resolved (Kitchenham and Charters, 2007). Also, the Cohen Kappa statistics could be used to measure the level of agreement between coders (Higgins and Green, 2008; Kitchenham and Charters, 2007). Higgins and Green (2008) further recommend the use of clear instructions and decision rules about coding the data in order to facilitate the consistency of the data extraction process.

> *We did not perform a parallel independent validation of the data extraction as we felt the process was rather straightforward and therefore did not introduce potential bias. Indeed, the information extracted from the primary studies mainly referred to the definition of the variables and the statistical results. This type of data did not involve subjectivity or require interpretation from us. However, we recognize that errors might arise when entering data in the database. Having two researchers independently enter and cross-check the data would prevent this kind of bias. In our case, the use of structured entry forms in Microsoft Access also minimized such errors, as it pre-specified the type of data valid for entry.*

4.3.6 Step 6: Data analysis and synthesis

The sixth and last step refers to the use of appropriate techniques to make sense of the information gathered during the data extraction process as well as the appropriate reporting of the review results. Errors in the data analysis stage are particularly detrimental for meta-analyses which aim at testing theories and hypotheses. As mentioned by Cooper (2009), "during data analysis, the separate data points collected by the researcher are summarized and integrated into a unified picture" (p. 16). Authors of meta-analyses should also present in a transparent manner the main results of their analyses (Liberati et al., 2009).

4.3.6.1 Summary of the included studies

Meta-analyses should contain a table that provides a descriptive account or summary of the included studies and their findings (Higgins and Green, 2008). Liberati et al. (2009) recommend reporting study-level information on the main characteristics of the primary studies included in the review. According to them, "publication of summary data from individual studies allows the analyses to be reproduced and other analyses […] to be investigated" (Liberati et al., 2009, p.

17). In addition, providing a descriptive summary might help demonstrate the relevance, representativeness, and generalizability of the population of included studies (Cooper, 2009).

For the purpose of this illustration, we present the results of our analysis for one commonly-used predictor, namely "Perceived Benefits". A total of 36 studies in our sample investigated this particular variable. First, we present a descriptive summary that provides the main characteristics of studies considered for analysis. Second, we report the results of our meta-analysis using the standards recommended by the methodologists.

For the descriptive summary presented below, we classified the 36 studies that investigate the relationship between Perceived Benefits and IT Adoption.

Table B – Profile of the selected articles (n=36)

		N	%
Year of publication	1992-1995	3	8%
	1996-2000	2	6%
	2001-2005	11	30%
	2006-2010	14	39%
	2011-2012	6	17%
Journal	The Journal of Computer Information Systems	4	11%
	Information & Management	3	8%
	Information Systems Research	2	5%
	International Journal of Electronic Commerce	2	5%
	Journal of Global IT Management	2	5%
	European Journal of Information Systems	2	5%
	Industrial Management & Data Systems	2	5%
	The Data Base for Advances in Information Systems	1	3%
	Journal of Strategic Information Systems	1	3%
	Information Systems and e-Business Management	1	3%
	Communications of the AIS	1	3%
	International Marketing Review	1	3%
	Decision Support Systems	1	3%
	Journal of Management Information Systems	1	3%
	Technovation	1	3%
	Technological Forecasting & Social Change	1	3%
	Internet Research	1	3%
	International Business Research	1	3%
	Journal of Global Marketing	1	3%
	International Journal of Information Management	1	3%
	Journal of the Association for Information Systems	1	3%
	Journal of Organizational Computing and e-Commerce	1	3%
	ICIS Proceedings	2	5%
	Doctoral dissertations	2	5%

As shown in Table B, all studies were classified according to publication dates and journal names. Results show that most of the studies investigating this relationship were published after 2000. Indeed, studies published between 2001 and 2012 represent 86% of the sample.

Table B also shows that the studies included in our meta-analysis were published or reported in a wide variety of outlets, including top-ranked IS journals, conference proceedings and dissertations. More specifically, our database includes a total of 32 articles published in 22 different journals, 2 studies presented at the International Conference on Information Systems, and 2 doctoral dissertations. We are therefore confident that our search strategy helped us minimize the risk of publication bias.

4.3.6.2 Analysis method

As mentioned by Cooper (2009), "rules for summarizing and integrating data from the individual studies might be inappropriate and lead to incorrect cumulative results" (p. 249). According to King and He (2005), like other statistical methods, meta-analytic methods are based on assumptions about the population from which the observations are taken. There are two common analysis methods, namely, the fixed-effect and the random-effects models. Whereas the fixed-effect model assumes that the true effect size is the same for all studies in the analysis, the random-effects model assumes variations among effect sizes (King and He, 2005). A strategy to protect the analysis from potential validity threats is for the researchers to be as explicit as possible about the approaches, procedures and assumptions for analyzing the data (Cooper, 1982; Kitchenham and Charters, 2007). This will make the review process less difficult to replicate and allow the readers to properly assess the conclusions of the review (Cooper, 2009).

In our meta-analysis, we discussed our choice of a statistical model along with the assumptions leading to it.

As recommended by King and He (2005), we used a random-effects model for our meta-analysis. Indeed, there exist many variations between the studies included in our sample in terms of design, methods, and population of interest. Also, as explained below, the Q statistic shows the presence of significant heterogeneity in effect sizes across the 36 studies. We used the Comprehensive Meta-Analysis (CMA) software to compute our statistics. Borenstein et al. (2011) provide an overview of available softwares for meta-analysis. Available softwares include different features and have

therefore pros and cons depending on the type of analysis the researcher wants to undertake. CMA is particularly useful for our meta-analysis, as it allows to compute statistics from different data formats.

4.3.6.3 Homogeneity

Authors of meta-analyses should validate the homogeneity of the studies both conceptually and statistically. More precisely, they should provide descriptions of the evidence covered by the individual studies and report the criteria used to assess whether the studies that are grouped together are conceptually similar. This step refers to the "apples versus oranges problem" that arises when "attempting to summarize or integrate over studies that do not really deal with the same constructs and relationships" (Lipsey and Wilson, 2001, p. 2). It has been suggested that combining a diverse range of studies in a meta-analysis will yield meaningless results (Card, 2012). This problem is particularly crucial in the IS field, where studies are rarely pure replications of one another. Therefore, this step is one of the most critical tasks in conducting IS meta-analyses. Authors must be able to argue that the primary studies included in a meta-analysis examine the same relationship and aggregating the studies becomes meaningful. At first, the validation involves a cross-comparison of the conceptual and operational definition. To do so, authors could perform what we call a "conceptual cleaning" of their data. Figure 4.2 describes the types of decisions taken during the conceptual cleaning process, along with some rationales.

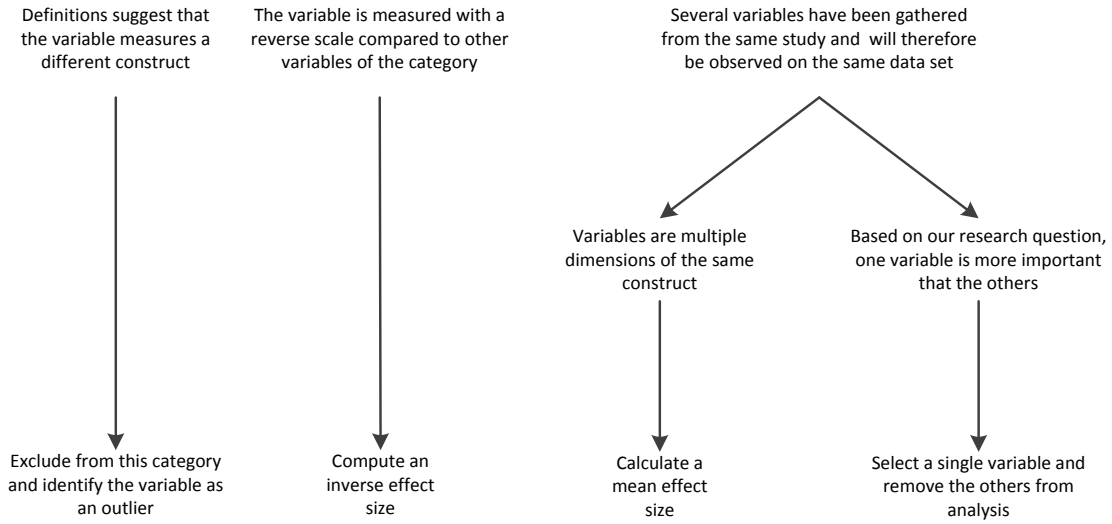

Figure 4.2 – Decisions for conceptual cleaning

Next, statistical analyses of homogeneity test whether the assumption that all of the effect sizes are estimating the same population is reasonable (Lipsey and Wilson, 2001). For that purpose, authors should provide an assessment of the consistency of the data from the included studies such as Q and I^2 (Liberati et al., 2009). The process aims to statistically validate the assumption that combined studies are indeed comparable (Lipsey and Wilson, 2001).

In our illustration of a meta-analysis, we first performed a conceptual assessment followed by a statistical assessment of homogeneity. The results of the statistical assessment will be presented in the next section, together with the other statistical results.

> *As a first step, we regrouped the variables extracted from the primary studies on the basis of their conceptual and operational definitions. Next, we performed a "conceptual cleaning" of each category using the steps described below. For all variables, we analyzed the definitions reported in the articles. Decisions were taken according to the content and meaning of these definitions. First, we compared the provided definitions to exclude those constructs that have different meanings. Such variables were grouped together into an additional outlier category. Such process is highly iterative and the variables included in the outlier category will be discussed and categorized at the end of the process. Second, we screened the items and measures to identify variables using reversed scales. For those variables, we computed an inverse index in order to calculate the average effect size. Finally, we checked for variables measuring the same constructs, therefore grouped in the same category, and that were extracted from the same study. Observations regarding those variables would be based on the same data set and therefore violate one important assumption of meta-analyses (Ma and Liu, 2004). To respect this assumption, we either selected and retained a single variable for analysis or calculated a mean effect size. The conceptual cleaning process was performed by the first author and cross-checked by the second author. All discrepancies and disagreements were discussed and resolved during team meetings.*
>
> *Figure E presents the results of the conceptual cleaning process for the variables related to "Perceived Benefits". First, we excluded 11 variables from this category on the basis of their conceptual or operational definitions, leaving us with a total 50 variables from 36 studies. At this stage, ten studies in our database provided more than one variable for "Perceived Benefits". For two studies, we selected a single variable, judged closer to*

the overall definition of "Perceived Benefits", and we therefore removed the other. For the remaining studies, we defined and computed multidimensional variables and calculated the mean effect size for each. As a result, 36 variables investigated the relationship of interest. Appendices E and F, respectively, provide the description of the variables removed during the process and those included for analysis purposes.

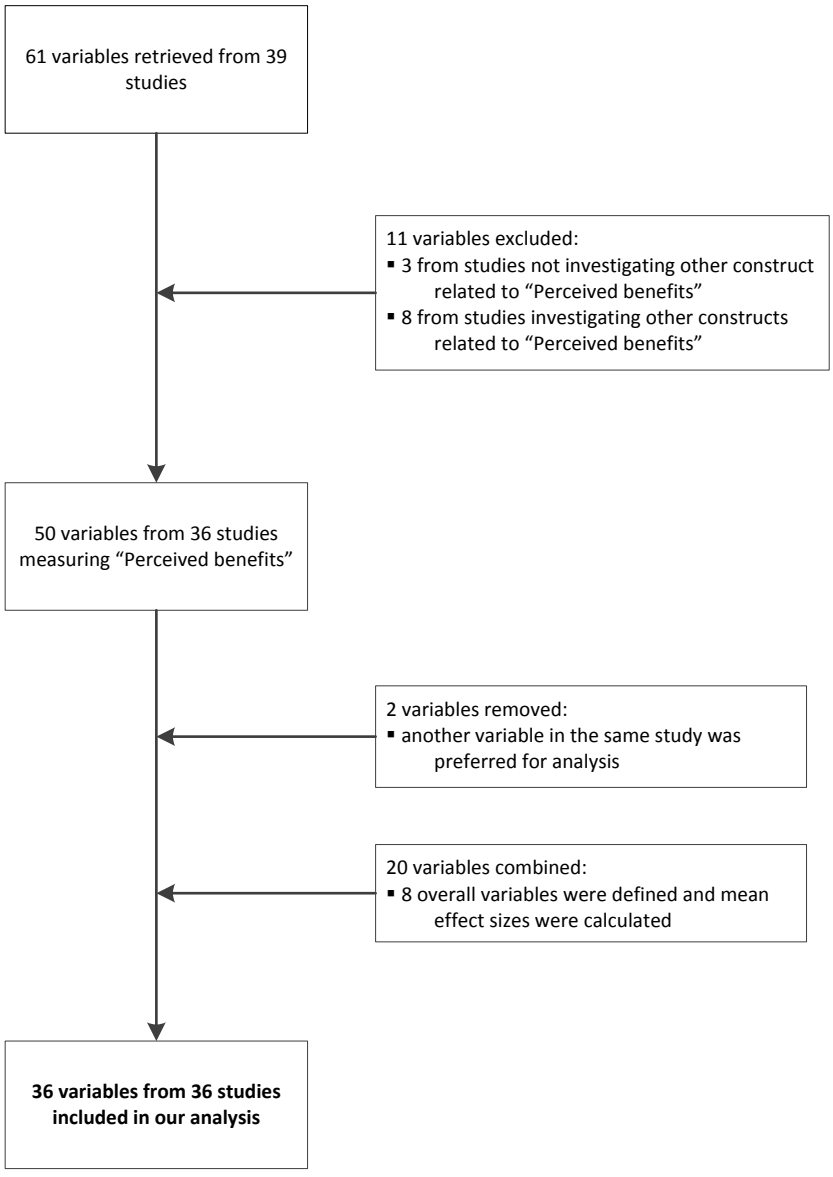

Figure E – Conceptual cleaning process for "perceived benefits"

4.3.6.4 Estimates, indices and test results

In addition to the above analyses, the statistical results should also be reported in sufficient detail to allow the reader to critically assess the foundations of the authors' conclusions (Oxman and Guyatt, 1988). Data analysis in conducting meta-analyses involves at least two steps, namely, effect size calculation and effect size combination. Card (2012) defines an effect size as "an index of the direction and magnitude of association between two variables" (p. 87). The three most common types of indices for representing effect sizes are *r* (correlation coefficient between two variables), *g* or *d* (standardized mean difference between two groups) and *o* (odds ratio between two dichotomies) (Card, 2012). In order to calculate the average effect size between two variables, authors need to transform other statistics, such as correlations, means and standard deviations, t-test and F-ratio into comparable effect sizes. Lipsey and Wilson (2001) and Card (2012) provide equations and formulas to compute effect sizes from the results of primary studies. Next, authors of meta-analyses should combine the individual effect sizes into an overall effect size for each relationship of interest. With random-effects models, this step involves the weighting of each effect size and the calculation of a weighted mean effect size. At this stage, Liberati et al. (2009) propose a list of appropriate standards that should be reported to present the main results. Authors should report the sample size and the estimated effects with a confidence interval for each individual study, as well as the pooled effect estimates across studies with a confidence interval for each relationship being investigated (Liberati et al., 2009). This information is commonly shown in a table or a forest plot (Kitchenham and Charters, 2007; Liberati et al., 2009). Kitchenham and Charters (2007) and Liberati et al. (2009) also recommend conducting a sensitivity analysis, for instance by repeating the analysis and comparing the results of subgroups of studies.

In our own illustration, we reported the sample size and the estimated effects for each individual study, as well as the summary effect estimates across studies. We also reported indices to assess the heterogeneity among effect size in the population of studies and performed a moderator analysis to attempt to explain such heterogeneity. Finally, we performed a series of analyses to test for the potential of publication bias.

> *In terms of statistical analyses, we first computed an effect size for each of the 36 studies included in our database. Data reported in the included studies is of three types: Pearson correlation coefficient, means and standard deviations of two groups and*

results of t-test between two groups. Using CMA software, we directly compiled Pearson r from the studies reporting a correlation coefficient. For those studies reporting other statistical results, the software first calculated Cohen's d indices from the means and standard deviations as well as the t-test results and then transformed d indices into r. Further, one study in our sample reported multiple effect sizes from different technologies' subsets of participants, and two other studies reported effect sizes separately for two different adoption outcomes. Also, as mentioned previously, 10 studies reported multiple effect sizes from multiple measures of the independent variable. For those studies reporting more than on effect size per construct, we either selected a single effect size or computed a mean effect size among these multiple effect sizes and used the average score as our single effect size for this study, as suggested by Card (2012) and Lipsey and Wilson (2001). Appendix G reports the sample size as well as the estimated effect sizes for each of the 36 studies in our sample. Further, before combining the effect sizes, we applied the recommended Fisher's Z transformation to correct for skewed distributions of samples. Card (2012) suggests the use of this kind of correction as symmetrical distributions are desirable when combining and comparing effect sizes across studies. However, following Card's (2012) recommendations, we converted the results of the meta-analysis back to r for analysis and reporting since it is easier to interpret. Appendix H presents the results of the Fisher's Z transformation.

Next, we combined the effect sizes into an overall effect size for the relationship of interest, using a random-effects model. This step involves the weighting of each effect size and the calculation of a weighted mean effect size. Table C summarizes the results of our meta-analysis. According to Card (2012), there are two fundamental questions that can be answered about this kind of research: "First, what is the typical effect size […] found in the empirical literature? Second, is the diversity of effect sizes found in these studies greater than you would expect from sampling fluctuation alone?" (p. 175). For the first question, the results in Table C show a typical positive effect of "Perceived Benefits" on "Adoption". The effect is highly significant and confirmed by the 95% confidence interval. Figure F presents a forest plot associated with those results.

Table C – Results of the meta-analysis

Study name	Effect size	Lower limit	Upper Limit	Z-value	p-value
Ifinedo (2011)	0,645	0,560	0,717	11,148	0,000
Plouffe et al. (2001)	0,600	0,495	0,688	9,011	0,000
Premkumar and Potter (1995)	0,597	0,463	0,704	7,197	0,000
Riemenschneider et al. (2003)	0,505	0,378	0,613	6,877	0,000
Ramamurthy et al. (2008)	0,499	0,394	0,591	8,198	0,000
Lee and Larsen (2009)	0,471	0,366	0,564	7,857	0,000
Tung and Rieck (2005)	0,430	0,277	0,562	5,142	0,000
Burgers et al. (2010)	0,420	0,221	0,586	3,931	0,000
Kim and Garrison (2010)	0,400	0,297	0,495	7,031	0,000
Karimi et al. (2009)	0,380	0,233	0,510	4,817	0,000
Wang and Cheung (2004)	0,370	0,216	0,506	4,496	0,000
Beatty et al. (2001)	0,368	0,172	0,536	3,555	0,000
Lee and Runge (2001)	0,300	0,072	0,499	2,556	0,011
Thong (1999)	0,299	0,154	0,432	3,938	0,000
Yusoff et al. (2011)	0,299	0,133	0,449	3,462	0,001
Pan and Jang (2008)	0,294	0,103	0,464	2,968	0,003
Mirchandani and Motwani (2001)	0,292	0,057	0,496	2,419	0,016
Di Benetto et al. (2003)	0,290	0,209	0,368	6,706	0,000
Li et al. (2011)	0,283	0,145	0,409	3,955	0,000
Ghobakhloo et al. (2011)	0,275	0,152	0,389	4,299	0,000
Chwelos et al. (2001)	0,274	0,169	0,373	4,983	0,000
Kim (2010)	0,219	0,045	0,380	2,461	0,014
Yu and Tao (2009)	0,217	0,084	0,342	3,171	0,002
Lertwongsatien and Wongpinunwatana (2003)	0,204	0,100	0,303	3,820	0,000
Low et al. (2011)	0,200	0,018	0,368	2,154	0,031
Saya et al. (2010)	0,170	-0,026	0,354	1,703	0,089
Premkumar et al. (1997)	0,132	-0,021	0,280	1,690	0,091
Seyal and Rahman (2003)	0,110	-0,064	0,278	1,240	0,215
Basaglia et al. (2009)	0,095	0,016	0,172	2,360	0,018
Laux et al. (2012)	0,095	-0,089	0,272	1,010	0,313
Chang et al. (2008)	0,069	-0,147	0,279	0,626	0,531
Neo et al. (1994)	0,040	-0,124	0,202	0,475	0,635
Cho (2006)	0,020	-0,159	0,198	0,217	0,828
Kang (2009)	0,000	-0,094	0,094	0,000	1,000
Wang et al. (2010)	-0,062	-0,228	0,107	-0,722	0,470
Saunders and Clark (1992)	-0,120	-0,257	0,022	-1,658	0,097
Summary (Random) Fisher's Z	**0,288**	**0,217**	**0,358**	**7,981**	**0,000**
r	**0,280**	**0,214**	**0,344**	**7,981**	**0,000**

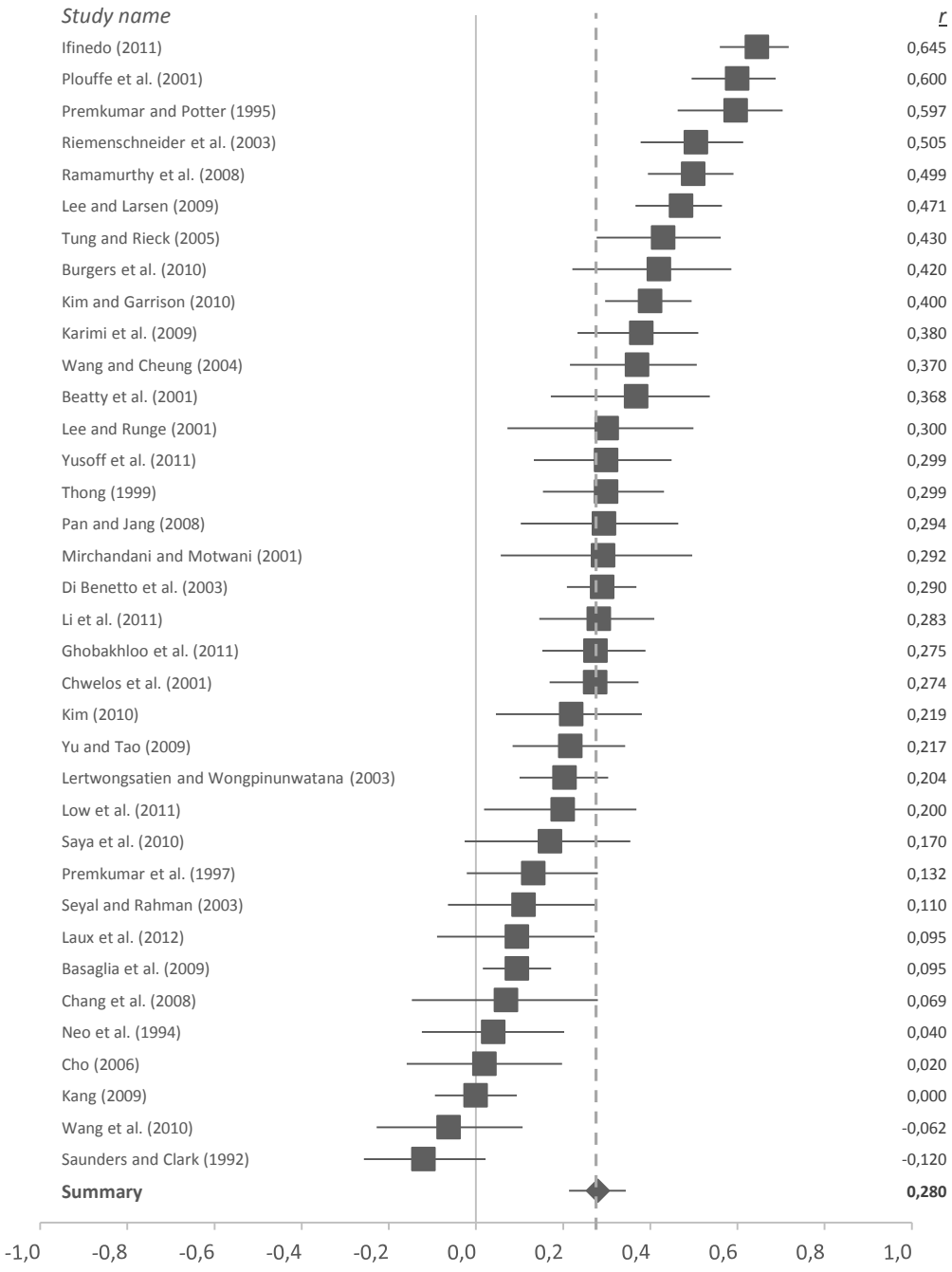

Figure F – Forest plot

In order to answer the second question related to the diversity of effect sizes, we performed a homogeneity test to investigate whether our results showed significant heterogeneity among the effect sizes. Figure F illustrates that the lower limit of the

confidence interval of some studies is above the upper limit of confidence interval of other studies. Also, some studies have confidence intervals that do not contain the overall population effect size (shown as the dotted grey line in Figure F). This suggests that the effect sizes are heterogeneous. Following Card's (2012) recommendations, we therefore statistically estimated heterogeneity using Q, τ^2 and I^2. Table D reports the results of the heterogeneity analysis. Our estimate yields Q = 290,682, which is high enough (compared to a χ^2 value of 66,619 for a 35 df and a level of significance of p=0,001) to reject the null hypothesis of homogeneity (Card, 2012). We conclude from our results that the variability in effect sizes across the 36 included studies is greater than we would expect from sampling fluctuation alone. This confirms our choice of a random-effects model to combine the effect sizes across studies. However, Q does not tell us the magnitude of the heterogeneity (Card, 2012; Huedo-Medina, Sánchez-Meca, Marín-Martínez, and Botella, 2006). We therefore computed the τ^2 index as an estimation of the population variability and the I^2 index as an alternative representation of heterogeneity. The I^2 index is derived from τ^2 and represents the percentage of between-study variability relative to the total variability among effect sizes (Card, 2012; Higgins and Thompson, 2002; Huedo-Medina et al., 2006). Following the suggestions from Huedo-Medina et al. (2006), our estimate of I^2=88% is interpreted as a large amount of heterogeneity.

Table D – Results of the Heterogeneity analysis

Heterogeneity			
Q	df (Q)	p-value	I^2
290,682	35	0,000	87,959
τ^2			
τ^2	SE	Variance	τ
0,040	0,012	0,000	0,200

As a next step, we performed moderator analyses to explain the heterogeneity among effect sizes. These analyses attempt to identify characteristics of the studies that are associated with consistent variations of effect sizes across studies. As a first step, we coded study characteristics related to 7 potential moderators. To answer our research questions, we extracted information related to the context of the studies and the measurement of the dependent variable. In addition, as explained previously, we coded

characteristics related to the quality of the studies. To do so, we calculated a quality score, which depicts whether the study reported the items used to measure the dependent variable of adoption, the items for the predictor variables, and the value of the reliability index, if applicable. Table E summarizes the coded moderators included in our analysis.

Table E – List of Coded Moderators

	Moderator	***Values***
Context	**Technology**	IOS (EDI) e-Business (e-Commerce, e-Procurement) Enterprise IS application (ERP, CRM) Other IS (web, cloud services, RFID, VoIP, etc.)
	Industry sector	Manufacturing Retailing Logistics Services Various Not specified
	Firm size	Large firms Small and medium firms Both Not specified
Adoption dependent variable	**Scale**	Continuous Categorical Not specified
	Adoption proxy	Actual Intention Not specified
	Adoption dimension	Timing Occurrence Extent of adoption Not specified
Quality assessment	**Score**	0 (no information) 1 2 3 (detailed information)

To test for moderating effects, we performed subgroup comparisons by grouping studies according to the categorical moderators. We removed from the analysis those studies that did not provide information about the moderator (coded as "not specified") as well as those studies pertaining to multiple categories (e.g., studies covering various

industry sectors). There are two steps when conducting subgroups analyses: computing the mean effect size within each subgroup and comparing the summary effects across subgroups (Borenstein and Higgins, 2013). Here again, we selected a random-effects model to compute the summary effects within each subgroup. Further, to compare these summary effect sizes, we needed to select either a fixed-effects model or a random-effects model. "When we are working between subgroups, [the fixed-effects] model is appropriate when our interest is limited to the subgroups at hand" (Borenstein and Higgins, 2013, p. 140). For instance, when analyzing the scale of the dependent variable, our question of interest was, "Is the effect size different for continuous measures versus categorical measures?"; and asking the same question would always require the same two groups. Therefore, for such moderators (i.e., Scale and Proxy), we used a mixed-effects model, that is, the use of a random-effects model for within subgroup computation, and a fixed-effects model to compare the summary effects across groups. On the contrary, for all other moderators, we used a fully random-effects model, that is, the use of a random-effects model for both within subgroup computation and between subgroups comparison. The random-effects model "is appropriate when the subgroups are sampled from a population of subgroups" (Borenstein and Higgins, 2013, p.140). For instance, when analyzing the type of technology, our question of interest was, "Does the effect size vary from a particular technology to another?"; and another researcher asking the same question might define different types of technology based on the data available. This introduces a source of sampling error that has to be taken into account in the model. Lastly, we needed to specify our assumption about the random-effects variance: either all groups share the same variance component or each group has its own variance component. In the following analyses, we used a pooled estimate of variance because there was a relatively small number of studies within the subgroups; and therefore, the estimates of τ^2 within the subgroups were likely to be imprecise. As stated by Borenstein et al. (2009), "the increased accuracy that we get by pooling more studies is likely to exceed any real differences between groups in the true value of τ^2" (p. 163). Tables F, G, H and I present the results of the subgroup analyses for the moderators related to the context, the dependent variable of adoption and the quality assessment, respectively. The key question when evaluating moderators is to determine whether there is greater-than-expectable between-group heterogeneity or

not (Card, 2012). Therefore, we computed for each moderator the between-group heterogeneity ($Q_{between}$) and tested its statistical significance to conclude whether the groups based on the categorical moderator differed in their effect sizes.

Table F – Results of the Moderator Analyses (context)

	k	r	Z	SE	p-value	I^2
Technology						
IOS	6	0,127	0,128	0,077	0,098	82,99
e-Business	10	0,322	0,334	0,060	0,000	84,38
Enterprise IS	4	0,452	0,487	0,095	0,000	68,57
Random effects	**$Q_{between}$**	**df (Q)**	**p-value**	**I^2 (overall)**		
	9,147	2	0,010	87,29		
Industry sector						
Manufacturing	5	0,187	0,189	0,112	0,092	81,30
Retailing	5	0,336	0,349	0,113	0,002	93,76
Logistics	2	0,102	0,103	0,180	0,568	0,00
Services	3	0,156	0,157	0,144	0,274	87,04
Random effects	**$Q_{between}$**	**df (Q)**	**p-value**	**I^2 (overall)**		
	1,997	3	0,573	88,94		
Firm size						
Large firms	2	0,176	0,178	0,125	0,156	0,00
SMEs	12	0,341	0,356	0,052	0,000	83,71
Random effects	**$Q_{between}$**	**df (Q)**	**p-value**	**I^2 (overall)**		
	1,725	1	0,189	83,27		

The results in Table F show that the type of technology moderates the association between "Perceived Benefits" and "Adoption" (p<0,050). Table F also shows that the I^2 index for the subgroup "Enterprise IS" (I^2=69%) is smaller than the I^2 of the other groups as well as the overall I^2. However, because this moderator is not dichotomous, its interpretation is not straightforward. Here, the significant between-group heterogeneity indicates that at least two groups differ from each other, but it is unclear where those differences lie. We thus followed the procedures suggested by Card (2012) for the post-hoc analyses associated with a categorical moderator. Table G shows that the studies in the "IOS" subgroup have significantly different effects from the "e-Business" and the "Enterprise IS" groups (p<0,050). Being more conservative and using the Bonferroni-adjusted level of significance, our results show that only the between-group heterogeneity for "IOS" and "Enterprise IS" is significant (p<0,017). This indicates that the IOS studies yield lower effect sizes than studies based on other types of

technology. This suggests that the impact of "Perceived Benefits" on "IT Adoption" is smaller in the context of IOS.

Table G– Results of the follow-up analyses to the "Technology" moderator

	$Q_{between}$	df (Q)	p-value
e-Business vs. Enterprise IS	1,879	1	0,170
e-business vs. IOS	4,204	1	0,040
Enterprise IS vs. IOS	9,478	1	0,002

Table H indicates that none of the dimensions of the measurement of the dependent variable moderates the relationship between the two variables (p<0,050). However, the I^2 index for the subgroup "Timing" (I^2=58%) is much smaller than the I^2 of the other groups as well as the overall I^2 for this moderator analysis. The small number of studies in the "Timing" and "Extent" groups decreases the statistical power for comparing subgroups. Indeed, "power is adversely affected by the small number of studies often used in meta-analysis" (Shadish and Sweeney, 1991, p. 889). Therefore, the tests conducted might not have detected the effects even if they were present (Borenstein and Higgins, 2013; Hedges and Pigott, 2004). This also applies to the moderator analyses regarding "Industry sector" and "Firm size". This difficulty can be solved when a higher number of primary studies which include these moderators are conducted.

Table H – Results of the Moderator Analyses (adoption dependent variable)

	K	r	Z	SE	p-value	I^2
Scale						
Continuous	20	0,293	0,302	0,047	0,000	89,59
Categorical	16	0,248	0,253	0,053	0,000	83,09
Mixed-effects	$Q_{between}$	df (Q)	p-value	I^2 (overall)		
	0,458	1	0,498	87,35		
Proxy						
Actual	22	0,266	0,273	0,017	0,000	87,28
Intention	13	0,239	0,244	0,019	0,000	88,62
Mixed effects	$Q_{between}$	df (Q)	p-value	I^2 (overall)		
	0,101	1	0,751	87,49		
Dimension						
Timing	5	0,202	0,205	0,038	0,000	57,50
Occurrence	24	0,237	0,242	0,014	0,000	88,23
Extent	6	0,410	0,436	0,036	0,000	87,46
Random effects	$Q_{between}$	df (Q)	p-value	I^2 (overall)		
	2,685	2	0,261	87,49		

As mentioned previously, we also tested for the moderating effect of study quality. To do so, we calculated a quality score, ranging from 0 to 3, which counts how many of the three following elements were reported: the items used to measure the dependent variable of adoption, the items for the predictor variables, and the value of the reliability index. Table I indicates that the I^2 index for the subgroup "1" (I^2=74%) is slightly lower than the I^2 of the other groups as well as the overall I^2 for this moderator analysis. However, our results did not find a significant between-group heterogeneity, indicating that the methodological quality of the primary studies does not influence the results of the studies.

Table I – Results of the Moderator Analyses (quality assessment)

	k	r	Z	SE	p-value	I^2
Score						
0	0					
1	8	0,209	0,212	0,077	0,006	73,55
2	8	0,225	0,229	0,076	0,003	85,97
3	20	0,328	0,340	0,048	0,000	89,95
Random effects	**$Q_{between}$**	**df (Q)**	**p-value**	**I^2 (overall)**		
	2,775	2	0,250	87,96		

As a final step, we performed a series of analyses to test for the impact of publication bias. First, we constructed a funnel plot Sample size by Effect size for the 36 studies included in our database, represented in Figure G. Funnel plots represent a graphic way to evaluate publication bias (Card, 2012). The rationale is that studies with insignificant results (i.e., studies with a low effect size and a small sample size, represented by the dots in the lower left part of the diagram) are less likely to be published. Therefore, the presence of publication bias will appear on the diagram as an asymmetry, meaning the majority of the dots will be on the right part of the diagram. As shown in Figure G, there is no noticeable asymmetry about the summary effect size, revealing the absence of publication bias.

The Trim and Fill method is another recommended approach to assess publication bias in a meta-analysis. Using such method, we calculated an effect size that is corrected for publication bias and compared this adjusted effect size to our results. If the two values are identical, one can assume the absence of publication bias. We used Duval and Tweedie's method incorporated in Comprehensive Meta-Analysis (CMA). Table J

reports the results of the Trim and Fill method. The method attempts to look for and impute missing studies in the analysis in order to compute a summary effect size that is unbiased and more accurate. Using a random-effects model to look for missing studies, the method suggests that no studies are missing. Therefore, we can conclude that the original results are robust in relation to publication bias (Borenstein et al., 2009; Card, 2012).

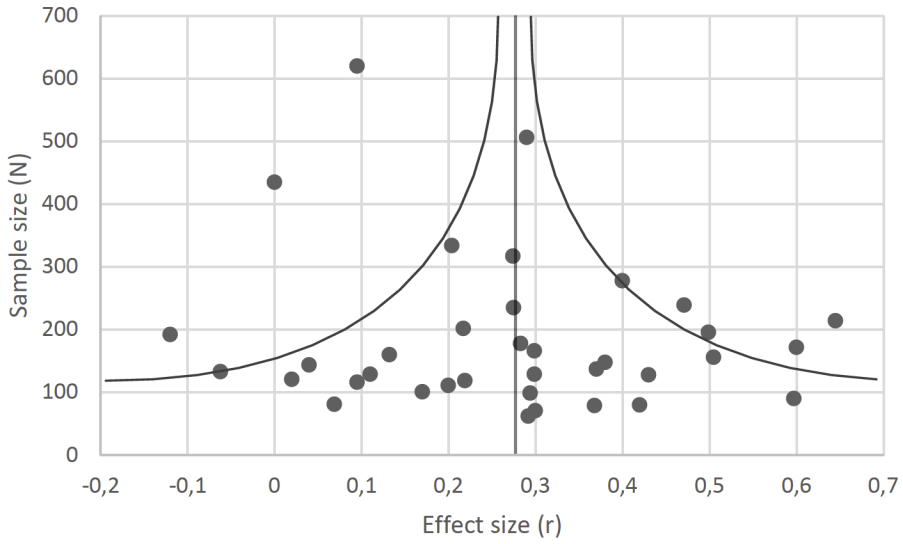

Figure G – Funnel plot

Failsafe N analyses (i.e., Rosenthal's failsafe N and Orwin's test) that help meta-analysts to evaluate the robustness of their findings about the existence of excluded studies are widely used methods to evaluate the risk of publication bias (Aguinis, Pierce, Bosco, Dalton, and Dalton, 2011). However, they are not recommended when heterogeneity among studies requires the use of random-effects models (Card, 2012) and were therefore discarded from our analysis.

Table J – Results of the Moderator Analyses (quality assessment)

	Studies trimmed	Effect size estimate	Lower limit	Upper limit	Q value
Observed values		0,280	0,214	0,344	290,68
Adjusted values	0	0,280	0,214	0,344	290,68

4.4 Discussion and concluding remarks

This essay, which takes the form of a tutorial, makes a contribution to our collective understanding and application of the meta-analysis method in the IS domain. Following the recommendations by King and He (2005), our framework builds upon commonly-accepted methodological guidelines and considers IS and other management domains specificities when conducting meta-analyses. Our overarching objective was to develop and illustrate a step-by-step methodology to conduct rigorous IS meta-analyses. In particular, we focused on important challenges meta-analysts face and sources of potential bias that occur when 1) methodological assumptions are erroneous or overlooked, 2) publication bias is not investigated or mishandled, or 3) study heterogeneity is ignored or incorrectly managed (Paré et al., in press). We hope our work will be useful to researchers within and outside our field as well as journal reviewers and editors. We also believe our work could serve important educational purposes and, hence, be introduced to doctoral students in Research Methods seminars. In the following paragraphs, we discuss a series of recommendations to meta-analysts as well as authors of primary studies. We then succinctly present the advantages and merits of meta-analytic reviews for building a cumulative tradition in our field (Keen, 1980).

First, major flaws might arise when assumptions about the population of studies being considered are wrong. As with other statistical methods, meta-analytic procedures are based on assumptions about the population from which the observations are taken (Borenstein et al., 2009; King and He, 2005). Such assumptions lead to the choice of a meta-analytic model. Fixed-effects and random-effects models represent two different approaches to analyzing and understanding data. As mentioned previously, whereas the fixed-effects model assumes that the true effect size is the same for all studies comprised in the analysis, the random-effects model assumes variations among effect sizes across the population of studies (King and He, 2005; Borenstein et al., 2009). The use of one model over the other has been shown to produce different findings and suggest different conclusions regarding the phenomena of interest (Kisamore and Brannick, 2007). In our field, there usually exist many variations between the studies in terms of design, methods and population of interest. Therefore, IS researchers should preferentially select the random-effects model. Cases in which the fixed-effects model is applicable are very rare in the IS domain, not to say non-existent. Hence, results from prior IS meta-analyses not specifying the statistical model or using a fixed-effects model (e.g., Alavi and

Joachimsthaler, 1992; Ma and Liu, 2004; Shepers and Wetzels, 2007) should be interpreted with caution.

Second, publication bias is particularly harmful for meta-analyses. As mentioned previously, publication bias, also known as the file-drawer problem, refers to the issue that significant and supporting results are more likely to be published than non-supporting or non-significant findings (King and He, 2005). Thus, the bulk of research that appears in scientific journals and that is considered for meta-analysis is not representative of the population of completed studies (Aguinis et al., 2011). Meta-analysts should take into consideration the potential threats of publication bias toward the validity and generalizability of their results. Besides enlarging their search strategies to less popular sources, such as scanning unpublished literature, locating doctoral theses or contacting experts working in the same topic area, authors of meta-analyses should also assess the potential for publication bias using recommended statistical tools. Aguinis et al. (2001) stress that "numerous organizational science meta-analysts have assumed that using a failsafe N to determine whether their results were affected by publication bias is sufficient to minimize publication bias" (p. 314). However, several limitations have been exposed in failsafe N analyses (Card, 2012; Aguinis et al., 2001). Among these, a criticism that has a strong resonance in the IS field is the failure of failsafe N to model heterogeneity among obtained results (Card, 2012). Moreover, Card (2012) "recommend[s] against using failsafe N when heterogeneity necessitates the use of random-effects models" (p. 271), which is the case most of the time in our field. In terms of best meta-analytic practices, Aguinis et al. (2011) recommend that meta-analysts use instead the Trim and Fill method to assess potential publication bias. Further, when performing our meta-analysis on IT adoption, we noticed a substantial variability in the reporting of the results and findings of primary studies. In particular, intermediate results (e.g., correlation matrices in the case of Structural Equation Modeling studies) and part of results that were not significant were often not reported. Therefore, we strongly recommend that authors of primary studies document thoroughly their results and report the appropriate statistics, including sample sizes, correlation matrix, group means and standard deviations, and reliability coefficients. We recognize that space limitation is often a constraint. Hence, we also encourage journal publishers and editors to provide opportunities for authors to publish additional materials, for instance in the form of online supplementary appendices. For their part, meta-analysts should contact the authors of primary studies for missing and needed information (King and He, 2005).

Third, a common criticism of meta-analyses is that they may aggregate results from studies with diverse research goals, measures and procedures (King and He, 2005). This issue is also known has the "oranges and apples" problem, which occurs when "attempting to summarize or integrate over studies that do not really deal with the same constructs and relationships" (Lipsey and Wilson, 2001, p.2). On the one hand, combining results from a diverse range of studies in a meta-analysis has been suggested to yield meaningless results (Card, 2012). This kind of issue is particularly sensitive in the IS field, where studies are rarely pure replications of one another. On the other hand, combining a diversity of studies may also yield some benefits. For instance, Rosenthal and DiMatteo (2001) suggest that the inclusion of studies with diverse methodologies, measures and samples might in fact improve the generalizability of the results of a meta-analysis. When generalizability of findings is important,, we concur that combining studies undertaken in a diversity of contexts may indeed be beneficial. However, prospective authors of IS meta-analyses should remain sensitive to this issue and must be able to justify that the selected studies examine the same relationship and whether attempting aggregation of these studies is meaningful. As mentioned by King and He (2005), this problem certainly exists for all review methods, be they qualitative or quantitative in nature, and researchers should always question themselves about the comparability of their data. For that reason, we developed and applied a structured procedure we called "conceptual cleaning". In our opinion, this procedure is one of the most critical ones in the conduct of an IS meta-analysis. Future IS meta-analyses should take into consideration the impact of aggregating a diversity of studies toward not only the internal validity but also the generalizability of their results, that is a form of "trade-offs made between reality and control" (Mason, 1988, p. 3). This conceptual validation involves a cross-comparison of the conceptual and operational definitions of the variables under investigation. However, as for the test results and indices, we noticed in our own meta-analysis that many primary studies did not report either the conceptual definition of the variables or the items used to measure the constructs. The latter is more detrimental for the conduct of a meta-analysis since meta-analysts are interested in how the results are obtained. We therefore recommend authors of primary studies to report the items, scales, and measurement procedures in detail. Further, we observed quite a diverse set of measurement instruments used in primary studies. Whereas the measures referred overall to a similar construct, in many cases, the number of items and their wording were very different. For instance, several measures of "Perceived Benefits" include a list of benefits, each measured by one item. In that case, the sets of items were sometimes different;

and therefore, they measured only some dimensions of the overall construct. Authors of organizational studies have long advocated the use of existing measures for reliability purposes as well as to facilitate comparison and accumulation of findings (Boudreau, Gefen, and Straub, 2001; Churchill, 1979; Kollat, Engel, and Blackwell, 1970). Changes are sometimes needed to adapt scales to new contexts. In this case, modifications should remain parsimonious and the sources of the original items should be reported. We thus reiterate the recommendation to use previously validated instruments wherever possible. As Churchill (1979) wrote in his seminal article: "Researchers should have good reasons for proposing additional *new* measures given the many available for most marketing constructs of interest, and those publishing should be required to supply their rationale" (p. 67). We believe that the same could be said about our field.

To conclude, it is our contention that meta-analyses have the potential not only to rigorously synthesize a body of literature but also to support research and theoretical progress (Chan and Arvey, 2012). For one thing, a meta-analysis offers powerful procedures to gather evidence and test existing theories. Criticisms have recently been formulated about "overvaluating novelty to the detriment of accumulating convergent findings" (Rousseau et al., 2008, p. 476). Similarly, Edwards (2010) suggests a shift in our definition of theoretical progress toward theoretical refinement and simplicity. He says that "in the interest of theory development, management and organizational research would make better progress if we devoted more attention to theoretical refinement, conducting research that identifies the boundaries and limitations of theories, stages competitive tests between rival theories, and increases the precision of theories so they yield strong predictions that can be falsified" (Edwards, 2010, p. 615). To do so, Leavitt, Mitchell and Peterson (2010) proposed a taxonomy of "theoretical pruning" strategies that are ways to bound and reduce the theoretical landscape of a field. Among these, meta-analytic designs represent important tools for summarizing existing evidence. Yet, meta-analyses also have the potential to explore new avenues as well as generate new ideas and hypotheses, especially with the assessment of the diversity between studies (that is a substantial characteristic of our field) and the analysis of potential moderators. In fact, meta-analytic approaches "can go beyond just replication and confirmation by looking at moderators generated by different theoretical perspectives or, as in a few cases, actually testing the effect sizes for different theories" (Leavitt et al., 2010, p. 656). As mentioned above, theoretical development is highly regarded in our field. In fact, theorizing is at the heart of research efforts

in IS and other management domains (Burton-Jones, McLean, and Monod, 2014; Edwards, 2010). Hence, we posit that meta-analytic efforts in our field should be bound to theory. Authors of meta-analytic reviews should keep in mind the theoretical meaning and significance associated with the numerous statistics they generate. As stressed by Leavitt et al. (2010), the interplay and contingencies between method and theory can lead to improvement in both. Therefore, meta-analysts should naturally pursue both methodological rigor and theoretical relevance. For their part, research communities should reward their efforts and provide career incentives similar to those recognized for new theoretical developments (Eden, 2002). As a field, we should see the meta-analytic method as theoretically valuable and not only "a sophisticated way of summarizing what we already know" (Leavitt et al., 2010, p. 647). Future research could investigate the traits of the meta-analytic method that are valuable for theorizing efforts.

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4.6 Appendix A – Journals included in the Web of Knowledge search

Computers in Human Behavior
Data Base for Advances in Information Systems
Decision Sciences
Decision Support Systems
European Journal of Information Systems
Health Affairs
Health Care Management Review
IEEE Transactions On Engineering Management
Industrial Management & Data Systems
Industrial Marketing Management
Information & Management
Information Economics and Policy
Information Systems Frontiers
Information Systems Journal
Information Systems Management
Information Systems Research
International Journal of Electronic Commerce
International Journal of Information Management
International Journal of Production Economics
Journal of Business Research
Journal of Computer Information Systems
Journal of Management Information Systems
Journal of Organizational Computing And Electronic Commerce
Journal of Strategic Information Systems
Journal of the Association for Information Systems
Management Science
MIS Quarterly

4.7 Appendix B – Email sent to authors to ask for missing data

Dear Prof. *Names*,

I am currently conducting a meta-analysis on organizational adoption of IT with one of my doctoral students, Mathieu Templier. We would very much like to include the below mentioned article in our review:

Reference

However, the current format of the data provided in your article does not allow us to consider it in our own analyses. We were wondering if you could please send us one of the following groups of statistics:

1.a) All correlations between the following independent variables and the dependent variable of adoption
- *Perceived relative advantage*
- *Perceived compatibility*
- *Perceived complexity*

1.b) The reliability coefficients of the following constructs
- *Perceived relative advantage*
- *Perceived compatibility*

1.c) The size of your sample

1.d) The list of items used to measure the following constructs
- *Perceived complexity*
- *Cost*
- *Top management attitude*

OR

2.a) The means and standard deviations of the following independent variables for each of the following groups: *adopters, non-adopters, etc.*

2.b) The reliability coefficients of the following constructs

2.c) The size of each of the following groups: *adopters, non-adopters, etc.*

2.d) The items used to measure the following constructs

We understand that this paper was published several years ago and it might be difficult for you to retrieve your raw data. However, if at all possible, we would be very pleased to include it in our meta-analysis.

Warm regards,

4.8 Appendix C – Data extraction form

Data extraction form

Article #: _____ **Author:** _____ **Journal:** _____ **Year:** _____

Dep. Var. #: _____ **Rater :** _____ **Date:** _____

DEPENDENT VARIABLE

Type of dependent variable?
categorical vs. continuous?
1. Actual adoption cat. / cont.
2. Likelihood of adoption cat. / cont.
3. Other: _____
Name: _____

Conceptual definition : _____

Operational definition : _____

STUDY DESIGN

Nature of theory?
1. Analyzing
2. Explaining
3. Predicting
4. Explaining and predicting
5. Design and action

Object of inquiry
1. Relationships between variables
2. Comparison across groups
3. Other: _____

Methods
Experiment vs. survey? Exp / Surv
Demographics: _____

Sample size provided? Y / N
If yes, n= _____
If t-test or ANOVA, n1=_____ n2=_____

CONTEXT

Class of technology
Knowledge burden? High / Low / n-s
User interdependencies? High / Low / n-s
Locus of implementation? Intra / Inter / n-s
Details: _____
Context of adoption
Industry type: _____

GENERAL COMMENTS

PREDICTORS

Type of independent variables? [circle all that apply]
1. Innovation characteristics
2. Organization characteristics
3. Environment characteristics
4. Individual characteristics

List of predictors	**Effect size?** Corr.	Value	Pages
1. _____	_____ =	_____	(____)
2. _____	_____ =	_____	(____)
3. _____	_____ =	_____	(____)
4. _____	_____ =	_____	(____)
5. _____	_____ =	_____	(____)
6. _____	_____ =	_____	(____)
7. _____	_____ =	_____	(____)
8. _____	_____ =	_____	(____)
9. _____	_____ =	_____	(____)
10. _____	_____ =	_____	(____)
11. _____	_____ =	_____	(____)
12. _____	_____ =	_____	(____)

STASTISTICS

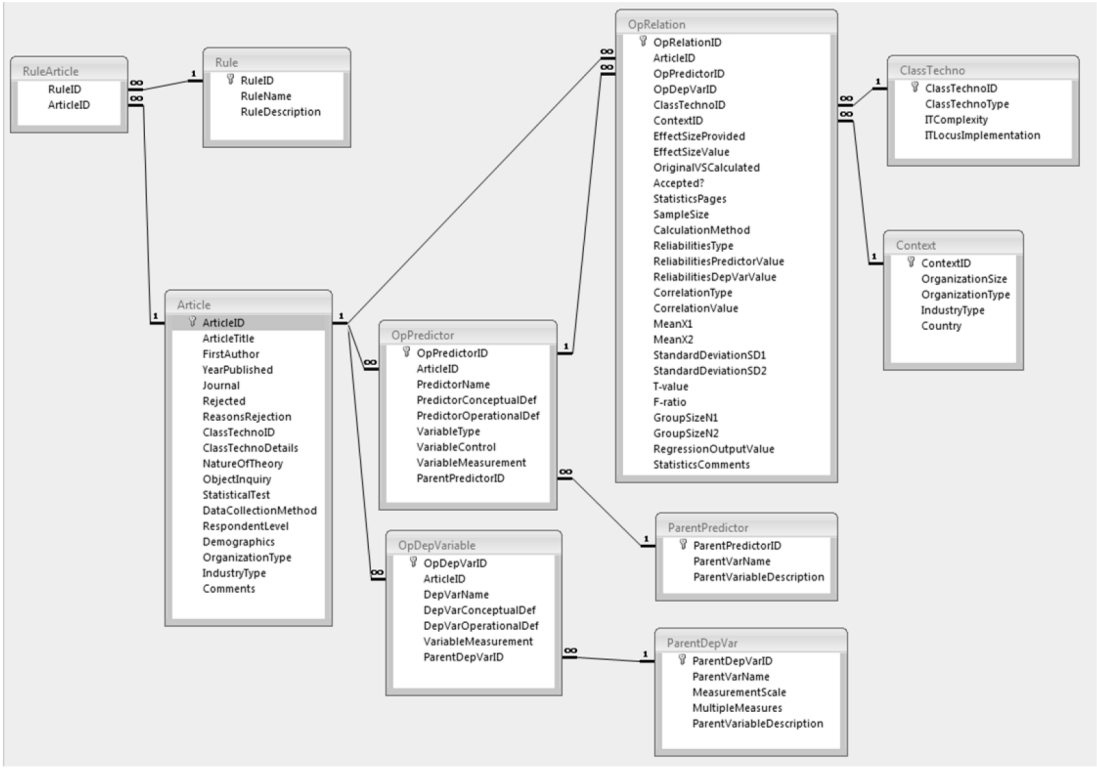
Statistical test used: _____

Statistics provided?
Correlations provided? Y / N
If no,
1. Standardized mean difference
   a. means (X1, X2) and standard deviations (s-pooled)
   b. t-value and group sizes (n1, n2) *[independent t-test]*
   c. F-ratio and group sizes (n1, n2) *[one-way ANOVA]*
2. Regression output
   a. R or β *[one independent variable]*
   b. R or β *[first variable in Multiple hierarchical regression]*
3. Odds-ratios
4. No direct calculation formula

Other statistics provided: _____

Construct reliabilities provided? Y / N

4.9 Appendix D – Structure of the Microsoft Access database



4.10 Appendix E – Example of variables removed during the "conceptual cleaning" process

Article #	Variable Name	Definition
65	Attitude	"The attitude a person has toward performing the behavior (AB: positive or negative evaluation of B)" (p.176) "Your firm using ____ within the next 6 months would be ... GOOD/BAD HARMFUL/HELPFUL POSITIVE/NEGATIVE EFFECTIVE/INEFFECTIVE FOOLISH/WISE" (p.192)
126	Perceived usefulness	"The extent to which a technological innovation is expected to improve the potential adopter's performance" (p.210) "(1) Using the Exact card system enables me and my staff to process payments more quickly. […] (2) Using the Exact card system improves the job performance of me and my staff. […] (3) Using the Exact card system increases the productivity of me and my staff. […] (4) Using the Exact card system enhances the on-the-job effectiveness of me and my staff. […] (5) Using the Exact card system makes it easier for me and my staff to do our jobs. […] (6) My staff and I find the Exact card system useful to us in our jobs. […]" (p.219)
141	Attitude	"Attitude is assumed to be determined by a sum of cross-products of behavioral beliefs (bb) and evaluations (ev) about the expected positive of negative consequences […]" (p.270) "Effective/ineffective. Good/bad. Foolish/wise. Positive/negative. Harmful/helpful" (p.277)
201	Ability to offer new services to users	"Attention toward users refers to organizational ability to satisfy their technological needs and to perceive their emergent behaviors." (p.109) " […] The extent to which VoIP offers new and useful services to users (Serv) […]" (p.111)
226	Attitude toward adoption	"The operational definition of attitude used in this study is the adopter's feelings about adoption of the new technology from a foreign company. […] The scale gathers opinions on whether adoption of the foreign technology is a good practice; whether it is appropriate to adopt the technology into existing production facilities; whether the adoption of the technology would be beneficial to the firm; and whether the respondent would feel good about the adoption decision." (p.454-455)
237	Recognition of learning option	"Recognition of the opportunities to learn and get a better understanding of RFID from its current adoption" (p.10) "RFID adoption – (1) allows us to gain important knowledge related to the technology; (2) enables us to accumulate valuable know-how for future use; (3) keeps us abreast with the latest developments in RFID" (p.10)
291	Enhancement of products and services	"Enhancement of products and services: - Improve product functions - Improve the applications and services of the products - Ensure that the products are certified to meet quality standards - Develop potential new products" (p.98)
320	Benefit of system integration	"The extent that integration is perceived to be economically advantageous" (p.372) "Benefit of system integration." (p.374) "(1) In general integration between firms: (1 = Is not a benefit of ERP adoption; 7 = Is a benefit of ERP adoption)" (p.386)

Article #	Variable Name	Definition
348	Manager's attitude	"Att-1. Soon business will be conducted by using EC Att-2. Use of EC enhances standard of living Att-3. Life will be easier and faster Att-4. EC as fast and efficient way of getting information" (p. 25)
418	Information security	"The IBIS is secure." (p.421)
423	Ubiquity	"Ubiquity refers to an organization's perception regarding the extent to which the RFID provides personalized and uninterrupted connection and communication throughout the organization." (p.392) "U1: RFID provides our organization "anytime-and-anywhere" communication and connectivity U2: RFID providing communication and information accessibility "anytime-and-anywhere" is highly critical for our organization U3: Business activities in regards to our organization require personalized and uninterrupted connection and communication" (p.395)
435	Perceived lack of security	"Security refers to a system's ability to prevent unauthorized access or modification to information in storage, processing, or transit" (p.4) "Perceived Lack of Security (reflective) - unsafe to… SE1: store critical data; SE2: perform monetary transactions; SE3: download data/software" (p.7)
442	Business benefit driver	"Lawler et al. (2005) referred to business benefit driver as the "extent to which anticipated benefits to the business of the firm drive the Web Services project" (p. 6)." (p.10) "(BBD1) The effort of solving the lack of integration in systems will encourage the adoption of WS in my company. (BBD2) The effort of solving the high complexity in legacy systems infrastructure will encourage the adoption of WS in my company. (BBD3) The innovative business process of introducing WS is expected to improve the performance of job tasks in my company. (BBD4) The introduction of WS associated with SOA is expected to improve the overall efficiencies and effectiveness of business operation processes." (p.101)

4.11 Appendix F – "Perceived benefits" variables included in our analysis

Article #	Variable Name	Definition
Variables directly taken from studies (28 studies)		
12	Perceived benefits	"Perceived benefits include reduced transaction costs, improved cash flow, increased productivity, and better customer service" (p.339) "Adoption of web site technology will (1) reduce my company's cost of performing business transactions; (2) improve my company's cash flow; (3) improve my company's level of overall productivity; (4) enable my company to provide better customer service; (5) increase my company's ability to compete; (6) allow my company to reach new customers; (7) improve our relationships with our existing customers; (8) improve my company's level of operational efficiency" (p.352)
32	Perceived benefits	"[…] measures were adapted from Jones and Beatty (1998). Perceived benefits relate to the direct and indirect benefits of Internet-based EDI through a third-party B2B portal. Moreover, an additional item related to the improvement of internal operations, which is a key concern to most manufacturers, is added to the construct of perceived benefits" (p.24) "Improves internal Operations. Improves internal control. Improves trading partner relationships. Increases our ability to compete" (p.26)
35	Perceived benefits	"Perceived benefits refer to the anticipated advantages that EDI can provide the organization. Benefits are both direct and indirect in nature. Direct benefits include operational cost saving and other internal efficiencies […]. Indirect benefits are opportunities that emerge from the use if EDI, such as improved customer service and the potential process reengineering." (p.307) "Importance of achieving various benefits of EDI in terms of the organization's decision to adopt" (p.319)
107	Relative advantage	"The CEO's perception of relative advantage expected from the IS" (p.71) "Relative Advantage: (1) Use of Electronic Commerce enables company employees to accomplish tasks more quickly. (2) Use of Electronic Commerce improves the quality of work of company employees. (3) Use of Electronic Commerce makes it easier for company employees to do their jobs. (4) Use of Electronic Commerce enhances the effectiveness on the job of company employees. (5) Use of Electronic Commerce gives company employees greater control over their work. (6) Use of Electronic Commerce improves information processing in the company. (7) Use of Electronic Commerce improves planning and control in the company. (8) Use of Electronic Commerce improves work life by eliminating boring tasks" (provided by the authors after request)
116	Relative advantage	"Degree to which an innovation is perceived as being better than the idea it supersedes" (p.163) "The extent to which TradeNet reduces paperwork costs and supports business objectives of the firm" (p.163)
126	Relative advantage	"Relative advantage represents the degree to which an innovation is perceived to be superior to current offerings" (p.210) "(1) Using the Exact card system improves the quality of the sales transaction my staff and I conduct in our business. […] (2) Using the Exact card system gives me and my staff greater control over our business' sales transactions. […]" (p.220)
127	Relative advantage	"Relative Advantage is the degree to which the innovation is perceived to be superior to the idea or artifact it supersedes" (p.109) "Relative advantage was measured by five items that assessed the respondents' perception of benefits from CASE technology based on well published lists of benefits" (p.112)

Article #	Variable Name	Definition
128	Relative advantage	"Relative advantage is the degree to which an innovation is perceived as being better than the product/process it supersedes" (p.112) "The innovation attributes of complexity, compatibility, cost, and relative advantage were measured using items that were adapted from earlier studies on innovation adoption (Moore and Benbasat, 1991; Grover, 1993) and modified to suit the EDI context (Premkumar et al, 1994)" (p.113)
141	Perceived usefulness	"Perceived usefulness is defined as the degree to which someone believes that adopting a particular technology will have a performance benefit" (p.271) “Accomplish tasks more quickly. Improve job performance of employees. Improve quality of work. Make it easier for employees to do jobs. Allow firm to accomplish more work. Support critical aspects of employees’ jobs. Enhance firm’s effectiveness. Give form greater control over work. Increase firm’s productivity. Be useful to our firm”(p.277)
147	Perceived benefits	"[…] EDI benefits into two major categories: efficiency and process." (p.11) "Perceived benefits include: (1) efficiency benefits, such as reduced data keying, paper reduction, increased productivity, reduced error rates; and, (2) process benefits, such as reduced inventory costs, improved customer service, faster response to orders and enhanced ability to compete." (p.14-15)
166	Perceived benefits	"Perceived benefits refer to the anticipated advantages that an innovation, in this case e-Government services, can provide to the organization." (p. 422) "Perceived benefits was measured by one item (Item 1), which asked for the importance of certain benefits to the organizations’ adoption decision" (p.427)
212	Visible profit	"The degree of the organization’s understanding of profit-savings potential when introducing IT." (p.202) "(1) The company believes that adopting RFID can reduce the cost of labor force and error. (2) The company believes that adopting RFID can reduce the complexity of operational procedure. (3) The company believes that adopting RFID can promote SCM." (p.208)
266	Response efficacy	“The belief that the adaptive response will work in averting an undesirable threat” (p.179) “(1) Installing antimalware software will successfully prevent malware attacks. (2) Antimalware software is the best solution for counteracting problems caused by malware. (3) If we install antimalware software on our computers, we can minimize the threat of malware.” (p.187)
269	Perceived benefits	"Perceived benefits refer to the extent of management recognition of the relative advantage that e-commerce can provide to the firms." (p.74) “Perceived compatibility is assessed by a three items scale; […]. These two scales were developed based on prior studies scales (Thong, 1999).” (p.78)
291	Production and operations improvement	"Production and operations improvement: - Improve the efficiency and flexibility of the production process - Assist in reducing costs and in automating production - Handle the key components of the product - Enhance the capabilities of system planning and integration" (p.98)
293	DW's relative advantage	"[…] the degree to which an innovation is perceived to be better than the one it replaces" (p.823) “Relative advantage was measured by six indicators capturing benefits such as effective decision support; improved on-line analytical processing; availability of high quality/accurate/secure data; high payback; low cost access; and data mining/improved customer service” (p.826)

Article #	Variable Name	Definition
316	Relative advantage	“Relative advantage is the degree to which an innovation is perceived as better than its precursor” (p.195) “IS characteristics were measured by items taken from Moore and Benbasat's (1991) instrument, which was designed to measure the various perceptions that an individual might have of adopting an IS innovation.” (p.197)
338	Perceived usefulness	“This research defines […] [Perceived usefulness] in terms of benefits obtainable by the firm using e-marketplaces” (p.97) “[Perceived usefulness] was measured using eight items. The respondents were asked to indicate their level of agreement or disagreement with the following eight potential benefits of e-marketplace adoption: (1) beneficial trading relationships with partners; (2) enhanced collaboration with partners; (3) increased competitive advantages; (4) increased diversity of trading goods; (5) increased source of buyers and sellers; (6) increased speed of trade; (7) increased opportunities to trade; and (8) decreased trading costs.” (p.98)
348	Perceived benefits	"Relative advantage is the degree to which an innovation is seen as superior to existing practice." (p.12) "ReI-I. Increase sale and enlarge market share Rel-2. Reduce cost Rel-3. Develop new business Rel-4. Establish strong relationship with client business partner" (p. 25)
349	Perceived advantage of e-commerce	"The degree to which an innovation is perceived as better than the idea it supersedes" (p.47) ”(1) Reduce operation costs (2) A promising business model (3) Develop long-term cooperation with trading partners” (p.63)
364	Relative advantage	"Relative advantage is defined as the degree to which an innovation is perceived as providing greater organizational benefits than the idea it supersedes or the status quo" (p.807) “ RA1. My company expects RFID to help lower inventory costs. RA2. My company expects RFID to help quick data capture and analysis. RA3. My company expects RFID to help reduce paperwork.” (p.809)
382	Perceived relative advantage	“In the context of EC, perceived relative advantage can be categorized as usefulness and benefits of EC for customers of a company (Sutanonpaiboon and Pearson, 2006) or benefits of EC for the internal users of EC in a company and for the company itself (Grandon and Pearson, 2004; Pearson and Grandon, 2006).” (p.1244) “PRA1 EC provides new opportunities PRA2 EC allows us to accomplish specific tasks more quickly PRA3 EC allows us to enhance our productivity PRA4 EC allows us to save time in searching for resources PRA5 EC allows us to improve our job performance PRA6 EC allows us to purchase products and services for the business PRA7 EC allows us to learn more about our competitors PRA8 EC allows for better advertising and marketing PRA9 EC provides timely information for decision making purposes PRA10 EC enhances the company’s image PRA11 EC increases our profitability” (p.1266)
390	Relative advantage	“Rogers (1983) defined relative advantage as the degree to which a technological factor is perceived as providing greater benefit for firms” (p.1011)

Article #	Variable Name	Definition
394	Perceived benefits	"'Perceived benefits' refers to the relative advantage that IEBT can provide the adopting organization" (p.259) "-The adoption of internet/e-business technologies would help increase our revenues/profits. -The adoption of internet/e-business technologies would ultimately help increase our firm's returns on investments (ROI). -The adoption of internet/e-business technologies would help reduce our direct and indirect costs. -The adoption of internet/e-business technologies would help improve our business processes. -The adoption of internet/e-business technologies would help us to serve our customers better. -The adoption of internet/e-business technologies would help us to work better our suppliers. " (p.280)
407	Value	"Value of e-procurement adoption is defined in this study simply as benefits from its implementation over costs." (p.103) "Measures of Perceived system's benefits in this study are in term of reducing administrative costs, shortening the order fulfillment cycle time, lowering inventory levels and the price paid for goods, and preparing organizations for increased technological collaboration and planning with business partners" (p.103) "Measures of Perceived cost benefits in this study are in term of price benefits, transaction cost benefits and reducing in Technology Lock-in Costs. Price benefits comes from potential price reduction off average market price while transaction cost benefits result from savings in search, negotiation and contracting, and coordination costs. Technology lock-in costs are cost involve in choosing and using a specific procurement system, including switching costs, opportunistic behavior by contracted suppliers" (p.103)
428	Perceived relative advantage	"One commonly identified value-focused variable is perceived relative advantage, which is defined as "the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 1983, p. 15)." (p.9) "Perceived Relative Advantage (ADVANTAGE): We use three indicators to measure perceived relative advantage of ODSC to the firm: perceived potential of ODSC to help increase the company's overall revenue, perceived potential to enhance the firm's profitability, and perceived ability of ODSC to improve commercial transaction efficiency, in particular, the efficiency of the ordering process." (p.13)
442	Perceived benefits	"In this study, perceived benefit is defined as managers' perceptions within a firm regarding the overall benefits of adopting Web Services" (p.17) "(PB1) Adopting WS in my company will provide the effectiveness of system integration with the existing legacy system. (PB2) Adopting WS associated with SOA in my company will reduce operation costs. (PB3) Adopting WS in my company will improve the ability to manage organizational resources effectively. (PB4) Adopting WS in my company will lead to flexible business process implementation and architecture. (PB5) Adopting WS in my company will enable new business models through the integration of systems and connectivity with other companies. (PB6) Adopting WS associated with SOA in my company will reduce the costs and duration of future IT projects. (PB7) The adoption of WS in my company will increase our competitive advantages." (p.102)

Article #	Variable Name	Definition
456	Perceived benefits	"Mobility/portability; no cabling; Easy set-up; Cost savings; Administrative process flexibility; Competitive advantage; Easy collaboration; Time saving; Improved organization image" (p.55)
Variables combined into multidimensional variables (8 studies)		
96	Strategic advantage	"The information technology enhances the effectiveness of my business" (p.48)
	Tactical advantage	"The information technology enhances the efficiency of my business" (p.48)
	Management control	"The information technology gives the business owner greater control" (p. 48)
201	Extent of cost reductions	"Perceived internal benefit was measured as a formative construct through two different sub-constructs: the extent to which VoIP allows to reduce costs (Cost)" (p.111)
	Extent of reductions in infrastructure complexity	"The extent to which VoIP allows to reduce infrastructural complexity (Infr)" (p.111)
226	Technology benefits	"[…] three technological benefits are of prime importance: increases in product quality, improvements in productivity, and reductions in production process problems. A four item scale measuring these perceived benefits was used to operationalize the technology benefit construct." (p.453)
	Economic benefits	"Perceived economic benefit was operationalized using a five-item scale measuring long term economic benefit for the company, increased competitiveness, and increased performance." (p.453)
254	Knowledge Reach/Richness	"(1) ERP implementation has reduced error rates in our operational processes; (2) ERP implementation has significantly improved our forecasting accuracy; (3) ERP implementation has improved the flexibility of our decision-making; (4) ERP implementation has made us more adaptive to changing business environment; (5) ERP implementation has made our company more agile" (p.41)
	Process Reach/Richness	"(1) ERP implementation has given us more ways to customize our processes; (2) ERP implementation has improved our efficiency of operations; (3) ERP implementation has reduced the amount of rework needed for data-entry errors; (4) ERP implementation has improved our quality of operations; (5) ERP implementation helps us complete more transactions in less time" (p.41)
418	Accuracy	"We get accurate information through the IBIS." (p.421)
	Saves money	"The IBIS saves us money." (p.421)
	Profitability	"The IBIS increases our profitability." (p.421)
	Sales	"The IBIS increases our sales." (p.421)

Article #	Variable Name	Definition
423	Benefits	"For the purpose of this study, technological benefits are defined as the extent to which organizations believe that using RFID technology will bring operational savings and increase sales" (p.392) “B1: RFID reduces error rates in managing organization’s data B2: RFID provides information for decision make in a timely manner B3: RFID provides accurate information in decision making B4: RFID offers efficient way for managing product information B5: RFID improves company image” (p.395)
	Cost savings	"Cost Savings refers to the organizational expectations that RFID will provide cost-effective communications, information exchanges, and business operations" (p.392) “CS1: Our organization can avoid any unnecessary costs and time by using RFID CS:2 In our organization, the use of RFID saves costs related to time and effort CS:3 RFID is more cost effective than other types of technologies” (p.395)
435	Perceived scalability	“Perceived Scalability (reflective) - able to… SC1: increase or decrease resources based on requirements; SC2: handle inconsistent loads of traffic; SC3: expand or contract resource allocation” (p.7)
	Perceived cost effectiveness	“Perceived Cost Effectiveness (reflective) - CE1: is reasonably priced; CE2: offers value for money; CE3: is a good product for the price” (p.7)
	Perceived accessibility	“Perceived Accessibility (formative) - able to access cloud computing… AC1: independent of location; AC2: independent of system; AC3: cloud computing is susceptible to outages attributed to service provider (reverse coded)” (p.7)
438	Security	“Iacovou and colleagues (1995) described Perceived Benefits as an organization's level of recognition of the relative advantage that the new technology will give it.” (p.230) “Please rate the importance of achieving each of the following benefits of biometrics in terms of your organization's decision to adopt biometrics. (Not at all Important = 1 to Extremely Important = 7) 1. Improved Accuracy of Authentication 2. Reduced Operating Costs 3. Increase in Member Account Security 4. Decrease in Member Transaction Time 5. Member Ease of Use” (p.244)
	Usability	

4.12 Appendix G – Effect sizes computation for the "Perceived Benefits" studies

Study name	Data format	N	r	SE
Beatty et al. (2001)	means, SD's	79	0,368	0,094
Cho (2006)	Corr, N	121	0,020	0,092
Chwelos et al. (2001)	Corr, N	317	0,274	0,052
Lee and Runge (2001)	Mean ES	71	0,300	0,110
Mirchandani and Motwani (2001)	t, N	62	0,292	0,114
Neo et al. (1994)	Corr, N	144	0,040	0,084
Plouffe et al. (2001)	Corr, N	172	0,600	0,049
Premkumar and Potter (1995)	means, SD's	90	0,597	0,062
Premkumar et al. (1997)	means, SD's	160	0,132	0,077
Riemenschneider et al. (2003)	Corr, N	156	0,505	0,060
Saunders and Clark (1992)	Corr, N	192	-0,120	0,072
Tung and Rieck (2005)	Corr, N	128	0,430	0,073
Basaglia et al. (2009)	Mean ES	620	0,095	0,040
Chang et al. (2008)	means, SD's	81	0,069	0,110
Di Benetto et al. (2003)	Mean ES	506	0,290	0,041
Karimi et al. (2009)	Corr, N	148	0,380	0,071
Lee and Larsen (2009)	Mean ES	239	0,471	0,051
Lertwongsatien and Wongpinunwatana (2003)	means, SD's	334	0,204	0,052
Pan and Jang (2008)	Corr, N	99	0,294	0,093
Ramamurthy et al. (2008)	means, SD's	196	0,499	0,050
Thong (1999)	Corr, N	166	0,299	0,071
Yu and Tao (2009)	means, SD's	202	0,217	0,066
Seyal and Rahman (2003)	Corr, N	129	0,110	0,088
Wang and Cheung (2004)	Corr, N	137	0,370	0,075
Wang et al. (2010)	means, SD's	133	-0,062	0,086
Ghobakhloo et al. (2011)	Corr, N	235	0,275	0,061
Low et al. (2011)	means, SD's	111	0,200	0,090
Ifinedo (2011)	Corr, N	214	0,645	0,040
Yusoff et al. (2011)	Corr, N	129	0,299	0,081
Burgers et al. (2010)	Mean ES	80	0,420	0,094
Kim and Garrison (2010)	Mean ES	278	0,400	0,051
Li et al. (2011)	means, SD's	178	0,283	0,068
Saya et al. (2010)	Mean ES	101	0,170	0,098
Laux et al. (2012)	Mean ES	116	0,095	0,093
Kim (2010)	means, SD's	119	0,219	0,086
Kang (2009)	Corr, N	435	0,000	0,048

4.13 Appendix H – Fisher's Z transformation for the "Perceived Benefits" studies

Study name	Fisher's Z	SE
Beatty et al. (2001)	0,386	0,109
Cho (2006)	0,020	0,092
Chwelos et al. (2001)	0,281	0,056
Lee and Runge (2001)	0,310	0,121
Mirchandani and Motwani (2001)	0,301	0,124
Neo et al. (1994)	0,040	0,084
Plouffe et al. (2001)	0,693	0,077
Premkumar and Potter (1995)	0,688	0,096
Premkumar et al. (1997)	0,133	0,079
Riemenschneider et al. (2003)	0,556	0,081
Saunders and Clark (1992)	-0,121	0,073
Tung and Rieck (2005)	0,460	0,089
Basaglia et al. (2009)	0,095	0,040
Chang et al. (2008)	0,070	0,111
Di Benetto et al. (2003)	0,299	0,045
Karimi et al. (2009)	0,400	0,083
Lee and Larsen (2009)	0,511	0,065
Lertwongsatien and Wongpinunwatana (2003)	0,207	0,054
Pan and Jang (2008)	0,303	0,102
Ramamurthy et al. (2008)	0,548	0,067
Thong (1999)	0,308	0,078
Yu and Tao (2009)	0,220	0,070
Seyal and Rahman (2003)	0,110	0,089
Wang and Cheung (2004)	0,388	0,086
Wang et al. (2010)	-0,063	0,087
Ghobakhloo et al. (2011)	0,282	0,066
Low et al. (2011)	0,202	0,094
Ifinedo (2011)	0,767	0,069
Yusoff et al. (2011)	0,308	0,089
Burgers et al. (2010)	0,448	0,114
Kim and Garrison (2010)	0,424	0,060
Li et al. (2011)	0,290	0,073
Saya et al. (2010)	0,172	0,101
Laux et al. (2012)	0,095	0,094
Kim (2010)	0,223	0,091
Kang (2009)	0,000	0,048

5 Conclusion

En guise de conclusion de cette thèse, nous présentons un tableau (5.1) récapitulatif qui reprend les grandes lignes de chacun des trois articles qui la composent.

Tableau 5.1 – Synthèse des trois articles qui composent la thèse

	ARTICLE #1	**ARTICLE #2**	**ARTICLE #3**
Problématique	Développer une grille exhaustive de critères méthodologiques associés à la rigueur des revues de littérature et de fournir ainsi aux chercheurs en SI un cadre pouvant servir à l'évaluation d'articles de synthèse	Évaluer dans quelle mesure les chercheurs en SI ont adopté et implanté les techniques et pratiques recommandées visant à assurer la rigueur et la qualité méthodologique des articles de synthèse	Illustrer, sous la forme d'un tutoriel, comment l'approche méthodologique de méta-analyse peut être appliquée à notre domaine
Cadres conceptuels et théoriques	• 4 catégories de revues de littérature en fonction de leurs objectifs fondamentaux et de leurs motivations • Processus générique de réalisation d'une revue de littérature		• Approche méthodologique pour réaliser une méta-analyse en SI
Approche méthodologique	• Revue de littérature développementale • Identification et synthèse des directives et recommandations existantes concernant la réalisation d'un article de synthèse	• Revue de littérature cumulative • Identification des revues de littérature publiées en SI • Développement et validation d'un instrument de codification • Codification et évaluation des articles	• Tutoriel
Contributions	• Grille exhaustive de critères pour évaluer la rigueur méthodologique des revues de littérature	• Évaluation de la rigueur des revues de littérature en SI • Analyse des forces et faiblesses des pratiques de revue • Liste de recommandations pratiques pour les auteurs de revues	• Procédure structurée pour réaliser une méta-analyse en SI • Illustration détaillée de l'approche par la réalisation d'une méta-analyse des facteurs d'adoption des innovations technologiques

Les conclusions propres à chaque article ont été présentées dans les chapitres précédents. L'objectif de cette section est de démontrer la contribution générale de cette thèse en tant qu'ensemble de production scientifique. Par la suite, nous discutons les défis soulevés et suggérés lors de la réalisation de cette thèse, à la fois pour les chercheurs souhaitant réaliser des revues de littérature et pour le domaine dans son ensemble.

La contribution générale de cette thèse est d'abord et avant tout d'ordre méthodologique. Elle vise notamment à (1) améliorer la compréhension des chercheurs, évaluateurs et éditeurs vis-à-vis des méthodes et techniques propres aux revues de littérature, (2) encourager la réalisation d'articles de synthèse dans le domaine des SI, et (3) augmenter la rigueur et la qualité méthodologique des revues de littérature publiées dans notre domaine. Le fil conducteur qui motive ces contributions est la conviction que la valeur d'une méthodologie, en tant qu'outil de production de la connaissance, réside non seulement dans sa capacité à améliorer la qualité du résultat de la recherche, mais également à faciliter l'effort et le travail du chercheur. Cette thèse contribue à ces deux aspects. Cependant, plusieurs pistes de recherches futures sont proposées. D'une part, la littérature antérieure montre que les aspects pratiques et la facilité d'utilisation des méthodes existantes sont peu considérés. A cet égard, des efforts supplémentaires sont nécessaires pour, notamment :

- Décomposer le processus de réalisation d'une revue de littérature autonome en étapes plus détaillées, moins complexes et plus contrôlables;
- Développer une liste de stratégies et de règles génériques applicables à chaque étape du processus;
- Distinguer pour chaque type ou famille de revues les directives obligatoires de celles recommandées et de celles non nécessaires; et
- Discuter des compromis acceptables qui permettent de fournir une réponse satisfaisante à la question de recherche et de réaliser la revue sur le plan pratique.

D'autre part, le développement d'outils méthodologiques a pour objectif d'augmenter la rigueur des revues de littérature autonomes. Cependant, la rigueur est seulement une des dimensions de la qualité des revues, qui inclut aussi la pertinence et la cohérence méthodologique. Ces trois éléments devraient être considérés par les auteurs de revues de littérature. Ainsi, à la lumière de nos travaux et réflexions, nous suggérons plusieurs recommandations, d'une part aux auteurs

de revues de littérature, et d'autre part aux chercheurs et au domaine des SI en général. Ainsi, nous encourageons les auteurs de revues de littérature à :

- Décrire les procédures méthodologiques utilisées pour réaliser leurs recensions des écrits, notamment pour chercher, identifier, et sélectionner les études pertinentes, ainsi que pour extraire et analyser les données ;
- Justifier de manière explicite le choix du type de revues et s'assurer qu'il est aligné avec les objectifs visés ;
- Motiver le problème et la question de recherche sous-jacents à la revue et expliquer pourquoi la réalisation d'une revue de littérature sur le sujet est à la fois importante et pertinente ;

Pour sa part, la communauté en SI, afin de supporter le développement et d'accélérer le progrès scientifique du domaine, devrait entre autres :

- Réaliser des revues de littérature autonomes pertinentes et rigoureuses, et contribuer ainsi à la synthèse des connaissances et au progrès du domaine ;
- Publier de nouvelles études empiriques rigoureuses et adéquatement documentées, qui sont la principale source de données des articles de synthèses ;
- Offrir aux auteurs de revues de littératures des opportunités de publication, notamment par la création de journaux ou de sections dédiées aux revues de littérature, et valoriser davantage leurs efforts.

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